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CRESCIMENTO E PERFORMANCE DAS EMPRESAS: UMA PERSPETIVA REGIONAL, INSTITUCIONAL E POLÍTICA

Firm performance and growth: a regional, institutional and policy perspective

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CRESCIMENTO E PERFORMANCE DAS EMPRESAS: UMA PERSPETIVA REGIONAL, INSTITUCIONAL E POLÍTICA

Quando confrontados com preocupações crescentes sobre o crescimento económico, o desemprego e a própria criação de emprego, os decisores políticos optam frequentemente por direcionar os seus esforços para a criação de novas empresas e o fortalecimento das condições de funcionamento do restante tecido empresarial, de forma a conservar a competitividade nos mercados globais.

É indubitável que a melhoria do potencial económico de qualquer região passa por um ambiente de negócios onde as empresas possam prosperar.

De modo a fortalecer e diversificar a economia, os decisores políticos e líderes locais necessitam de estar cientes das características e dos determinantes do desempenho e do crescimento das suas empresas, particularmente relevantes para as empresas de menor dimensão. Deste modo, a compreensão das características do crescimento empresarial e do seu contributo para o crescimento económico, torna-se cada vez mais pertinente para a formulação de políticas de estímulo adequadas.

Existem um conjunto de características regionais e institucionais relativas à estrutura socioeconómica de uma região, que podem contribuir de modo significativo para explicar os diferenciais, não só de criação de novas empresas, bem como de desempenho e crescimento. Estes incluem, nomeadamente, fatores do lado da procura, da oferta e aspetos relacionados com medidas de política, que contemplam mais concretamente não só aspetos regionais, institucionais e políticos, mas que se estendem à qualidade do mercado de trabalho local, clima de negócios, internacionalização e capacidade de inovação.

No atual contexto de abrandamento económico, a relevância de abordar destes temas torna-se assim mais pertinente do que nunca.

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MACROECONOMIC POLICIES AND STOCK RETURNS: COMPANY-SECTOR EMPIRICAL EVIDENCE

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Abstract. The stock market of any country acts as the mirror of economy. The present work tries to show that share prices are determined on the basis of macroeconomic factors which will affect firm performance. We investigate the effect of macroeconomic variables reflecting different economic environment effects on stock returns of individual companies and considering general sector indices using UK, US, Germany, Japan and Australian stock and market data for the period between March 1993 and February 2013 on the basis of monthly time series data, whereas previous studies concentrate on a specific market/country/sector. Also unlike previous studies we also include the consumer confidence index into our analysis. Results show that the market index has the largest statistical significance for all company and sector indices stocks. Empirical results seem to indicate that the consumer index is in fact an important variable to be included into the analysis and that macroeconomic variables effect over stock returns depend upon the country, sector and time period analyzed. Moreover, it is shown that all variables included are relevant and insignificance may be due to coefficients instability through time because these coefficients signs are shown to change, or else, there exists a nonlinear and unstable relationship between macroeconomic variables and stock returns.

Keywords: Factor Models, Macroeconomic Variables, Stock Returns, Firm Performance, Growth Determinants

JEL classification: C22; E0; G10

Resumo. O mercado dos ativos financeiros de qualquer país age como um espelho da economia. O trabalho presente tenta demonstrar que os preços das ações são determinados por variáveis macroeconómicas que afetam o desempenho das empresas. Aqui investigamos o efeito de diferentes variáveis macroeconómicas que refletem ambientes económicos diferentes sobre retornos de ativos, quer em termos de empresas individuais quer em termos dos índices de mercado setoriais para 5 diferentes países (UK, US, Alemanha, Japão e Austrália), usando dados de retornos de ativos e dados macroeconómicos para o período entre março 1993 e fevereiro 2013, usando observações mensais. Análises anteriores apenas consideravam mercados específicos, países ou até mesmo setores individuais. Também, e por oposição a estudos anteriores incluímos na nossa análise o índice de confiança do consumidor na análise. Os resultados obtidos mostram que o índice de mercado é a variável que maior influencia positiva exerce tanto em termos de empresas como de índices setoriais. Os resultados empíricos aqui obtidos tendem a mostrar que a variável índice de confiança do consumidor é uma variável importante a ser incluída na análise e que os efeitos das variáveis macroeconómicas sobre retornos são dependentes do país, setor ou até mesmo do período analisado. Também se tenta demonstra que todas as variáveis incluídas são relevantes e que a insignificância pode-se dever à instabilidade observada nas estimativas dos coeficientes beta obtidos ao longo do tempo, dado que o sinal dos mesmos varia ao longo do tempo. Ou seja, há uma relação não linear e instável entre as variáveis macroeconómicas e os retornos dos ativos.

Palavras-Chave: Modelos Fatores, Variáveis Macroeconómicas, Retornos Ativos, Performance Empresarial, Determinantes Crescimento

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1. Introduction

In order to survive and gain competitive advantage in this volatile global environment, organizational leaders need to understand not only the drivers of superior organizational performance (individual risk), but also the drivers of superior macroeconomic performance (market risk). The success and subsequent growth of a firm can be measured in various ways. Internal growth is a key measure of company growth. This success is also reflected by its stock market quotes. However, company growth is not only due to internal growth, depending also on general macroeconomic conditions, which will impact investor's decision of investment, and this also determines the future company performance.

Previous authors' studies allow us to state that the stock market and the overall economy are significantly related. As such, the role of macroeconomic variables in asset pricing theories is accepted to be important. Macroeconomic variables fluctuations affect business negatively by disturbing the smoothness of trade.

There have been many attempts empirically performed in order to identify the link between macroeconomic variables and stock market volatility. Recently, Akbar et al. (2012) stated that it has been popular to study the relationship between macroeconomic growth and stock market performance. Stock markets are mainly affected by the surrounding economy and useful to predict future economic conditions (Fama, 1990; Binswanger, 2000). Every country and stock exchange market has unique determinants specific to itself. Therefore, for the same considered variables, they may have different responses. So, estimation of future trends of macroeconomic variables can be helpful to see the leading direction of stock returns.

This study aims to improve investors' understanding and evaluation of the relevant stock returns to the systematic influences of macroeconomic factors including the stock market index, inflation rate, interest rate, consumer confidence, industrial production and oil price shocks. The derived information about the relationship between macroeconomic variables and stock market performance can enable investors to make optimal decision in their global business investments.

We have chosen to work with data from 2 European countries (UK and Germany) and three world developed countries (USA, Australia and Japan) on the basis of monthly returns for the period between March 1993 and February 2013. For all this countries we have considered individual company data as well as their sector stocks representatives. We chose these countries because developed countries' financial markets are observed to be more explained compared to the other financial markets. Results can be summarized as follows: 1) The market index revealed to be the variable which most influences both companies and sector stock index returns for all the countries under study; 2) There is no linear evident relationship between the rest of the macroeconomic variables and stock returns; 3) Results cannot be generalized in terms of sectors or countries; 4) Results suggest the importance of the inclusion of the consumer confidence index as an important affecting macroeconomic variable over returns; 5) Inflation, industrial production, market index and oil prices have a positive and statistically significant effect over developed sector stock market index returns; 6) It is shown that insignificant beta coefficients estimates obtained are not due to a bad choice of repressors, but yes to the instability of beta coefficients estimates throughout time which leaves room for future work.

It is expected that the findings of this study would provide meaningful insights to the body of literature, policy makers as well as the practitioners. The results of this study are expected to support the theoretical framework of the determinants of stock market movement from the developing economies perspective. Moreover, the identification and weight of the magnitude of macroeconomic variables effects over financial markets will impact both company and public policies, which interest scholars, investors and companies.

The rest of the work develops as follows. Section 2 provides a brief literature review, where section 3 presents the methodology and data used for the empirical results to be discussed in section 4 and in

light of the attained results, main implications are discussed in this section. Finally, section 5 concludes.

2. Literature Review

Previous literature reports that stock prices in well-developed markets are influenced by changes in macroeconomic variables. While Sharpe (2002) got a negative relation between expected long-term earnings growth and expected inflation, Jones and Wilson (2006) observed that inflation adjustments can weakly estimate stock returns. There is a general consensus among scholars that stock market plays an important role in the development of an economy (Levine and Zervos, 1998; Sharpe, 2002; Jones and Wilson, 2006; Adjasi and Biekpe, 2006; Hearn and Piesse, 2010). It has been proved that capital markets accelerate economic growth by enhancing mobilization of domestic and foreign resources and facilitating investment (Bencivenga et al., 1996). Capital markets also provide an avenue for growth oriented companies to raise capital at low cost (Marone, 2003), reduces reliance on bank finance which is susceptible to interest rate fluctuations, and provides a channel for foreign capital inflows (Yartey, 2008). However, it can also be state that these capital markets provide an opportunity for venture capital firms to exit and liquidate their investments in domestic start-up ventures (Black and Gilson, 1999).

There have also been some critics of securities market, arguing that markets characterized by weak corporate control mechanisms may jeopardize investor wealth (Khanna, 2009; La Porta et al., 1998; 1997), even worse for foreign investors (World Bank, 2005) who are likely to dispose their shares at discount prices. As stated by Hearn and Piesse (2010), this phenomenon is more pervasive in developing economies because they are characterized by weak regulatory institutions and poor systems of corporate governance.

We are able to find many literature attempts to study the relation between stock markets and macroeconomic variables. Gunasekarager et al. (2004) choose the Sri Lanka stock market and money supply, Treasury bill rate, CPI and exchange rates as macroeconomic variables. The authors observed that all macroeconomic variables especially Treasury bill rate had a significant influence on stock prices except the exchange rate. However, the share price index could not be found to have influence on macroeconomic variables except the Treasury bill rate. For the Pakistani market, Nishat and Shaheen (2004) took the data from 1973 to 2004 and by considering industrial production index, the consumer price index, money supply, the value of an investment earnings and the money market rate, they employ the unit root test, Augmented Dickey Fuller (ADF) test, vector error correction model (VECM) and Granger-causality in order to determine the relationship among the considered variables. They found that industrial production is the largest positive and inflation is the largest negative influencing factors of stock prices. There was also a reverse causality observed between industrial production and stock prices. For the Athens stock exchange, Patra and Poshakwale (2006) observed both short and long-term relationships between inflation, money supply and trading volumes but no relationship between the exchange rate and stock prices.

There is also evidence of none impact of macroeconomic variables over stock returns. Kandir (2008) uses monthly data from July 1997 to June 2005 and the multiple regression model to suggest a negative impact of interest rates on stock returns, since interest rate was the best alternative investment opportunity in Turkey. Conclusions point out that industrial production, money supply and oil prices don't show any significant influence on stock returns. But a significant effect of the exchange rate was identified. Özlen and Ergun (2012) study macroeconomic variables (inflation rate, exchange rate, interest rate, current account deficit and unemployment rate) and their effects on stock returns of 45 companies from 11 different sectors in Turkey. The Autoregressive distributed lag method is employed for the monthly data spanning from February, 2005 to May, 2012. The overall results indicate that exchange rate and interest rate are the most significant factors in stock price fluctuations of companies. Gay and Nova (2008) used Augmented Dickey-Fuller (ADF) test on exchange rate and oil price for Brazil, Russia, India, and China (BRIC) and the monthly data of stock market indices between 1999 and 2006. The relationship between exchange rate and oil price over the stock market index prices for the countries analyzed was not significant.

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Using ten years of data, from June 1998 to June 2008, Hasan and Javed (2009) evaluated macroeconomic[1] variables and equity prices by using several linear time series models. Oil prices and inflation are detected as no significant but interest rate (IR), exchange rate and money supply appeared to be significant in the long run. Furthermore, the error correction model (ECM) has captured the short term dynamics of prices effect on equity prices. Sohail and Hussain (2009) found out that there is both a long-run and short-run relationship between macroeconomic variables and stock returns in the Lahore stock exchange from December 2002 to June 2008, finding also that inflation negatively influences stock returns while there are positive influences of money supply, industrial production and real effective exchange rate on stock prices. According to Rjoub et al. (2009) empirical analysis, it seems to exist a relationship between macroeconomic variables including interest rate, unanticipated inflation, risk premium, exchange rate, money supply, unemployment rate and the Istanbul Stock Market (ISE) from January 2001 to September 2005 by using the arbitrage pricing theory (APT) model, correlation among explanatory variables and portfolios regression. A significant pricing relationship between the stock return was identified. Moreover, macroeconomic variables are found to have a significant influence on the stock market returns in various portfolios. On the other hand, results suggested that there should be other macroeconomic factors affecting stock market returns in Istanbul Stock Market (ISE) instead of the tested ones due to the existence of weak explanatory power of the selected variables. For this same market, Gencturk (2009) studied the relations between stocks in Istanbul Stock Exchange (ISE) and macroeconomic variables by considering crisis periods and normal periods. Therefore, ISE-100 index is taken as the dependent variable; and treasury bond interest rates, consumer price index, money supply, industrial production index, dollar, gold prices are taken as independent variables.

Also, Aktas (2011) studied the influence of 19 macroeconomic announcements on equity index options for the period from 1983 to 2002 in ISE and found out that balance of trade, consumer price index, producer price index; employment, housing starts, money supply and retail sales are strongly related with index option returns. By applying the Structural VAR (SVAR) model, Akay and Nargeleçekenler (2009) studied the relationship between monetary policy, inflation rate, industrial production index, interest rates and stock prices. A negative monetary shock was observed to be influential on the interest rate in both the long and short term. Consequently, it negatively affects stock prices.

Sayılgan and Süslü (2011) analyzed the influence of macroeconomic factors on stock returns in emerging market economies using panel data from 1996 to 2006. Stock returns are found to be significantly influenced by exchange rates, inflation rates and the S&P 500 Index while returns are not influenced by interest rate, gross domestic product, money supply and oil prices. Hosseini et al. (2011) studied the relationships between stock market indices and four macroeconomics variables including crude oil price, money supply, industrial production and inflation rate in China and India for the period January 1999 to January 2009. Results suggest both long and short run linkages between macroeconomic variables and the stock market index in both countries. One year after, Quadir (2012) investigates the effects of macroeconomic variables like Treasury bill interest rate and industrial production on stock returns on Dhaka Stock Exchange for the period between January 2000 and February 2007 on the basis of monthly time series data using the Autoregressive Integrated Moving Average (ARIMA) model. The paper takes the overall market stock returns as an independent variable, and does not consider the stock returns of different companies separately. Although results indicate a positive relationship between Treasury bill interest rate and industrial production with market stock returns, the coefficients have turned out to be statistically insignificant.

Although considerable attention has been devoted to the relationship between stock markets and economic growth, there is still little empirical work on the determinants of stock market development in developing economies as well as the determinants of individual company stocks. Moreover, country specific data usage is necessary to determine the relationship between

1 These include inflation, industrial production, oil prices, short term interest rate, exchange rates, foreign portfolio investment and money supply.

macroeconomic factors and securities market development because it is presumed that the determinants of securities market development vary from country to country depending on nature of regulatory mechanisms, economic policies, as well as institutional structures.

Tangjitprom (2012) reviews a number of studies on macroeconomic factors and stock returns. All of the macroeconomic variables are classified into four groups: variables reflecting general economic conditions, variables related to interest rate and monetary policy, variables concerning price level, and variables concerning international activities. Furthermore, various studies on macroeconomics factors and stock returns have employed different methodologies based on their purposes and interpretations. Although the results are mixed, most studies have shown evidence that there are significant relationships between macroeconomic variables and stock returns.

Zhu (2012) study the impact of macroeconomic factors on returns of the energy sector in Shanghai stock market (SEE), which are inflation rate, money supply (M2), exchange rate, industrial production, bond, exports, imports, foreign reserve and unemployment rate. The findings reveal that exchange rate, exports, foreign reserve and unemployment rate have effects on the stock return of energy sector in Shanghai stock market. Benaković and Posedel (2010) analyzes returns on fourteen stocks of the Croatian capital market in the period from January 2004 to October 2009 using inflation, industrial production, interest rates, market index and oil prices as factors. The analyses included fourteen stocks and their sensitivities to factors were estimated. The results show that the market index has the largest statistical significance for all stocks and a positive relation to returns. Interest rates, oil prices and industrial production also marked a positive relation to returns, while inflation had a negative influence.

This brief literature review highlights that macroeconomic factors are critical in predicting the variability of stock returns. The key macroeconomic factors in the prediction of the stock returns may be price volatility of energy, interest rate risk, money supply, risk free rate, exchange rates, inflation and industrial production index. The review of the literature has presented that there are many studies which consider the micro (company size and dividend yield) and macro factors together. There may be other influencing factors such as the transmission of shocks and psychological effects (the consumer confidence index could be used) in the determination of stock price movements. They may include the changes in world oil prices, changes in interest rates and inflation rates. No standardized set of macroeconomic variables exist, despite the clear relationship between stock market and economic activities. However, inflation rate, exchange rate, interest rate, and unemployment rate are the most popular significant factors in order to explain stock market movements. The present study differs from the previous ones by taking both sectored and company data into account.

3. Methodology and Data

The present study uses factor models based on the arbitrage pricing theory (APT) which allow us to include several factors into one regression which may influence stock returns. In this model, it is need to use previous statistical and economic analysis to determine which factors must be used as independent variables.

The econometric model used obeys the following specification:

$$r_{i,t} = \alpha_i + \beta_{i,1}F_{1,t} + \beta_{i,2}F_{2,t} + \ldots + \beta_{i,k}F_{k,t} + \varepsilon_{i,t}, \qquad (1)$$

where $r_{i,t}$ represents the return on stock i computed as the log difference between consecutive prices, α is the constant term, β_i measures the sensitivity of a stock I to a set of n macroeconomic factors, F_n indicates realizations of macroeconomic factors and ε is the error term with an expected value of zero.

In this work we have collected daily data from both sectors and 5 different individual companies for each of the considered ten sectors for countries like UK, US, Australia, Japan and Germany from the

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period of March 1993 until February 2013. So, in total we have collected data for 250 individual companies and 50 sector indices. The daily data was converted into monthly returns using the month last day of trading available data. The five companies considered for each sector were randomly selected where we have decided to collect from those companies for which we had more years of available data over the sample available. Data for the considered representative sector indices goes from December 1992 until October 2012, which were also converted into monthly series. The sectors here analyzed are Basic Materials (BM), Consumer Goods (CG), Consumer Services (CS), Financials and Banks (F; B), Healthcare (HC), Industrials (I), Oil and Gas (OG), Technology (Tec), Telecommunications (Tel) and Utilities (U). When analyzing sector market indices the world index for that specific sector has been considered as the proxy for the market index.

As stated previously, in the multifactor model it is the researcher who identifies which and how many factors are to be identified in regressions. The factors used in the present analysis were selected based on the literature review previously presented and which were considered to be the most representative. With respect to the number of factors Campbell, Lo and MacKinlay (1997) show that it is sufficient to use between three to six factors in the model. Having this in mind, and for the US capital market, Chen, Roll and Ross (1986) use as macroeconomic variables industrial production, inflation, risk premium, term structure, market index, consumption and oil prices.

Macroeconomic variables used in the present work, can be classified into five groups of variables: reflecting general economic conditions, related to interest rate and monetary policy, concerning price level, considering investors behavior and concerning international activities. As such, we have used oil returns, the inflation rate, the industrial production index, the market interest rate, the market index and the consumer confidence index for each of the countries under analysis. So, each series is the country specific series and data refers to monthly observations. All price series have been converted into log returns and were denominated in US dollars. All collected data is from DataStream.

Consistent with previous studies inflation (π in tables) has been used as a measure of macroeconomic stability (Nacuer et al., 2007). Macroeconomic stability has been found to exert effects on stock market development and inflation, which consists in a rise in the general price level, reduces the real value of money and as a consequence the expected cash inflow of an asset. So, we expect inflation to affect negatively both stock and sector indices. For some countries we use the direct inflation rate provided by the data, while for others the consumer price index of the respective country was used to compute it. Nacuer et al., (2007) found that macroeconomic instability has a negative and significant relationship with stock market capitalization. Boyd et al., (2001) found a nonlinear relationship between inflation and equity market development such that as inflation rises, the marginal impact on stock market development diminishes rapidly. In Yartey (2008) no significant relationship between inflation and stock market development was found. Kolluri and Wahab (2008) use an asymmetric model to examine the relationship between expected inflation and stock returns. They found that a negative relationship exists during low inflation regimes whereas there is a positive relationship during high inflation regimes.

Research on the relationship between financial sector development and economic growth is not consensual. For some, the banking sector development has a positive effect on economic growth (Christopoulos and Tsionas, 2004) while others suggest that the banking sector may not be beneficial for growth (Singh, 1997). In reality, the banking sector is important for the stock market development because it affords investors with liquidity by advancing credit, and facilitating savings. Nacuer et al., (2007) and Yartey (2008) found support to a positive relationship between banking sector development and stock market development. The last, found that a very high level of bank sector development may have negative effects because stock markets and banks tend to substitute one another as financing sources. Stock markets and banks are considered as competitors in providing finance. So, with a well-developed money market, the capital market may be overshadowed leading to a slower rate of development. Our measure of the banking sector is countries interest rates (IR in the tables). We know that high interest rates tend to decrease the

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present value of future cash flows. This will reduce the investment attractiveness and according to economic theory this will reduce stock prices. The interest rate used here is the 3-month Treasury bill reference interest rate, one for each respective country. As such, we expect a negative sign between interest rates and stock returns.

Li, Iscan, and Xu (2010) use the US's Federal fund rate and Canada's overnight rate to study the effect of policy shock on stock prices. Stock returns are affected by monetary policy shocks in both countries, being this effect in the US more pronounced. They have addressed this difference in relation to the level of stock market openness. Chang et al. (2011) conducted a study about monetary policy and stock returns using the Federal fund rate. They found that the Federal fund rate had little effect on stock returns. Some studies have used other interest rates, such as LIBOR or LIBOR futures, to be the proxy of change in interest rate level. Gregoriou et al. (2009) used 3-month Sterling LIBOR futures as the proxy for monetary policy shocks in the UK market, finding a negative relationship between interest rate changes and stock returns.

Another variable used as a proxy for economic conditions and activity in previous studies is the industrial production index. Here we use the industrial production (IP in the tables) growth rate for each respective country. Humpe and Macmillan (2009) used co-integration analysis to show a positive relationship between the industrial production index and stock prices in both the US and Japanese market. The authors emphasize that the industrial production index can be a better proxy for economic conditions in general. Also Benakovic and Posedel (2010) use the industrial production index given that GDP data is only published on a quarterly basis. It is expected a positive relationship between industrial production and stock returns.

Globalization turned international activities important. Exchange rate is one of the most important factors in this group, especially for the countries that depend to a great extent on international trading activities as the ones we are analyzing here. Maysami, Howe, and Hamzah (2004) have studied the relationship between stock returns and macroeconomic variables, including exchange rate in Singapore. They found a significantly positive relationship, which can intuitively be explained by the high level of international trade of Singapore. In the present study we do not use exchange rates as independent variables directly but in a disguised way. Exchange rates are used to transform all the needed series into dollar prices.

Another independent variable considered in the present study is oil prices. The oil price (OP in the tables) series used here is the West Texas Intermediate (WTI), monthly spot price. Some studies have focused on oil prices, which are a critical asset in both the production and consumption process, also considered as a proxy for cost-push inflation. This importance is due to the fact that oil price rises increase the uncertainty in capital markets and the risk of inflationary pressures in the economy (Benakovic and Posedel, 2010). They increase companies costs like transportation and production, while may reduce their profits and consequently stock returns. So, oil prices are expected to have a negative influence on the capital market. Faff and Brailsford (1999) for Australian equity return sensitivities show that these sensitivities to oil prices vary across industries. They found negative effects over the oil and gas, paper, packaging and transportation industries. Kilian and Park (2009) have studied the effect of oil demand and supply price shock on stock returns, finding that only oil demand shocks have a significant impact on stock returns. Fedorova and Pankratov (2010) used Brent oil price to examine the influence of macroeconomic factors on stock returns in Russia, revealing that this Brent oil price is the macroeconomic factor that most affects stock returns.

Following Benakovic and Posedel (2010), macroeconomic variables cannot comprise all the information available in capital markets but stock prices react quickly to publicly information released. On the basis of this argument, the authors suggest the inclusion of financial market variables like the stock market index in the factor model. Previous authors like Chen, Roll and Ross (1986) have also used this variable and we will use each country individual stock market index (MI in the tables) representative as an independent variable.

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Finally, we have also included the consumer confidence (CC in the tables) index for each respective country into our multifactor model. Consumer confidence acts as a proxy for individual investor sentiment. It attempts to gauge consumers' feelings about the current economy condition and their expectations about the economy's future direction. Investor's sentiment has a determining role in stock market price movements (Brown and Cliff, 2004). Also, positive or negative expectations affect economic growth (AmosWeb, 2013). Lin, Ho and Hsu (2009) found that changes in the consumer sentiment are contemporaneously associated with market returns. They conclude that "positive (negative) changes in the sentiment tend to drive aggregate stock prices higher (lower) in the same period." Empirical results revealed that changes in sentiment capture variation in average returns in the energy, financial, industrial, information technology and material sectors, which should be somehow expected given that this valuation of stocks tend to be more subjective. Returns in the consumer, health care, property trusts, telecommunication and utility sectors is not affected robustly by sentiment given that these are matured sectors characterized by limited growth and stable earnings and are thus less sensitive to changes in sentiment. To reach these conclusions monthly return data is used in multivariate regression analysis, perform causality tests and present VAR regression results over stock sector returns and consumer confidence index (7 monthly bivariate VAR analyses). The links between consumer sentiment and the stock market have also been reported previously by Otoo (1999) and Jansen and Nahuis (2003) who studied the European market to find that stock returns and changes in sentiment are positively correlated.

The next section provides the results attained for the variables analyzed and their respective discussion.

4. Empirical Results

We have performed more than 300 regressions in order to consider all the variables under investigation. In the multiple regressions models performed our stock returns act as dependent variables while the macroeconomic variables described above are the independent ones. These regressions have provided us six different coefficient sensitivities for each performed multiple regression, which estimate stock or index sector returns sensitivities to changes in each macroeconomic factor. As such, results are interpreted as the monthly change in the stock or index sector stock return when a particular macroeconomic factor changes by one percentage point keeping all other variables constant. Results of the regression analysis are presented in tables 1, 2, 3, 4 and 5, one for each of the countries under analysis.

Table 1: UK individual companies stock returns by activity sector regression results: determinants of returns

Sector	BM		CG		CS		F		B		HC		I		OG		Tec		Tel		U	
Company	5		2		1		3		1		1		2		1		5		1		2	
α	-3,319		-13,033		-1,222		1,930		-4,348		0,881		6,878	**	1,174		-5,548		-3,303		2,271	
	(2,958)		(6,494)		(3,070)		(2,268)		(3,145)		(4,133)		(2,844)		(2,067)		(4,234)		(2,500)		(1,816)	
MI	0,934	***	2,155	***	1,239	***	0,557	***	1,472	***	0,871	***	0,995	***	0,515	***	1,707	***	0,560	***	0,368	***
	(0,129)		(0,283)		(0,134)		(0,099)		(0,137)		(0,180)		(0,124)		(0,090)		(0,184)		(0,109)		(0,079)	
IR	1,024	**	1,527		0,176		-0,310		0,809	*	0,138		-0,584		-0,128		0,521		0,439		-0,321	
	(0,129)		(0,283)		(0,134)		(0,099)		(0,137)		(0,180)		(0,124)		(0,090)		(0,184)		(0,109)		(0,079)	
π	-0,789		0,891		-0,485		0,579		-0,494		-0,386		-2,153		0,987	*	1,176		1,336	*	0,419	
	(0,816)		(1,792)		(0,847)		(0,626)		(0,868)		(1,141)		(0,785)		(0,570)		(1,168)		(0,690)		(0,501)	
CC	-0,022		-0,265		-0,069		0,161	*	-0,167		0,006		-0,171		0,243	***	-0,009		0,163	*	0,150	**
	(0,108)		(0,236)		(0,112)		(0,083)		(0,115)		(0,150)		(0,104)		(0,075)		(0,154)		(0,091)		(0,066)	
IP	-0,336		-0,726		-0,077		-0,146		-0,232		0,344		0,249		0,056		-0,192		-0,031		0,141	
	(0,218)		(0,478)		(0,226)		(0,167)		(0,231)		(0,304)		(0,209)		(0,152)		(0,312)		(0,184)		(0,134)	
OP	0,083		-0,107		0,087		-0,075		-0,167		0,004		-0,052		-0,039		0,188	*	0,064		-0,050	
	(0,067)		(0,148)		(0,070)		(0,052)		(0,071)		(0,094)		(0,065)		(0,047)		(0,096)		(0,057)		(0,041)	
Sample Size	223		223		223		223		223		223		223		223		223		223		223	
Rsqrt	0,225		0,242		0,291		0,161		0,388		0,106		0,272		0,176		0,290		0,129		0,127	

Source: Own regression results. Notes: The estimation method used in this multifactor model has been the OLS with White heteroskedastic correction. Standard errors are in parentheses. ***= significant at 1% level; ** = significant at 5% level; * = significant at 10% level. α represents the constant term; MI the market index; IR the interest rate; π the inflation rate; CC the consumer confidence; IP industrial production and OP the oil return. The sectors here analyzed are Basic Materials (BM), Consumer Goods (CG), Consumer Services (CS), Financials and Banks (F; B), Healthcare (HC), Industrials (I), Oil and Gas (OG), Technology (Tec), Telecommunications (Tel) and Utilities (U).

Although we have performed regressions over 250 individual company stocks, in order to save space we will only present the results for one randomly selected company for each sector and for each country, given that results were mostly similar among the five companies considered for each sector and thus can be generalized. All the other results will be provided upon request.

Table 1 reports the results obtained for one of each of the 5 considered companies, randomly selected, for each sector for the United Kingdom stock market. Results can be generalized to the other companies. It is clearly evident that it is the stock market index which most affects company individual stock returns and in a positive manner. The interest rate variable, when statistically significant indicates a positive relationship with the company stock returns, which is also observed for the variable inflation in the UK market. Also, when statistically significant, the consumer confidence index indicates a positive relationship with individual stock returns, and for UK this happens for the financials, oils and gas, telecommunications and utilities companies sectors. As also stated by previous authors, oil returns have asymmetric effects depending on the sector under analysis but we have only attained a positive significant relationship in the UK for the technology sector. Faff and Brailsford (1999) found negative effects over the oil and gas, paper, packaging and transportation industries. We have attained negative relationships for the consumer goods, financials, banks, industrials, oil and gas and utilities sectors, which is consistent with the economic reasoning concerning this sectors nature. As such, we cannot clearly state for the UK market that oil returns and stock returns have a significant relationship, contrary to Kilian and Park (2009) and Fedorova and Pankratov (2010).

For both the UK and US markets we have considered banks as an individual sector within the financial sector and for both we can only state that there is a positive influence of the market index over this stock returns. Moreover, whereas for the UK we see the interest rate exerting a positive influence, for the US market it is both the inflation rate and the oil price which seem to have a positive influence over these. Results for the US market are showed in table 2.

Table 2: US individual companies stock returns by activity sector regression results: determinants of returns

US																														
Sector	BM		CG		CS		F		B		HC		I		OG		Tec		Tel		U	
Company	3		4		1		4		1		2		1		5		2		1		3	
α	9,187	***	3,042	**	-1,803		-1,996		-2,164		1,774		1,372		11,253		0,463		0,090		-0,990	
	(3,527)		(1,422)		(3,009)		(1,070)		(1,697)		(2,967)		(1,360)		(8,930)		(2,935)		(2,391)		(1,100)	
MI	1,167	***	0,819	***	0,823	***	0,278	***	0,583	***	1,433	***	1,163	***	1,398	***	1,924	***	0,646	***	0,306	***
	(0,212)		(0,085)		(0,181)		(0,064)		(0,102)		(0,178)		(0,082)		(0,537)		(0,176)		(0,144)		(0,066)	
IR	1,266		-0,282		-0,251		-0,023		-0,073		-0,034		0,713	***	-2,644		0,248		0,439		0,099	
	(0,212)		(0,085)		(0,181)		(0,064)		(0,102)		(0,178)		(0,082)		(0,537)		(0,176)		(0,144)		(0,066)	
π	-4,330		-0,069		1,282		0,968	**	1,116	*	-0,263		-1,445		1,073		-0,123		0,349		0,428	
	(1,321)		(0,532)		(1,126)		(0,400)		(0,635)		(1,111)		(0,509)		(3,343)		(1,099)		(0,895)		(0,412)	
CC	-2,577		-1,000		-0,702		1,180		-1,030		-4,688		-2,435		-18,580		-3,885		-3,780		4,112	*
	(7,014)		(2,827)		(5,983)		(2,127)		(3,375)		(5,900)		(2,704)		(17,758)		(5,836)		(4,755)		(2,187)	
IP	-0,220		-0,176		0,088		-0,129		0,077		0,419		0,114		1,127		-0,293		-0,323		-0,098	
	(0,408)		(0,164)		(0,348)		(0,124)		(0,196)		(0,343)		(0,157)		(1,032)		(0,339)		(0,276)		(0,127)	
OP	0,035		-0,025		0,218	*	0,007		0,139	**	-0,023		-0,071		-0,309		0,203	*	0,154		-0,014	
	(0,143)		(0,058)		(0,122)		(0,044)		(0,069)		(0,121)		(0,055)		(0,363)		(0,119)		(0,097)		(0,045)	
Sample Size	223		223		223		223		223		223		223		223		223		223		223	
Rsqrt	0,191		0,320		0,097		0,094		0,146		0,245		0,527		0,052		0,364		0,103		0,110	

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Source: Own regression results. Notes: The estimation method used in this multifactor model has been the OLS with White heteroskedastic correction. Standard errors are in parentheses. ***= significant at 1% level; ** = significant at 5% level; * = significant at 10% level. α represents the constant term; MI the market index; IR the interest rate; π the inflation rate; CC the consumer confidence; IP industrial production and OP the oil return. The sectors here analyzed are Basic Materials (BM), Consumer Goods (CG), Consumer Services (CS), Financials and Banks (F; B), Healthcare (HC), Industrials (I), Oil and Gas (OG), Technology (Tec), Telecommunications (Tel) and Utilities (U).

In the US market we can also observe that the market index is the one which affects all individual companies' returns. Oil prices seem to negatively affect consumer goods, health care, industrials, oil and gas and the utilities sector, but these results are not statistically significant. Curiously, and similar to what have happened before in the UK market, oil price increases seem to decrease the oil and gas individual companies returns. We should expect the opposite sign effect, and given that these results are statistically significant we do not see the need for more detailed interpretations. Moreover, only the utilities sector in the US seems to be positively and statistically influenced by the consumer confidence index and the inflation rate results indicate a positive influence of this one over the financials and banks sector company returns.

Table 3: Australia individual companies stock returns by activity sector regression results: determinants of returns

Sector	BM		CG		CS		F		HC		I		OG		Tec		Tel		U	
Company	1		3		2		1		5		4		2		3		5		1	
α	1,388		5,340		3,356		2,435		-1,861		5,422		-0,205		10,088		3,349		-8,209	
	(3,148)		(5,823)		(2,867)		(10,665)		(3,188)		(3,510)		(4,570)		(13,522)		(2,956)		(9,092)	
MI	0,843	***	1,045	***	0,688	***	0,997	**	0,728	***	1,036	***	1,154	***	3,170	***	1,015	***	1,489	***
	(0,126)		(0,234)		(0,115)		(0,428)		(0,128)		(0,141)		(0,183)		(0,543)		(0,119)		(0,365)	
IR	-0,334		-1,557		-0,773		0,052		1,030	*	-1,215		-0,462		-0,723		-0,522		0,691	
	(0,126)		(0,234)		(0,115)		(0,428)		(0,128)		(0,141)		(0,183)		(0,543)		(0,119)		(0,365)	
π	0,349		1,631	*	0,079		-0,903		-0,385		0,372		1,195	*	-0,706		-0,169		0,998	
	(0,485)		(0,898)		(0,442)		(1,645)		(0,492)		(0,541)		(0,705)		(2,085)		(0,456)		(1,402)	
CC	1,217		7,416		9,785	**	31,672	*	-4,325		10,387	*	3,261		-27,422		4,077		32,504	**
	(5,369)		(9,931)		(4,889)		(18,189)		(5,438)		(5,986)		(7,793)		(23,061)		(5,041)		(15,505)	
IP	0,010		0,111		0,074		0,254		-0,038		0,074		0,076		-0,305		0,001		0,488	***
	(0,061)		(0,112)		(0,055)		(0,205)		(0,061)		(0,068)		(0,088)		(0,261)		(0,057)		(0,175)	
OP	-0,099		-0,304		-0,040		-0,169		0,050		-0,149		0,048		0,281		-0,160		-0,112	
	(0,064)		(0,119)		(0,059)		(0,218)		(0,065)		(0,072)		(0,093)		(0,277)		(0,060)		(0,186)	
Sample Size	223		223		223		223		223		223		223		223		223		223	
Rsqrt	0,187		0,139		0,175		0,044		0,141		0,245		0,169		0,152		0,291		0,113	

Source: Own regression results. Notes: The estimation method used in this multifactor model has been the OLS with White heteroskedastic correction. Standard errors are in parentheses. ***= significant at 1% level; ** = significant at 5% level; * = significant at 10% level. α represents the constant term; MI the market index; IR the interest rate; π the inflation rate; CC the consumer confidence; IP industrial production and OP the oil return. The sectors here analyzed are Basic Materials (BM), Consumer Goods (CG), Consumer Services (CS), Financials and Banks (F; B), Healthcare (HC), Industrials (I), Oil and Gas (OG), Technology (Tec), Telecommunications (Tel) and Utilities (U).

Results for Australia are presented in table 3 and these are worth of comment with respect to the consumer confidence index. Similar to Otoo (1999), Jansen and Nahuis (2003) and more recently Lin, Ho and Hsu (2009) we can also state that changes in the consumer sentiment are contemporaneously associated with market returns. So, positive (negative) changes in the sentiment tend to drive aggregate stock prices higher (lower) in the same period, at least for company sector returns like consumer services, financials, industrials and utilities. When we have a negative sign influence we have no statistical significance and so results may be ignores and generalized to state that the consumer confidence index is an important variable to be considered when analyzing the effects of macroeconomic variables over stock returns, at least for some markets. However, there have been reduced efforts in this sense in the empirical literature to establish this relationship among the two variables.

Also, up to now we have only able to see a statistical significant relationship between industrial production and the utilities sector for the Australian market. The interest rate only influences

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positively the health care individual companies sector, whereas inflation only revealed a positive influence over the oil and gas company considered, which is consistent with the fact that oil prices have a positive and straightforward relationship with the inflation rate (FRBSF, 2008).

The results for the German market are presented in table 4, while those for Japan are in table 5. For the first time we cannot say that the market index is the variable which most influences individual companies, considered by sectors, sector returns in the German market. This positive influence is only verified in sectors like basic materials, consumer goods, consumer services and financials, which were somehow surprising results given the financial literature which emerged in this context. But curiously industrial production reveals to be a very positive statistically influencing variable in German companies in sectors like basic materials, consumer goods, industrials and technology, which in fact are very developed sectors in this market and which have highly grown in the period considered. In fact, Germany is one of the leading countries of the actual European economic and monetary unit. Moreover, as German usage of renewables has also been increasing, we may justify the fact that oil prices do not represent a significant influence over stock returns. But a much deeper analysis is needed in order for us to be able to justify all of the results attained here.

Table 4: German individual companies stock returns by activity sector regression results: determinants of returns

Sector	BM		CG		CS		F		HC		I		OG		Tec		Tel		U	
Company	1		1		2		5		1		5		1		2		1		1	
α	1,336		-1,203		1,852		1,089		-0,945	***	-0,930		-4,551	***	8,968		1,802	***	-1,128	***
	(2,627)		(1,855)		(2,667)		(2,845)		(2,179)		(6,510)		(6,067)		(6,278)		(2,104)		(1,431)	
MI	0,372	**	0,222	*	0,832	***	0,584	***	0,687		0,183		1,753		0,235		0,413		0,264	
	(0,177)		(0,125)		(0,180)		(0,192)		(0,147)		(0,439)		(0,410)		(0,424)		(0,142)		(0,097)	
IR	-0,498		-0,256		0,014		-0,473		-0,133	*	-0,548		1,607		-0,897		0,053		0,147	
	(0,177)		(0,125)		(0,180)		(0,192)		(0,147)		(0,439)		(0,410)		(0,424)		(0,142)		(0,097)	
π	-0,388		0,428		-0,058		-0,242		1,584		-0,784		-0,882		-5,385		-1,482		0,207	
	(1,036)		(0,731)		(1,051)		(1,122)		(0,859)		(2,567)		(2,392)		(2,475)		(0,830)		(0,564)	
CC	-0,220		-0,165		0,077		-0,280		0,093		-0,283		0,112		-0,691		-0,142		-0,049	
	(0,089)		(0,063)		(0,091)		(0,097)		(0,074)		(0,222)		(0,206)		(0,214)		(0,072)		(0,049)	
IP	0,265	*	0,295	***	-0,212		0,107		-0,079		0,723	*	0,200		0,754	**	0,061		0,012	
	(0,158)		(0,112)		(0,161)		(0,171)		(0,131)		(0,392)		(0,365)		(0,378)		(0,127)		(0,086)	
OP	-0,041		0,002		-0,100		0,003		-0,061		0,029		0,165		-0,241		-0,056		-0,016	
	(0,072)		(0,051)		(0,073)		(0,078)		(0,060)		(0,179)		(0,167)		(0,173)		(0,058)		(0,039)	
Sample Size	220		220		220		220		220		220		220		220		220		220	
Rsqrt	0,065		0,063		0,110		0,104		0,111		0,019		0,094		0,093		0,103		0,047	

Source: Own regression results. Notes: The estimation method used in this multifactor model has been the OLS with White heteroskedastic correction. Standard errors are in parentheses. ***= significant at 1% level; ** = significant at 5% level; * = significant at 10% level. α represents the constant term; MI the market index; IR the interest rate; π the inflation rate; CC the consumer confidence; IP industrial production and OP the oil return. The sectors here analyzed are Basic Materials (BM), Consumer Goods (CG), Consumer Services (CS), Financials and Banks (F; B), Healthcare (HC), Industrials (I), Oil and Gas (OG), Technology (Tec), Telecommunications (Tel) and Utilities (U).

Finally, interest rate reveals to have a negative sign over the representative company considered for the health care sector, which is consistent with our prior assumptions about the influence of interest rates sign over stock returns. However, this negative influence is not generalized for all the countries under analysis as previously observed. In all the other countries, when for some specific sectors the sensitivity of the interest rate, or else its coefficient revealed to be statistically significant, we see a positive sign. These results are contrary to our initial expectation abot the two variables relationship but are in accordance with those obtained by Benakovic and Posedel (2010) for the Croatian market, also considering individual companies results.

The Japanese market companies' regression data obtained is even worse in terms of results interpretation. In this case the market index is the one which most influences sector individual companies returns and in a positive manner, similar to the other countries under analysis. Moreover, the consumer confidence index only statistically influences the basic materials company returns

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randomly selected for the results presentation, and once again in a positive way, consistent with previous empirical findings.

Table 5: Japanese individual companies stock returns by activity sector regression results: determinants of returns

Sector	BM		CG		CS		F		HC		I		OG		Tec		Tel		U	
Company	3		1		2		5		1		4		2		5		4		1	
α	-0,256		-1,485		-0,108		-13,400		-0,691		1,033		-0,155		0,546		-0,751		-0,719	
	(1,840)		(1,568)		(1,278)		(4,980)		(0,989)		(4,720)		(2,318)		(1,726)		(1,932)		(2,552)	
MI	0,980	***	0,764	***	0,489	***	1,318	***	0,564	***	1,298	***	1,066	***	0,489	***	0,743	***	0,838	***
	(0,176)		(0,150)		(0,123)		(0,478)		(0,095)		(0,453)		(0,222)		(0,165)		(0,185)		(0,245)	
IR	1,964		2,920		-0,331		17,138	*	0,478		-0,150		0,778		-0,564		0,409		1,377	
	(0,176)		(0,150)		(0,123)		(0,478)		(0,095)		(0,453)		(0,222)		(0,165)		(0,185)		(0,245)	
π	2,192		-0,924		-0,451		-8,268		-0,643		1,701		0,964		0,761		-2,056		1,128	
	(1,940)		(1,653)		(1,347)		(5,251)		(1,043)		(4,976)		(2,444)		(1,820)		(2,037)		(2,691)	
CC	22,023	**	-3,465		-1,748		-21,635		-3,932		6,875		5,997		10,602		-1,950		6,608	
	(8,639)		(7,363)		(5,999)		(23,381)		(4,642)		(22,159)		(10,882)		(8,102)		(9,071)		(11,983)	
IP	-0,165		0,035		-0,021		0,222		-0,001		-0,105		0,065		-0,120		-0,032		-0,014	
	(0,067)		(0,057)		(0,047)		(0,182)		(0,036)		(0,173)		(0,085)		(0,063)		(0,071)		(0,093)	
OP	-0,199		0,171	**	0,158	***	-0,063		0,100	**	0,113		-0,138		-0,013		0,053		0,099	
	(0,081)		(0,069)		(0,057)		(0,220)		(0,044)		(0,209)		(0,103)		(0,076)		(0,085)		(0,113)	
Sample Size	81		81		81		81		81		81		81		81		81		81	
Rsqrt	0,424		0,311		0,263		0,162		0,377		0,115		0,272		0,189		0,246		0,146	

Source: Own regression results. Notes: The estimation method used in this multifactor model has been the OLS with White heteroskedastic correction. Standard errors are in parentheses. ***= significant at 1% level; ** = significant at 5% level; * = significant at 10% level. α represents the constant term; MI the market index; IR the interest rate; π the inflation rate; CC the consumer confidence; IP industrial production and OP the oil return. The sectors here analyzed are Basic Materials (BM), Consumer Goods (CG), Consumer Services (CS), Financials and Banks (F; B), Healthcare (HC), Industrials (I), Oil and Gas (OG), Technology (Tec), Telecommunications (Tel) and Utilities (U).

We may also observe that it is for the Japanese market that oil prices most influence, and in a positive fashion, sector company returns like those of consumer goods, consumer services and health care. In fact we should expect that besides the market index, oil prices should have more statistically significant relationships with each of the other companies sectors. In the case of Japan this positive influence in these specific sectors is mostly due to production and transportation costs influences, which will thus influence stock returns in the increasing sense.

We can also observe from the tables that R^2 values are all very small for the generality of the countries, sectors and companies considered. Given the results that we have attained for individual companies we may conclude that other type of influence can be presented in these relationships. In fact, we can have disguised lagged effects or even clockwise effects, meaning that we should also explore the dynamic and nonlinear effects which might be happening among these variables. We could for example have oil prices influencing inflation and interest rates, and only then these will influence industrial production and stock returns, or some similar kind of relationship. But we leave this kind of analysis for other improving work. Moreover, it should also be interesting if we could separate the analysis between the pre and post-worldwide financial crisis to see if results change given that also previous authors point for separate effects. One example is that of Gregoriou et al. (2009) which found a negative relationship between interest rate changes and stock returns before the credit crisis period; however, the relationship reversed to a positive one during the credit crisis.

In order to see if results change by using individual company data or general stock market sector indices returns we will next test the significance and explanatory power of all the macroeconomic variables previously described plus the world respective stock index sector return (as representative of the market index) over sector stock index returns, in total ten for each of the countries analyzed which sums 50 sector indices analyzed. Table 6 presents all country sector indices results obtained.

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Table 6: Sector index stock returns by activity sector and country regression results: determinants of returns

Sector	BM		CG		CS		F		HC		I		OG		Tec		Tel		U	
Country	UK (United Kingdom)																			
α	-0,482		0,009		-1,035		-0,026		0,210		-0,224		-1,198		0,862		-0,357		-1,321	
	(1,359)		(1,377)		(1,340)		(2,067)		(1,192)		(1,476)		(2,188)		(1,989)		(1,923)		(1,423)	
WSI	1,015	***	0,931	***	0,575	***	0,828	***	0,630	***	0,889	***	0,869	***	0,787	***	0,795	***	0,225	***
	(0,044)		(0,062)		(0,063)		(0,077)		(0,072)		(0,055)		(0,076)		(0,055)		(0,074)		(0,074)	
IR	0,117		0,039		-0,019		-0,208		-0,080		-0,047		0,116		-0,180		-0,118		0,269	
	(0,194)		(0,198)		(0,193)		(0,297)		(0,172)		(0,212)		(0,313)		(0,287)		(0,278)		(0,205)	
π	0,043		-0,059		0,495		0,283		0,152		0,168		-0,314		-0,052		0,399		0,072	
	(0,376)		(0,379)		(0,372)		(0,577)		(0,332)		(0,410)		(0,605)		(0,553)		(0,534)		(0,395)	
CC	0,018		0,044		0,051		0,034		0,061		0,041		-0,084		0,064		0,032		0,077	
	(0,049)		(0,050)		(0,049)		(0,075)		(0,044)		(0,054)		(0,079)		(0,073)		(0,071)		(0,052)	
IP	-0,160		-0,034		-0,013		0,086		-0,064		-0,090		0,019		-0,082		0,025		-0,141	
	(0,100)		(0,101)		(0,099)		(0,153)		(0,088)		(0,109)		(0,160)		(0,148)		(0,143)		(0,105)	
OP	0,024		0,028		0,049		0,000		0,033		0,008		-0,076		0,018		0,022		0,050	
	(0,030)		(0,031)		(0,030)		(0,047)		(0,027)		(0,033)		(0,049)		(0,045)		(0,044)		(0,032)	
Country	US (United States)																			
α	-0,346		-0,266		-0,773		-1,335		-1,284		-0,742		-1,426		0,758		0,336		-0,104	
	(0,576)		(0,951)		(0,538)		(0,630)		(0,559)		(0,769)		(0,641)		(1,205)		(0,780)		(0,632)	
WSI	0,915	***	0,775	***	0,931	***	0,924	***	0,804	***	0,838	***	0,818	***	0,932	***	0,922	***	0,599	***
	(0,034)		(0,077)		(0,045)		(0,042)		(0,060)		(0,052)		(0,040)		(0,060)		(0,055)		(0,060)	
IR	0,062		-0,052		0,090		0,158		-0,009		-0,118		0,077		-0,033		-0,003		-0,107	
	(0,110)		(0,181)		(0,102)		(0,122)		(0,108)		(0,147)		(0,124)		(0,231)		(0,150)		(0,124)	
π	0,082		0,303		0,226		0,372		0,532	**	0,527	*	0,502	**	-0,219		-0,185		0,270	
	(0,217)		(0,354)		(0,201)		(0,238)		(0,209)		(0,289)		(0,240)		(0,454)		(0,295)		(0,239)	
CC	0,325		-0,411		0,500		1,383		-0,102		1,028		-0,539		-0,264		0,056		0,695	
	(1,122)		(1,852)		(1,048)		(1,243)		(1,102)		(1,504)		(1,266)		(2,362)		(1,533)		(1,259)	
IP	0,036		-0,012		-0,077		-0,051		-0,033		-0,072		-0,035		0,131		0,085		0,051	
	(0,065)		(0,108)		(0,061)		(0,072)		(0,064)		(0,087)		(0,073)		(0,138)		(0,090)		(0,073)	
OP	0,026		0,002		-0,033		0,043	*	0,022		-0,010		0,023		-0,060		0,015		0,033	
	(0,023)		(0,038)		(0,021)		(0,025)		(0,022)		(0,031)		(0,026)		(0,048)		(0,031)		(0,026)	
Country	Australia																			
α	-0,759		-0,883		-0,390		0,418		-0,471		0,829		-0,144		5,402		0,155		-1,119	
	(1,259)		(2,193)		(1,321)		(1,195)		(1,435)		(1,480)		(1,505)		(3,499)		(2,653)		(1,745)	
WSI	0,720	***	0,558	***	0,776	***	0,574	***	0,523	***	0,631	***	0,806	***	0,413	***	0,372	***	0,373	***
	(0,037)		(0,089)		(0,056)		(0,040)		(0,078)		(0,050)		(0,047)		(0,083)		(0,082)		(0,081)	
IR	0,099		0,181		0,354		0,088		0,076		-0,369		-0,010		-0,865		0,704		0,515	
	(0,037)		(0,089)		(0,056)		(0,040)		(0,078)		(0,050)		(0,047)		(0,083)		(0,082)		(0,081)	
π	0,298		-0,080		-0,498		-0,076		0,155		0,406	*	0,206		-0,108		-1,041		-0,461	
	(0,193)		(0,334)		(0,202)		(0,183)		(0,223)		(0,229)		(0,232)		(0,643)		(0,369)		(0,272)	
CC	-2,461		-4,340		-1,875		-3,485		-0,343		-4,644		-2,497		4,503		-3,626		-2,055	
	(2,136)		(3,693)		(2,229)		(2,016)		(2,460)		(2,503)		(2,563)		(5,190)		(4,366)		(2,983)	
IP	-0,024		-0,016		-0,005		-0,033		0,002		-0,027		-0,026		0,085		-0,052		0,012	
	(0,024)		(0,042)		(0,025)		(0,023)		(0,028)		(0,028)		(0,029)		(0,056)		(0,046)		(0,034)	
OP	0,025		0,081	*	-0,016		-0,031		-0,046		0,019		-0,028		-0,131		-0,072		0,002	
	(0,026)		(0,044)		(0,027)		(0,024)		(0,030)		(0,030)		(0,031)		(0,063)		(0,046)		(0,036)	
Country	Germany																			
α	0,094		-2,534		-0,074		-1,048		1,295		-0,415		-7,578		-4,881		-0,908		-0,494	
	(1,196)		(1,593)		(1,182)		(1,164)		(0,917)		(1,076)		(4,526)		(2,231)		(2,003)		(0,942)	
WSI	0,714	***	1,096	***	1,100	***	0,966	***	0,698	***	0,951	***	1,038	***	0,858	***	1,016	***	0,730	***
	(0,047)		(0,088)		(0,068)		(0,053)		(0,066)		(0,050)		(0,140)		(0,076)		(0,095)		(0,060)	
IR	-0,077		0,057		0,051		-0,014		-0,203		-0,035		1,894	*	0,514		0,440		0,280	
	(0,220)		(0,295)		(0,218)		(0,216)		(0,171)		(0,198)		(1,122)		(0,414)		(0,370)		(0,176)	
π	-0,026		0,988		-0,652		0,196		-0,185		-0,088		-0,908		1,185		-0,644		-0,191	
	(0,470)		(0,624)		(0,467)		(0,461)		(0,361)		(0,428)		(1,580)		(0,889)		(0,800)		(0,374)	
CC	-0,044		-0,066		-0,066		-0,060		-0,017		-0,054		-0,076		-0,141		0,026		0,009	
	(0,040)		(0,053)		(0,040)		(0,039)		(0,031)		(0,036)		(0,180)		(0,075)		(0,067)		(0,032)	
IP	0,125	*	0,210	**	0,105		0,125	*	0,053		0,101		0,061		0,213		0,005		-0,055	
	(0,070)		(0,094)		(0,070)		(0,069)		(0,055)		(0,064)		(0,210)		(0,133)		(0,120)		(0,057)	
OP	0,034		-0,011		-0,030		-0,018		0,033		0,061	**	-0,103		0,001		-0,011		-0,034	
	(0,032)		(0,043)		(0,032)		(0,032)		(0,025)		(0,029)		(0,110)		(0,061)		(0,055)		(0,026)	
Country	Japan																			
α	1,125		0,370		0,523		1,069		-0,022		0,374		0,836		0,060		1,709	*	1,129	
	(1,403)		(0,498)		(0,467)		(0,746)		(0,367)		(0,616)		(0,589)		(0,321)		(0,906)		(0,784)	
WSI	0,643	***	0,706	***	0,907	***	0,832	***	0,976	***	0,809	***	0,874	***	0,964	***	0,729	***	0,676	***
	(0,067)		(0,046)		(0,042)		(0,044)		(0,039)		(0,039)		(0,034)		(0,022)		(0,079)		(0,067)	
IR	-4,302		-0,653		-0,691		-2,695		0,163		-0,773		-0,911		0,185		-3,114		-1,977	
	(2,474)		(0,876)		(0,824)		(1,320)		(0,646)		(1,086)		(1,038)		(0,566)		(1,595)		(1,382)	
π	1,803		0,134		0,065		0,600		0,089		-0,020		0,713		-0,053		1,239		0,218	
	(1,469)		(0,514)		(0,482)		(0,773)		(0,378)		(0,641)		(0,614)		(0,333)		(0,938)		(0,815)	
CC	2,505		0,095		-0,229		2,213		0,229		0,779		1,250		-0,590		3,372		-0,186	
	(6,551)		(2,310)		(2,174)		(3,486)		(1,703)		(2,880)		(2,751)		(1,497)		(4,232)		(3,685)	
IP	-0,048		0,000		0,003		-0,011		0,003		0,005		0,038	*	0,008		0,002		0,017	
	(0,052)		(0,018)		(0,017)		(0,028)		(0,013)		(0,023)		(0,022)		(0,012)		(0,033)		(0,029)	
OP	0,072		0,042	*	0,037	*	0,062	*	0,011		0,065	**	0,054	**	0,011		0,043		0,061	*
	(0,061)		(0,022)		(0,020)		(0,033)		(0,016)		(0,027)		(0,026)		(0,014)		(0,040)		(0,035)	

Source: Own regression results. Notes: The estimation method used in this multifactor model has been the OLS with White heteroskedastic correction. Standard errors are in parentheses. ***= significant at 1% level; ** = significant at 5% level; * = significant at 10% level. α represents the constant term; WSI the world sector index; IR the interest rate; π the inflation rate; CC the consumer confidence; IP industrial production and OP the oil return. The sectors here analyzed are Basic

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Materials (BM), Consumer Goods (CG), Consumer Services (CS), Financials and Banks (F; B), Healthcare (HC), Industrials (I), Oil and Gas (OG), Technology (Tec), Telecommunications (Tel) and Utilities (U).

Regarding sector stock market indices, for all countries we see that the world respective sector return index is the one which most influences positively individual country sector returns. In fact, for the UK market only this variable seems to have a statistically significant impact over sector index returns. Unfortunately, we haven't got many different results as those already obtained for individual companies operating in each of these sectors. As presented, only the macroeconomic variables inflation, oil prices and industrial production seem to have effects over sector stock market indices, and for all the variables whose results revealed to be statistically significant seem to indicate that there exists a positive influence of these over the sector indices.

For the Australian market inflation only exerts a positive influence over the industrials sector and for the US market it influences positively the health care, industrials and oil and gas sectors. As for industrial production results seem to indicate that there is only a positive impact of this variable over sector stock index returns for Germany and Japan. While in the last the impact is only significant over the oil and gas sector, for Germany this same effect is verified over basic materials, consumer goods and the financial sector. Finally, oil prices affect sectors positively like financials in US, Germany and Japan and that of consumer goods in Australia, Germany and Japan. It also affects positively basic materials in Germany, as well as consumer services, oil and gas and the utilities sector in Japan.

We could now ask why we have presented these results in face of such insignificance of coefficients obtained. In fact, we asked ourselves this and have tried to see if these results are due to a bad choice of macroeconomic variables or if these depend upon periods or model choice. In order to answer this we have applied the moving windows estimation technique for periods of 60 month windows for each of the sector stock indices returns in each of the countries analyzed. Once again and due to space restriction we will only present beta estimates through for two sectors in the UK market: financials and consumer goods. Results are showed in figures 1 (for the financial sector) and 2 (for the consumer goods sector).

These beta coefficients estimates are based on moving windows estimates where regressions for each index are done considering the same explained and explanatory variables for small samples of 60 months each. As such, we are able to obtain beta coefficients estimates for each macroeconomic variable considered through time given that each month the last 60 monthly observations are used to compute these same coefficients evolution through time. So, we can also observe if results statistical insignificance is always verified through time intervals samples of 60 months or even if the model specification used is the most correct one.

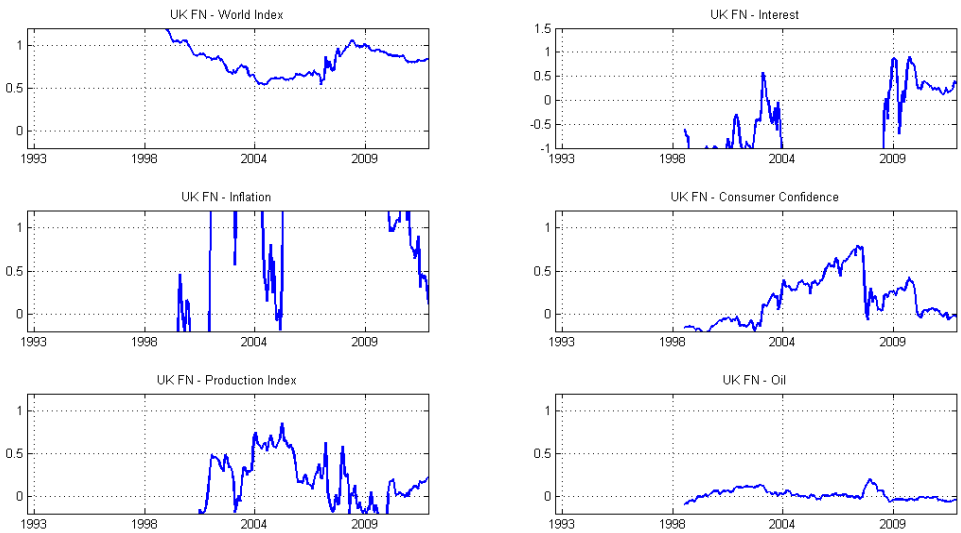

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Figure 1: Moving windows estimates for 60 months time intervals regressions: financial sector stock market index in the UK market

Source: Own produced results. Notes: These figures presents beta coefficients estimates obtained for the financial sector index stock returns in the UK market, by using small moving windows regression estimates based on the last 60 months observations. The x axis shows the betas evolution through time for the time period analyzed and also into account in each month estimate the previous 60 months values. The y axis represents the beta coefficients estimated values which goes from 0 (no sensibility of the stock index sector return to that macroeconomic variable) until 1.5 (high sensibility of the stock index sector return to that macroeconomic variables – positive or negative).

As observed in figure 1 and 2 the macroeconomic variables chosen do have effects over the specific sector stock market index returns, but these effects change through time and that's why the aggregate effect presented previously turned out to be so highly statistically insignificant in general. So, we do have a relationship between macroeconomic variables although it is not a stable relationship through time because it changes of sign throughout time. This means for example that until 2003 the interest rate has negatively influenced the financial sector returns but between 2003 and 2004 this effect turned out to be positive, or else that oil prices do not seem to have any statistical significant effect over the financial sector for the entire period for the UK market. So, changes of sign are not linear because for several periods we have high significance and for others there is simply no significance verified between the variables under analysis.

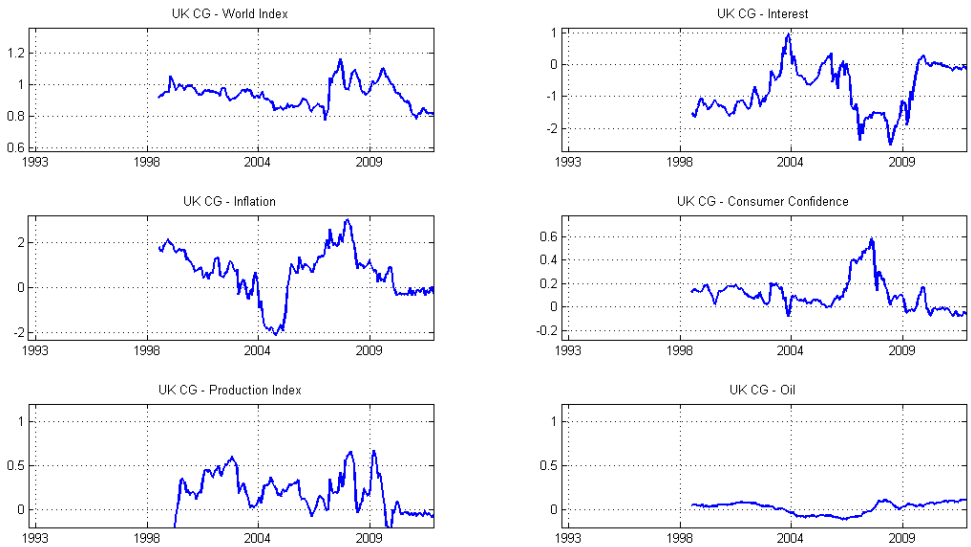

Figure 2: Moving windows estimates for 60 months time intervals regressions: consumer goods sector stock market index in the UK market

Source: Own produced results. Notes: These figures presents beta coefficients estimates obtained for the consumer goods sector index stock returns in the UK market, by using small moving windows regression estimates based on the last 60 months observations. The x axis shows the betas evolution through time for the time period analyzed and also into account in each month estimate the previous 60 months values. The y axis represents the beta coefficients estimated values which goes from 0 (no sensibility of the stock index sector return to that macroeconomic variable) until 2 (high sensibility of the stock index sector return to that macroeconomic variables – positive or negative).

Curiously in the consumer goods sector oil prices also seem to have no effect over sector stock returns, but conclusions to be taken from here need a deeper analysis. But for both sectors we have a positive and highly significance of the market index over sector returns as also previously concluded for the entire period. Turning to the consumers sector returns beta coefficients estimates we see that inflation rates had a negative effect over the sector index between 2004 and 2005 and again in the recent years of the financial world crisis. In that same period of 2004 we observe the interest rate positive effect over this sector, while consumer confidence and the production index impact have periods of unstable effects. This instability is not captured through a simple OLS model

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and we need to use nonlinear models or even different time samples in order to be able to take deeper and better conclusions.

This type of conclusions leaves room for a deeper understanding of these variables effect over companies and sector index stock returns. Given that both figures reveal the stability or instability of beta coefficients estimates throughout the sample period and this instability has been observed, future research should consider these different periods analysis and also the use of nonlinear models able to capture these unstable effects through time among variables.

5. Conclusions

Our findings have beneficial implications for policy makers who are responsible for managing the economy but also for individual company's managers. In this work we have analyzed the effects of macroeconomic variables like inflation rate, interest rates, industrial production, consumer confidence, oil prices and the market index over both individual companies stock returns, considered by sector and for stock market index sectors for five developed countries (UK, US, Germany, Australia and Japan) using monthly data series for the period between March 1993 and February 2013. For the analysis we have used a multifactor model, having performed more than 300 individual regressions.

Results indicate that the variable which most affects individual companies' returns independently of their sector is the market index, while we are not able to establish a unique relationship between the variables under analysis for the rest of the considered macroeconomic variables. Moreover, we are not able to generalize these other variables results in terms of sectors and countries and this fact can be attributed to their different market characteristics. Despite this fact, we are able to state that our empirical results suggest the importance of the inclusion of the consumer confidence index to explain macroeconomic impacts over stock returns, which has upon to now been somehow discarded from the emerged empirical literature over the issue.

Moreover, although even if we are not able to generalize this to all companies sectors and indices, we may conclude from our empirical analysis that companies returns sensitivities to macroeconomic variables change of sign depending over the sector and country under analysis. A curiosity is the fact that interest rate revealed to have a positive effect for most of the companies and countries under analysis, when we should expect from economic theory an opposite effect. As for general stock market country sectors indices also considered here we may conclude that inflation, industrial production, the market index and oil prices are the only variables able to explain some of the sector index returns, where all seem to have a positive effect. For all the dependent variables under analysis we may say that it is the market index the variable which most influence exerts over stock returns, although for Germany this conclusion cannot be taken for all companies and sectors under investigation. Finally, we have shown that these insignificant coefficients estimates obtained are not due to a bad choice of repressors, but yes to the instability of beta coefficients estimates throughout time which leaves room for future work.

We may state that more research into these effects is still needed given that it seems that other variables other than those here considered may still influence stock returns. Moreover, it would be interesting to take a pre and post crisis, or for small sample periods observations along the entire time span considered, perspective analysis in order to see if results change as well as to generalize these effects for all companies of all sectors in all countries, for the ones considered here or even others around the world, which still need more economic reasoning and exploration.

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INDICADORES ESTATÍSTICOS DO DESEMPENHO ECONÔMICO DA EMPRESA INDÚSTRIA DE MINERAÇÃO (90'S - 2010): OLHANDO ANTES DA REVOLUÇÃO

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Resumo. O objetivo deste trabalho é dedicado à apresentação de um dos principais nervos da economia tunisina, que é o depósito de fosfato de rocha no sudoeste da Tunísia integralmente detida pelo maior público mineiro Firm CPGT Tunísia, que na verdade é apenas o pólo industrial na Mineração bacia região da Tunísia. Na verdade, a Tunísia é mais de um século no setor de mineração, esta experiência tem sido colocado na linha de frente dos principais países produtores de fosfatos comerciantes em todo o mundo. Embora, Tunísia qualificou o segundo país no mundo tem delegado a recuperação de fertilizantes fosfatados com uma experiência que ultrapassa meio século neste negócio. No entanto, apesar da intensa competição, a indústria de fosfato da Tunísia nos últimos anos (90's-2010), principalmente no final de 2008 após a visão sem precedentes dos preços das commodities no mercado mundial de fosfato de fertilizantes fosfatados WPFP, ganhos de eficiência notáveis melhorar o setor de base financeira e que tenham direta consequências sobre o desempenho econômico.

Palavras-chave: Empresa pública mineira, A perícia, Os ganhos de eficiência, Tunísia fosfato,.

STATISTICAL INDICATORS OF ECONOMIC PERFORMANCE OF THE MINING INDUSTRY FIRM (90'S - 2010): LOOK BEFORE THE REVOLUTION

Abstract. The purpose of this paper is devoted to presenting one of the main nerves of the Tunisian economy, which is the deposit of phosphate rock in southwestern Tunisia wholly owned by the largest public mining Firm CPGT Tunisia, which is actually the only industrial pole in the Mining Basin region of Tunisia. In fact, Tunisia is more than a century in the mining sector, this expertise has been put in the forefront of major producing countries phosphates merchants worldwide. Although, Tunisia has qualified the second country in the world has deputed the recovery of phosphate fertilizers with an experience that exceeds a half-century in this business. However, despite intense competition, the Tunisian phosphate industry in recent years (90's-2010), mostly late 2008 following the unprecedented overview of commodity prices in world market for phosphate fertilizer phosphate WPFP, efficiency gains remarkable improving the financial base sector and which have direct consequences on economic performance.

Keywords: Expertise, Efficiency gains, Public Mining Firm, Tunisia phosphate.

INTRODUCTION

The natural deposits of ground Phosphate Rocks located in north of Africa are closely linked chains of mountains of the producing countries phosphates dealers (mainly Tunisia, Morocco and Algeria). These channels are spread over a large area where the starting point is the chain of mountains south-west of Gafsa in Tunisia, passing by Algeria to settle finally in front of the Atlantic Ocean in Morocco.

Considered the *first* and oldest in the exploitation of these mineral deposits *in North African*, *Tunisian industry phosphate* (the discovery of Tunisian phosphate was in 1897) was able to acquire for that purpose, hot *knowledge* in this area mining activity that exceeds more than a ***century*** of

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exploitation and international marketing of this product gray[2] sub-field which is fully localized in the Mining Basin Gafsa in Tunisia (MBGT).

Thus, with the Tunisian independence in 1956 until today, the Tunisian phosphate industry (TPI) which is represented by the large public Firm TCGP (**T**unisian **C**ompany **G**afsa **P**hosphates) has continued to proliferate more to finance a large share of other economic activities in the country. Although, like other sectors of economic activity, the global Tunisian phosphate industry has made some economic shocks in times of crises such as oil seventy years and debt in the mid-eighties.

Yet, the Tunisian mining industry has resisted facing this very difficult international situation for any mining company exporting whatever their economic size. As soon as the late eighties - under the efforts of Government assistance, through various policies to encourage research into new fields, exploration of markets and partnership - the Tunisian phosphate sector (TPS) has regained its vitality through *the technological modernization* of working tools and could therefore generate a significantly positive outcome and that is really real date overview of this industry for a more phosphate promoter since the mid-ninety today.

In this context, the Tunisia Phosphate Gafsa Company (TPGC) was engaged in a program of reorganization[3] and technological upgrading to significantly enhance its profitability, to handle to allow him to compete with foreign (Morocco the main competitor in the North Africa) more intense global and precisely address this global economic environment nowadays, unfavorable to the exporters, despite the plan of support and backup in various forms of aid by the Government.

How has been manifested Tunisian phosphate industry to cope with this latest world economic crisis of 2008 and just after tow years before the revolution 2011?

Strongly observed (Tunisian Central Bank report, 2009-2010) that Tunisian phosphates Sector TPS, presented by the Leader Company TPGC and subsidiary Group Chemical Tunisian where recovery is phosphate fertilizer, has continued its vigorous development in the global economic crisis of 2008. Although, the price of phosphate has more *triple* from $ 45 per ton in early 2007 to more than $ 324 per ton in 2008 (USGS 2008-2009, World Bank 2009).

This has generated highly remarkable efficiency gains leading to strengthening the financial base of TPS and improved accordingly Tunisian national GDP[4]. Despite the significant level of current sulfur imported ($ 810 per ton in late 2008), the latest global economic report (Davos Economic Report 2009 to 2010, Fitch Rating Agency 2010) showed that the wisdom of the Tunisian economic governance, and case here Tunisian phosphate industry, brought to fruition in the event of crisis and cyclical changes to cope with any economic damage and circumvent these adverse effects for advocates.

We chose to structure this research paper into three sections, namely:

In the first section of this article, we outline the general historical overview of this large public Firm Tunisian TCGP more than a century in its mining field, is taken as the framework for implementing our research study in this paper.

The second section of this paper is devoted to showing the rank occupied by this large global firm public before Tunisian TPGC world's leading producers of phosphates (such as USA, Morocco, China ..) with their economic weight in the global market phosphate fertilizers (GMPF) through their production potential of this ore. In presenting its contribution to the Tunisian economy in terms of

2 Returning to history since antiquity, the region of Gafsa Mining Basin (G.MB) in Tunisia was totally invaded by the sea, but we have attended several geological changes in northern Africa, in the case of Tunisia, where the level of the sea in the said period began to sink deeper and eventually the whole region (G.MB) has become Tunisian land without water. It remains in this region, according to geologists, the underwater environment (the various types of fish skeletons, seaweed, algae, various marine plants... etc..): Organic substances in water rooted mountains led by following the formation of various minerals, mainly phosphate (P). As is well known, world agriculture (FAO, 2010) is remarkable in need of phosphate fertilizers that are in high demand in the world market for phosphate fertilizer (WMPF).

3 The real objective was compression costs of production, while encouraging more in search of new mineral deposits by the mining area, in part cons acceleration for the closure of underground mines where the cost operation was very high.

4 GDP indicator: Gross Domestic Product.

various mineral products exported on a significant period of time with a deduction of the results achieved and future perspectives of these ores and those imported.

The final section will focus on development and economic performance of the Tunisian Industry phosphate. We focus on the reputation and image of this Tunisian Company of phosphates in the eyes of global Rating organizations, especially the annual contribution of the agencies Fitch Ratings 2006-2009, dealing with change current international cyclical.

"... The opinion of the International Monetary Fund over economic policy in Tunisia is very positive and is doing well despite the global financial crisis and the severe fluctuations in oil, metals, mining and food ... We don't have no fears for next year 2009, although in global, it will not be easy. In Tunisia, it works properly ..."(Mr. D. Strauss-Kahn, Managing Director of the International Monetary Fund, November 2008).

1. GENERALIZED OVERVIEW: ACTIVITY OF THIS GREAT TUNISIAN PUBLIC FIRM, TPGC: TUNISIA PHOSPHATE GAFSA COMPANY

Tunisia is a *pioneer* in the world regarding the field of extraction of phosphates and industry phosphate fertilizer. This is connected directly to the prestigious and oldest Company in Tunisia, namely, TPGC: **T**unisia **P**hosphate **G**afsa **C**ompany (*in French called CPGT*). It occupies the first places[5] in the world in terms of the production of phosphate (5th place) with an annual production in late 2009, which exceeds 8.5 million tones of phosphate raw (INS, Tunis, 2009) exported to fifty countries worldwide.

Thus, in order to witness the historic quality of the Tunisian phosphate and Ports in Basin Mining of Gafsa Armiger[6] and M. Fried. (1957), have compared 12 sources of phosphate rocks in terms of quality organic ... they could finally work out of such research as the Tunisian phosphate in region south-west of Gafsa is the best among the other samples of phosphates rock, it becomes after him the phosphate rock of South Carolina in the United States'.

1.1. Brief History of TPGC: Tunisia Phosphates Gafsa Company

In 1885, in the Gorge "THELJA" near Métlaoui in Gafsa , a French paleontologist, *Philippe Thomas(1885)*, prospecting rocks was found a *layer of lime phosphate*. Born then, the Tunisian Phosphates Gafsa Company TPGC. (See graphics card with the delivery of Gafsa phosphate to the ports of embarkation for export below).

5 Tunisia is the 2nd country in the world in the exploitation of phosphate fertilizer after Morocco. In addition, Tunisia occupies the 3rd place in terms of export of the product phosphate (2009) and 5th place for the production of that "underground-gray" (According to latest statistics from the Association of Industries fertilizer, USGS 2008-2009).

6 Armiger.H and M. Fried., 1957, 'the plant availability of Various Sources of phosphate rock. Soil Science Society of America proceedings',pp183-188. (1957).

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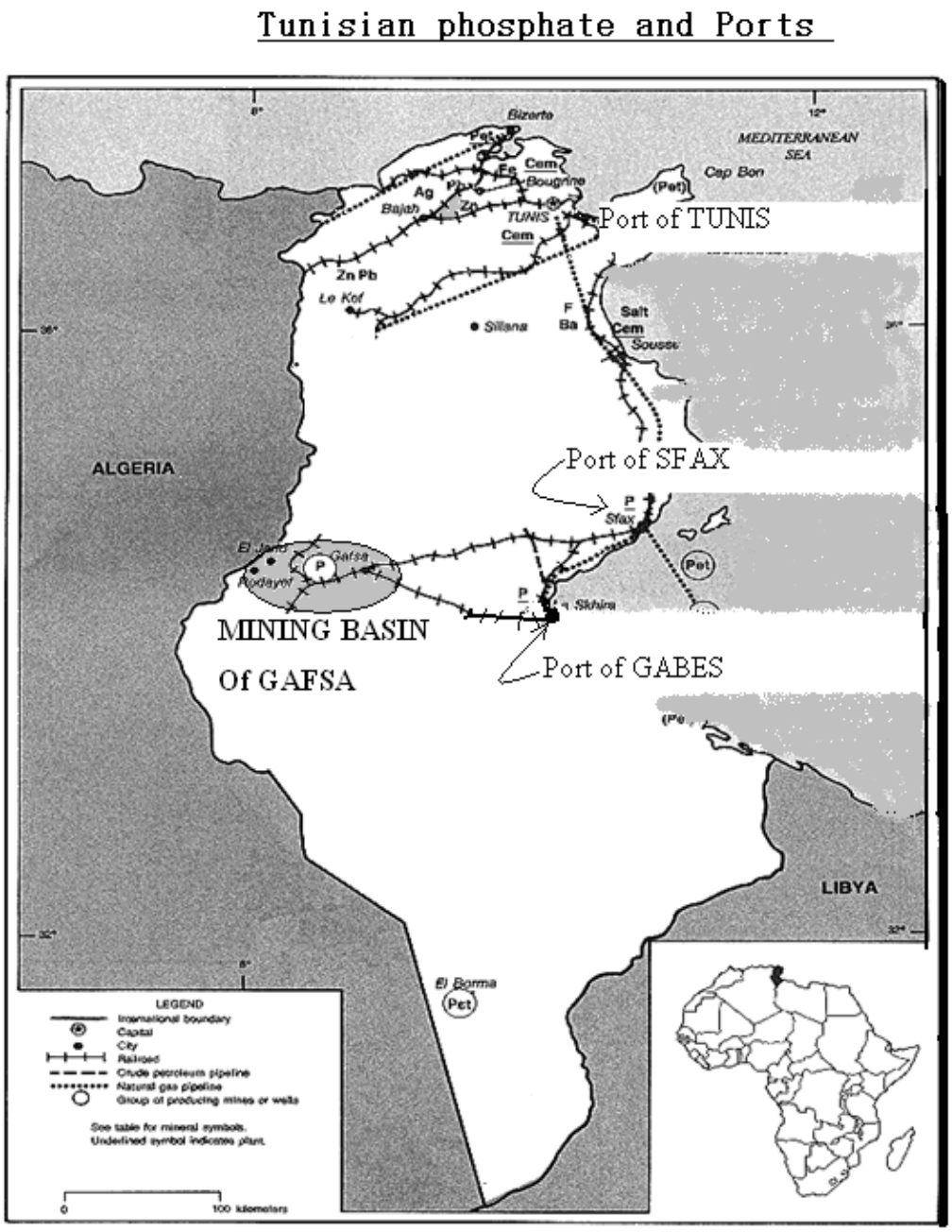

Figure 1: Tunisian Phosphate in Mining Basin of Gafsa

Table 1: Chronology of the time of foundation of Company Phosphate Gafsa Tunisia since the discovery of mineral deposit in 1885

1885	Date of discovery of mineral deposits in Tunisian south-western near the mountains of Métlaoui Gafsa by the French geologist "Philip Thomas".
1897	Appointment of the Gafsa Phosphate Company and Railway Gafsa (CPGCFG) as the first operator of mining offices Métlaoui. Followed by the first line linking ferrate Métlaoui to seaport of Sfax.
1899	Date of opening of the first under-ground mine Métlaoui (Gafsa)
1903	Date of opening of the second under-ground mine at Redeyef (Gafsa)
1904	Date of opening of the third under-ground mine at Moulares (Gafsa)
1905	Creation of the 'Stethos' (Tunisian Company operating phosphate) (Gafsa)
1920	Opening of M'Dhilla mine operated by the Company of Phosphate Tunisia.
1948	Turning SIAPE (Subsidiary industrial phosphoric acid and fertilizers)
1956	Progressive Nationalization of different Companies under the direction of the one leader Tunisian Company.
1962	fully capitalization of Tunisian Phosphates Company Tunisian M'Dhilla

1966	End alignment Railway-Gafsa Sfax, so that it becomes independent from that date.
1969	Merger between the "CPGCFG" Company and phosphates M'Dhilla
1970	Date opening of the mine Shib-Mrarta and starting in 1975 the career of mining Moulares
1975	Start the quarries of mining Moulares
1976	The merger between Stethos 'CPGCFG' and under the sole appointment of the TCGP wholly owned by the Tunisian Government.
1978	Switching quarries mining Kef-chfaire
1980	Start mining quarries of Umm-lekhcheb
1986	Start mining quarries of kef-dur
1989	Switching quarries mining Redeyef
1991	Start of mining quarries DJelebba
1994	Appointment of a single director general for TCGP and subsidiary chemical group
1996	The merger into a single business management.
2008	Signing of Partnership with Indian Companies, where TCGP and chemical group that holds more than 70% of capital.
2010	Date to Enter into force of this Tunisian-Indian partnership (the Company TIFERT Indian) for the recovery of phosphate fertilizers, largely intended for export.

Source: Documentation and planning Data, 2011.

Founded in 1897, Tunisia Company of Phosphates Gafsa, TCGP, is a company more than a *century,* which is the public operator of phosphates in Tunisia. Its expansion is unprecedented in the underground opening that extends to other areas of the mining area of Gafsa.

Indeed, extraction of phosphate product began in Tunisian Mining Basin more than 110 years ago. Although, in global level, Tunisia is the second country after Morocco which began to recover in the last fifty years in the Tunisian Chemical Group in Sfax, which is a subsidiary company directly linked to the parent TCGP, a remarkable share nearly 80% of this natural product in phosphate fertilizers quality (phosphoric acid, DAP, TSP .. etc..) very competitive and great demand in World Market phosphate fertilizers WMPF.

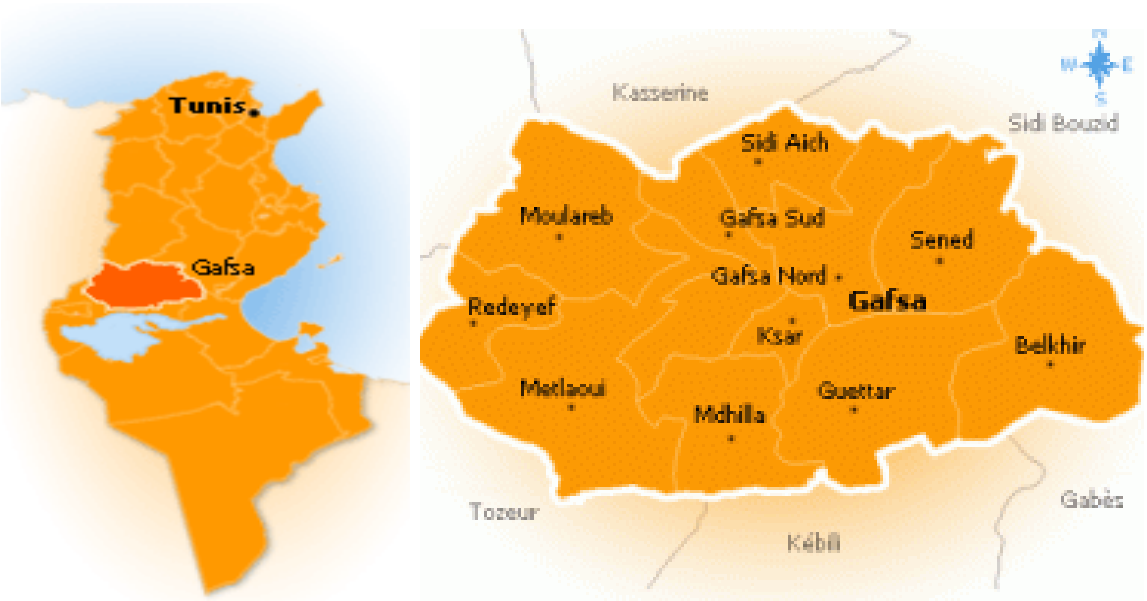

Figure 2: Graphics of the mining area of Gafsa, where Tunisian TCGP Company operates phosphate mining

Tunisia exports a large share of phosphate fertilizer into European Union EU saw bilateral trade well as geographical proximity Mediterranean, while the other is destined for other countries from four continents. (See illustrative diagram in the box below)

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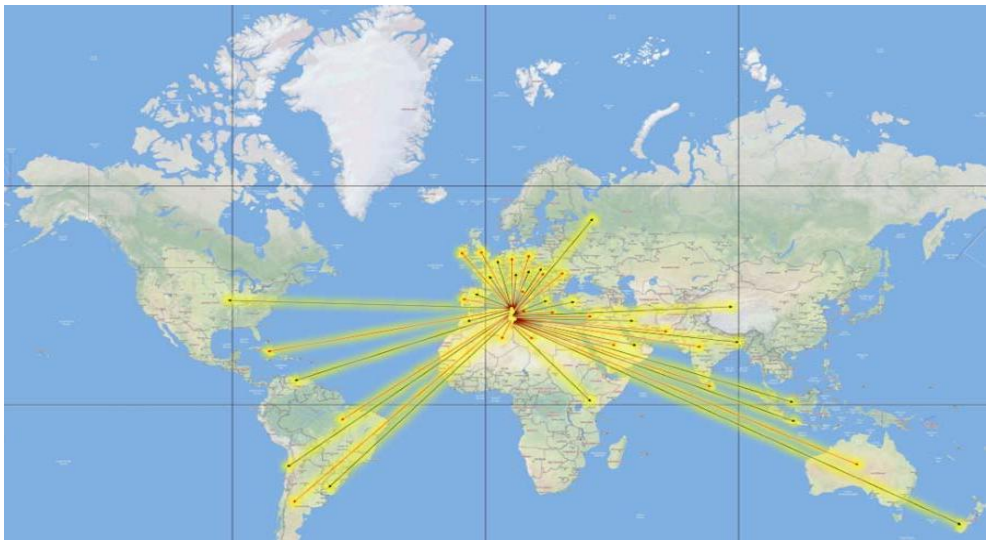

Figure 3: Export of Tunisian phosphate fertilizer to some fifty countries around the world

This Company is owned 90% by Tunisian Government, the **T**unisian **C**ompany **G**afsa **P**hosphates T.C.G.P, was founded in effect:

To exploit phosphate reserves in the Mining Basin of Gafsa in particular.

Undertake enrichment of ore to obtain a marketable quality.

To commercialize the phosphate product in the most favorable economic conditions possible.

To conduct surveys and geological research.

Thus, the TCGP Company of Tunisian phosphate had long been and so far as the single most major industrial center located, over one hundred years in the Mining Basin into southwest Gafsa in Tunisia where the lives of over 380,000 family homes Gafsa mining basin. This largest citizen Company currently employs in 2010, more than 5,200 employees including 512 managers (top and middle) and ranks fifth in world production, although the third place among countries exporting large phosphate product.

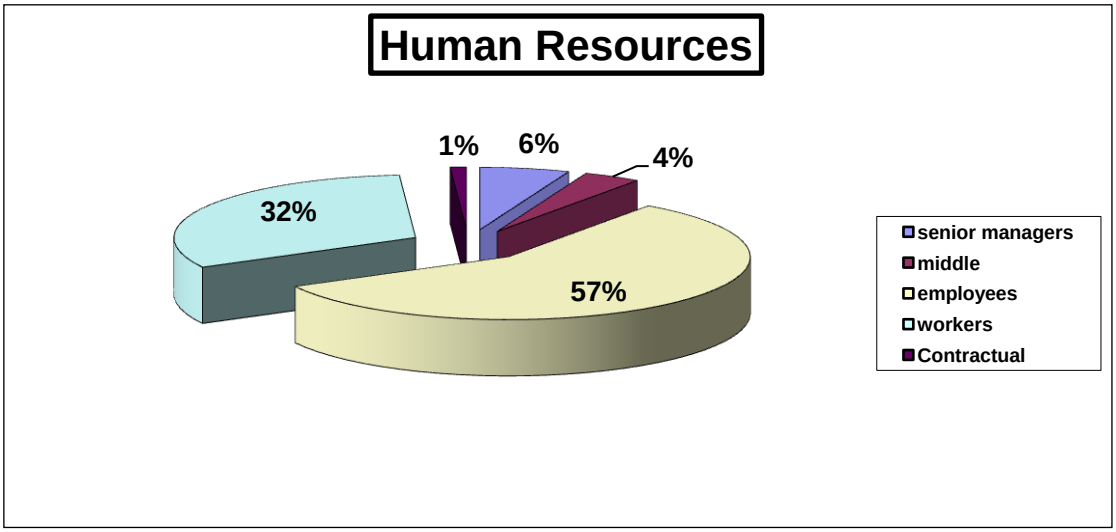

Figure 4: Graphics card on the allocation of human resources by the Tunisia Company Gafsa Phosphate

However, this position of this large Tunisian Company mining (T.C.G.P) worldwide, is caused by its potential reserves estimated at 1.300 Million tones with a very rare quality, its very popular with customers in the world market for fertilizers and phosphate, its yearly production is 8.5 million tones

of phosphate merchant in 2010 and projected 9.5 million tones from that product for years according to forecasts7 of medium and long term research into development center of T.C.G.P in Metlaoui Tunisia. (See box below on the production of Tunisian phosphate Merchant from 1900 to 2010)

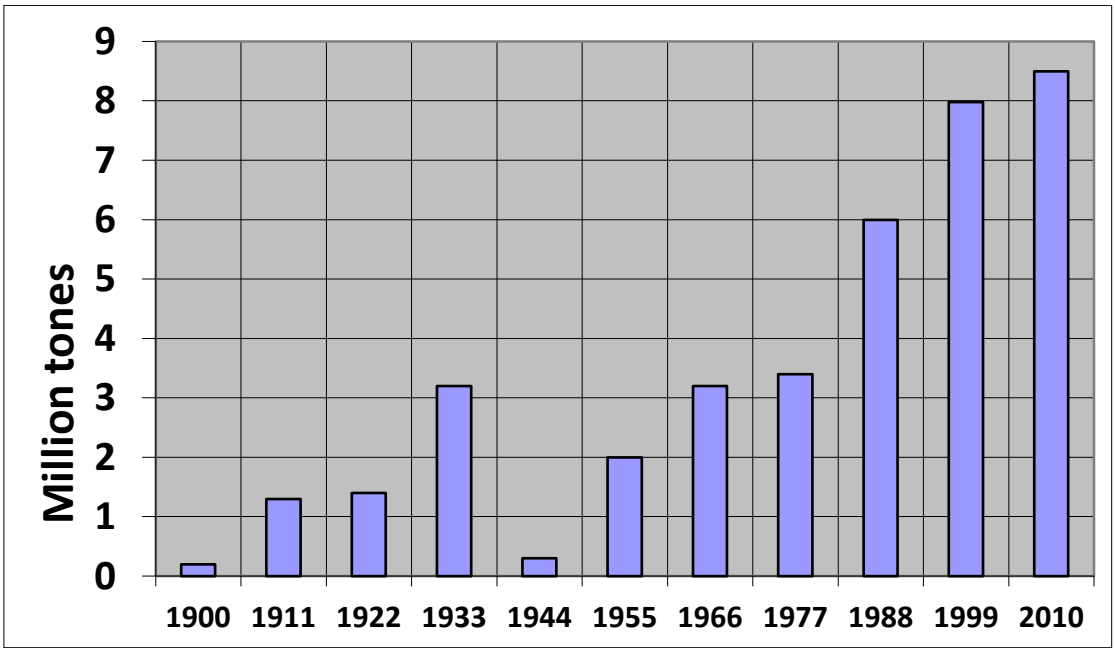

Figure 5: Evolution of yearly Tunisian natural phosphate between (1900-2010)
Source: Direction T.C.G.P, Management center of phosphate production, 2010.
Note: graphic representation by simple weighted average for each period of 11 years in simple smoothing until 2010, it forecast at predetermined by the previous two years 2008-2009.

Based on the shape of the graph on the production of natural phosphate on a time interval that exceeds more than a hundred years (1900 to 2010), most strikingly, two periods of sustained growth:

First phase (1900-1938) who in 1938 reaches peak near 3.2 million tones of phosphate produced. Another time the most remarkable stretches over a longer period, from 1946 to graphically present with growth typically continues until 2010, which is mainly due to good cost control by the company TCGP and by using modern ICT technology tools most sophisticated mining ores and recovery the Tunisian phosphate product. All these assets held by the Tunisian Mining public enterprise, contribute much to growth unprecedented production volume of Tunisian phosphate fertilizers until today.

Although, a difficult time passing (1938-1946) between the two periods when the production rate was tilted to the lowest level, the most shocking noted throughout the economic life of this great Tunisian public Mining Firm (TCGP) up until today. While, the causes are well known in fact that are related to the crisis[8] in 1929 and very serious disruption affecting all sectors of global economy.

1.2 Mining plant

Currently, the TCGP Company holds four mining centers consist of two underground mines and seven surface mines provide over seven laundries Tunisian phosphate enrichment. Mining activities in the

7 The Centre for Research and Exploitation in Métlaoui Tunisia (CRVM) is one of the main nerves of the Great Tunisian Mining Company TCGP. Its main task is to predict the annual production rate, while applying predictive models of means and long term (generally over periods of 10 years and over). The center promotes the research and also to exploit other areas of geological mining Gafsa Tunisia to maintain the one hand, and increase the volume of production of phosphate, on the other hand, through the new Technology ICT resources used and operational considered the most modern used by the world's leading producers such as Morocco (1st world producer).
8 Crisis 1929 (Black Thursday on October 24, 1929) is the worldwide economic depression which was evidenced by the collapse of several global macroeconomic indicators such as: the worst economic recession in the history of the world economy, an unprecedented deflation followed by a significantly higher rate of unemployment, falling stock prices and the bursting of the speculative bubble leading a stock market crash.

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TCGP Company are located in five main sectors in mining region of Gafsa Tunisia which are distributed as follows:

For the region of Mining Métlaoui, there were two areas which are:

- The sector "Kef-Métlaoui Schfaier" includes quarries Kef Shfaier and laundries of Métlaoui.
- The sector "Kef-Métlaoui Eddour" includes quarries and Laundromat of kef Eddour.

For other regions of the mining area:

- The sector "Redeyef" includes mine Erg-Lasfar, quarries and laundry Redeyef
- The sector "Moularès" includes mine Mrate, quarries and laundry Moulares.
- The sector "M'Dhilla" includes quarries and Jellabia Mzinda-andTHE M'Dhilla of laundries.

2. GLOBAL POSITIONING AND CONTRIBUTION TO THE NATIONAL ECONOMY

In regard to his rank in the world who can be classified as a *fifth* Tunisia powerful producer (USGS 2009) to the world's leading producers[9] of phosphate products and its ability to employability, as large industrial center in the mining region of Tunisia . This prestigious Tunisian citizen mining Company has a remarkable contribution to the gross value added of the Tunisian economy and the trade balance. Its turnover rose from 403Millions dinars in 2007 to 1,406 million dinars in 2008 and 1854 the following year. (Annual Report of the Finance Department of the TCGP, 2009)

2.1 Extraction of high quality of phosphate requested

The extraction of phosphate raw -gross- reached in 2009 (INS Tunisia, late 2009), 12 million tones is currently extracted from 10 units and is transported to processing units into Sfax for enrichment, which resulted in the production of nearly 9 million tones of phosphates commodities (merchants).

TCGP Company has placed Tunisia with this production of phosphate as the 5th largest global wholesale producer countries of phosphate immediately after Morocco, the United-States of America, China and the Russia. And the third largest exporter of the product.

Table 2: Ranking of the eight major producers of phosphate rock by volume and world share in 2006: Natural phosphate of Tunisia on Fifth Rank.

Major Producing Natural phosphate Countries	Production volume (In million tones)	World share in percentage (%)
United States (1)	36300	24.69
China (2)	30400	20.68
Morocco (3)	25200	17.14
Russia (4)	11000	7.48
Tunisia (5)*	8500	6.18
Jordan (6)	6320	4.24
Brazil (7)	6100	4.15
Syria (8)	3500	2.38

Source: USGS, May 2006.
Notes: (1) to (8) is the descending order in terms of production volume of natural phosphates by the major global producer; * Data are for Tunisia in 2009 (BCT.2009) who ranked fifth place in the world. Other data are attributed to the USGS in 2006, given the lack of data by country of origin.

9 The world's leading producers of phosphate product are classified as follows: MOROCCO (1st), the United States, China and the Russia. So, Tunisia in 5th place worldwide.

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The TCGP Company operates sedimentary deposits of phosphates multilayer separated by spacers' marl and limestone. The operation of these pools which was entirely in underground mines has been gradually transformed to a current open pit from which currently reaches more than 87% of the total extraction.

2.2. Exportation in World Market

Nearly 15% of phosphate rock extracted by the TCGP Mining Company is exported to 15 countries located in Asia (the largest share to India as the main customer in this region), mainly in LATIN AMERICA and EUROPE.

The remaining 85% is processed locally in Sfax Chemical Group factories (GCT) to phosphoric acid and rich variety of fertilizers most of which is exported to these countries by port of Sfax.

Table 3: World production of phosphate commodities between "1996-2008" (Millions tones of ore): Tunisia to 5th place worldwide

	United-States	China	Morroco	Russia	Tunisia	Other	World
Phosphate	41,2	26,4	25,7	11,2	8,1	35,2	143,8
P_2O_5*	14,6	8,2	8,3	4,8	3,7	11,6	47,3

Source: Association of Fertilizer Industry, USGS 2008.

Notes: The production of phosphates indicated by the Fertilizer Industry Association are slightly superior to those statistics from USGS, but the proportion of phosphoric anhydride (P2O5) in phosphate remains the same (31.2%).* The rate of phosphorus pentoxide (P2O5) in the phosphate is 31.2% on average.

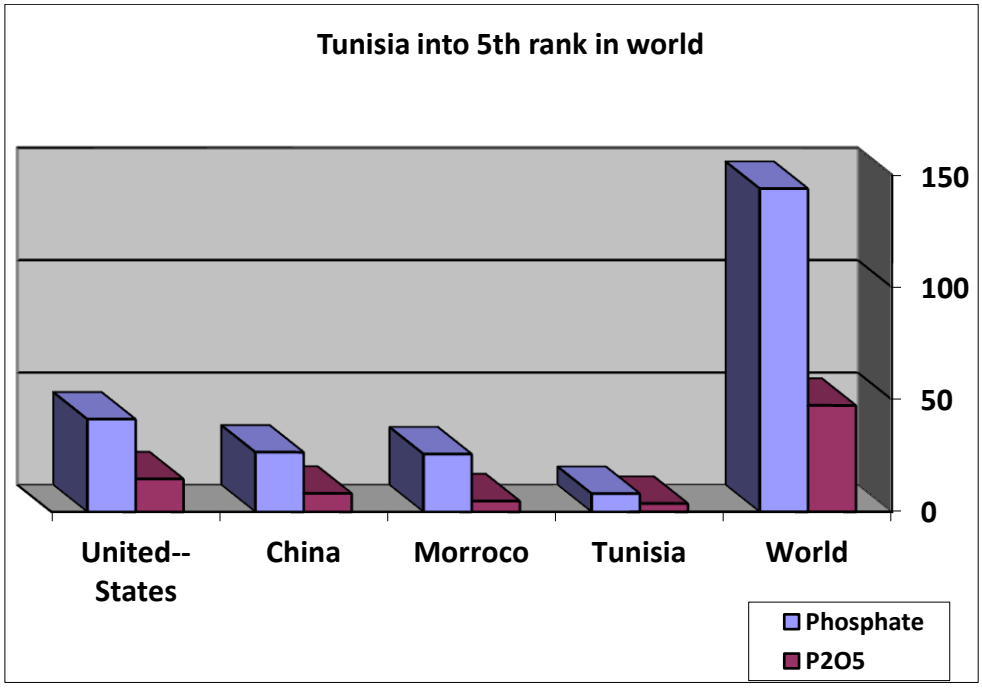

Figure 7: World production of phosphate - 1996-2008 (Million tones of ore)

According to statistics from the Association of Fertilizer Industry, USGS 2008, Tunisia ranked fifth worldwide by two indicators of production (yearly production volume of crude raw phosphate and the level of the ratio of phosphorus pent oxide P2O5 phosphate in Tunisia). However, 2008 has shown a greater demand for Tunisian phosphate rock with an export volume has more than doubled in 2008 to about 180.5 Million Tunisian Dinars, against only 71 in Million Tunisian Dinars 2007. (See Table 4, below).

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Table 4: Main exports (Mining, Phosphate and derivatives)

Years	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Phosphate rock raw	32.4	32.9	32.0	35.7	45.6	38.2	39.9	46.6	48.5	45.7	31.1	24.6	34.5	35.6	71.0	180.5	54.9
Phosphoric Acid	120.8	170.2	190.8	218.2	281.3	278.9	276.0	242.2	236.3	214.3	158.3	225.6	282.9	317.4	343.9	887.2	418.0
D.A.P	103.1	118.2	154.8	188.5	180.3	202.8	212.8	215.8	273.8	267.3	297.3	349.5	328.6	389.3	508.6	1074.3	502.2
Triple Superphosphate	75.0	103.0	110.5	119.7	122.1	135.6	133.8	142.2	130.5	137.3	142.8	185.3	205.0	200.8	324.9	767.0	377.6
Salt	5.1	6.3	7.0	7.6	6.1	6.9	7.1	8.8	11.7	11.1	14.7	13.9	18.0	17.2	13.8	18.8	31.3
Zinc	0.8	3.4	19.6	16.1	1.8	7.6	17.7	28.2	19.9	15.3	15.5	14.9	14.6	-	0.1	-	-

Source : National Institute of Statistics (INS), Tunis. 2010.
Note: Unit : Million of dinars

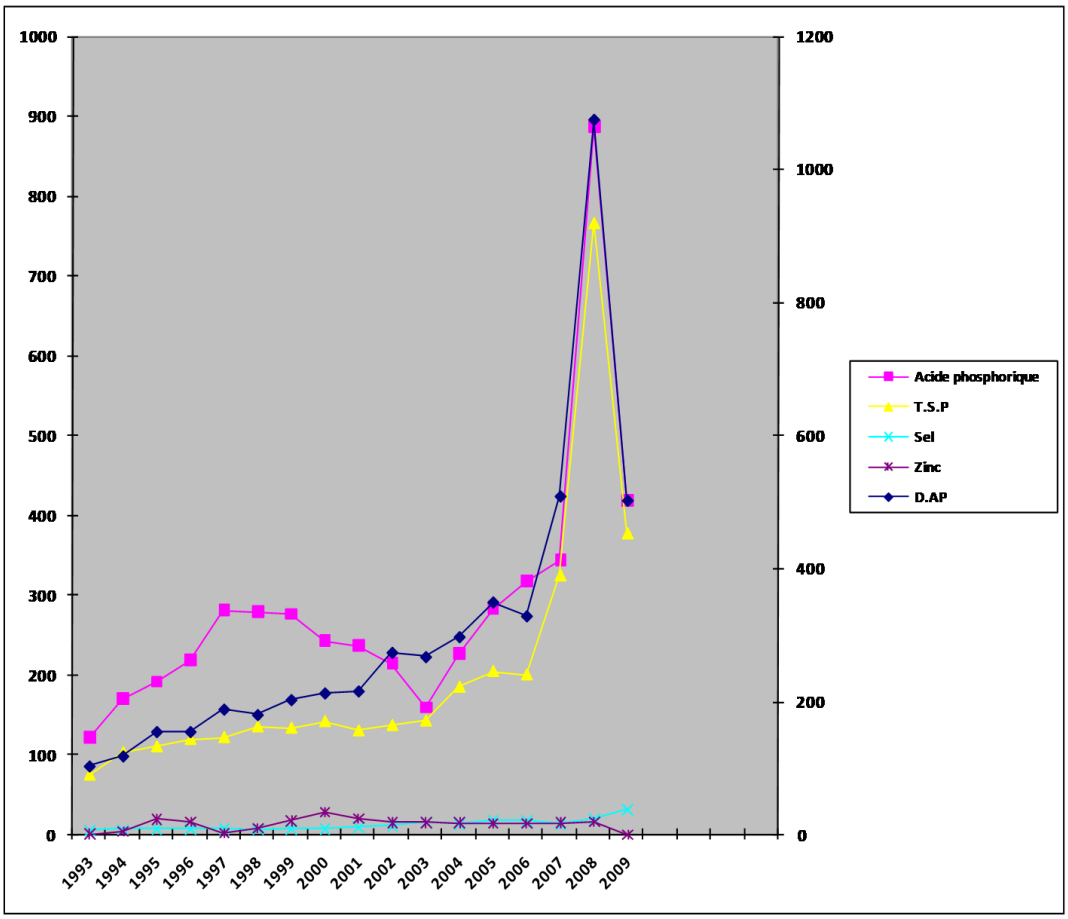

Figure 8: Evolution of the main exports: Mining Phosphate and derivative (1993 - 2009)

An overall view on the evolution of various phosphate ores exported from Tunisian Mining Bassin Gafsa (Mining area) displays an increasing rate of world exports of raw phosphate and its various components in mineral fertilizers as shown in the chart above.

Strongly held in 2008, flying over the price of phosphate fertilizer in the World Market PFWM, the trade balance is highly comfortable with these surplus yields gains generated by these products and derivatives exported phosphate (phosphoric acid 887.2 Million Dinars, 180.5 Million Dinars raw phosphate, DAP 1074.3 Million Dinars and Triple superphosphate 767 Million Dinars). But this export volume is almost halved in 2009 for these various phosphate fertilizers with a return to the state of price stability in the market PFWM after the unprecedented rise in prices in the end 2008.

Moreover, since 1994, the Tunisian government has decided the unification[10] of the general direction of the TCGP and Chemical group by appointing a single president. It was followed in 1996 by the

10 In 1994, under unification, the phosphate raw reached 32.9 Million Dinars TUN. (Echoes Tunisian Phosphate. 1994).

merger of the two sales divisions (exported raw phosphate posted in 1996, worth 35.7Million Dinars TUN), hence the rate of export of this product moderately accentuated to around 40 Million Dinars TUN, reaching in 2008 the highest price 180.5 Million Dinars TUN.

In 2009, prices for exported raw phosphate product were recovered near 59.9 Million Dinars TUN, after 2008 qualified more comfortable, its profits from the export of various phosphate fertilizer mining Tunisia, for this great public enterprise Tunisian mining TCGP. All these difficult global economic conditions, in contrast, conferred on the Tunisian industry phosphate more cohesion, efficiency and profitability made by exporting the phosphate product and its derivatives in the world market for phosphate fertilizer PFWM. (See the following table on the main products imported mineral enrichment between 1993-2009)

Table 5: Major Imports (Mining, phosphate and derivatives)

Years	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Sulfur	64	83.4	95.1	78.4	92.9	71.8	67.6	94.8	78.3	81.1	131.2	151.2	179.0	159.2	154.1	1150.2	163.5
Ammonia	37	37.7	51.5	57	48.8	38.3	39.3	69.5	72.7	60.5	101.5	109.3	109.7	119.2	104.2	212.4	124.1

Source: National Institute of Statistics (INS), Tunis. 2010.
Notes: Unit: Million of Dinars

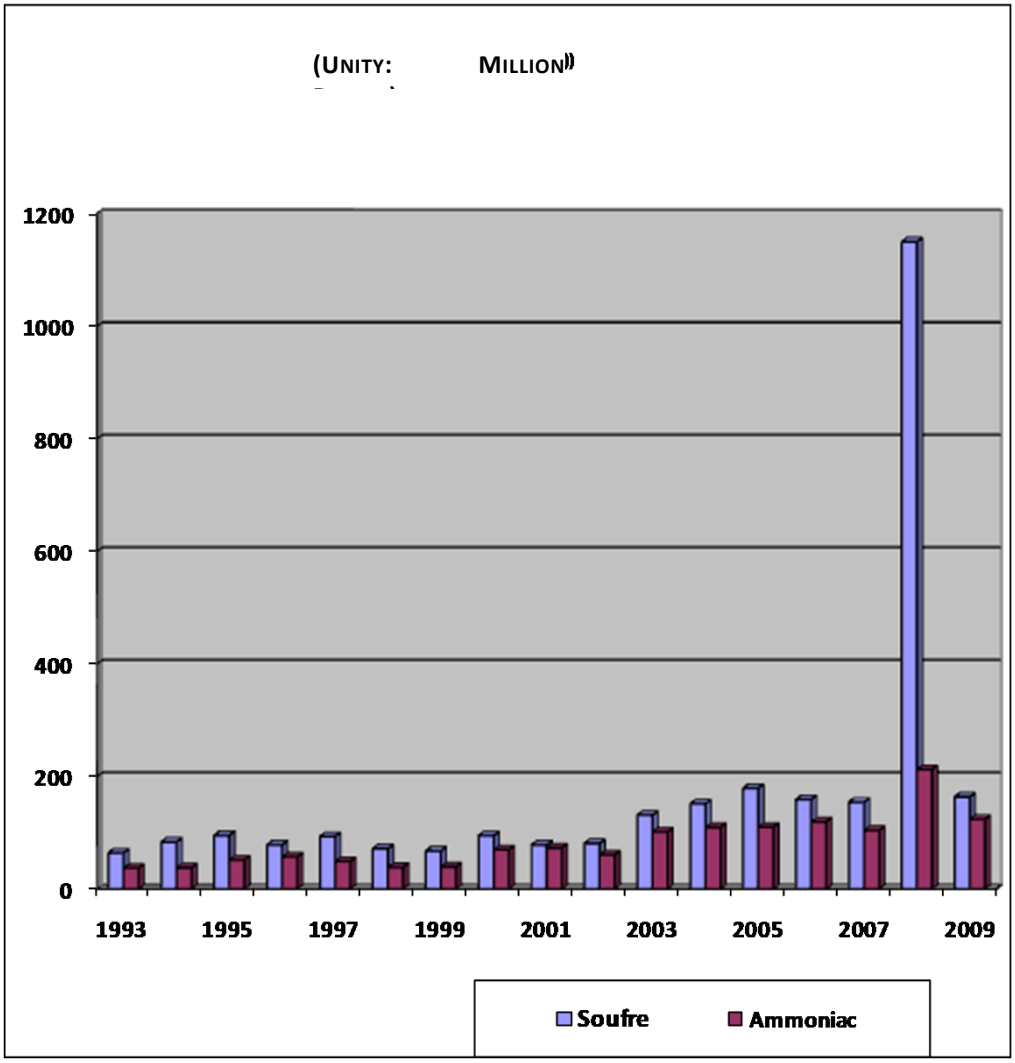

Figure 9: Main products imported (1993-2009)

By analyzing the values of sulfur and ammonia (see Table 4 and Figure 7 above) imported to enrich the Tunisian phosphate fertilizer for export; we note that average prices of both imported goods for

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the period (1993-2002) are around, respectively, 75 Million Dinars for the sulfur, and 52 Million Dinars for ammonia.

But from 2003 until now there has been a rise in prices on the world fertilizer market; the respective mean values of ammonia and sulfur are in the order of 289 Million Dinars and 125 Million Dinars. However, the highest peak of these two products is displayed in 2008 (1150.2 Million dinars for sulfur and 212.4 Million dinars for ammonia) of course year of world financial and economic crisis. Moreover, most strikingly in 2009 from the graph that the prices of those products are down almost the same damping averages from previous years 2006 and 2007.

3. Development and economic performance of the Tunisian Industry phosphate: Role assigned to the Leader Mining Company.

The phosphate industry in Tunisia will experience a great development in the coming decades with very large potential reserves of rare quality and the future investments already made, also to the restructuring program upgrade already followed. (Report of the BCT, 2009-2010)

For its development, TCGP Tunisian Mining Company has planned investments of around 128 million Tunisian Dinars, under the 10th structurally plan, which has already helped to achieve the horizon of the plan with production of 8.5 million tones of Tunisian phosphate rocks. The TCGP will have in future prospects, at least maintain production at current levels, improve productivity and compress costs of production and consumption of energy.

3.1 The extraction of phosphate quality: Facts and Estimates

The extraction of phosphate rock is estimated to reach finally 2010, 12 million tones (phosphate Tunisian TCGP, 2010), which will produce 9 million tones of phosphates rocks.

In addition, chemical, radiological, and mineralogical conducted by several laboratories around the world[11] indicate that the Tunisian phosphate Gafsa, produced by the largest public Company Tunisian citizen TCGP, is one of the most high quality rare phosphates in the world strongly requested. This places Tunisia in the world's third largest export phosphate mining product compared to leader exporter of phosphates (USA, Morocco …etc.).

3.2Development efforts and contribution of TCGP, economic performance against the last world economic crisis: International Notes issued by Fitch Ratings Agency to phosphate Tunisia

The Tunisian phosphate industry is one of the main nerves to the Tunisian economy. This is illustrated by the notes[12] of the Agency Fitch Ratings (AFR) published[13] recently (late 2009-2010) for this great Tunisian Mining Firm showing its good image in the world and its future trends that will keep pace with growing strong, albeit this situation unfavorable world economic crisis.

Currently and through this report[14] AFR (2009), the Tunisian phosphate industry will undergo a great development in the coming decades, thanks to its significant potential reserves that are very rare worldwide, and also for investment, reported by 11th (2007-2011) government Plan, already made and also to ongoing programs of technological modernization, restructuring and upgrading already followed since 1996 by the great Tunisian Mining Company, TCGP.

For increased its level of productivity and increasing the pace of development, this large Tunisian Mining Company has planned a investment in the order of 158 million Dinars in the 11th Plan (2007-

11 Research group phosphate rock, Fertilizer Industry Association, USGS 2009.
12 The confirmation notes to the TCGP Tunisian Mining Company by Agency Fitch Ratings (2009) are:
* For the Long Term (LT): AA (TUN)
* For the Short Term (CT): F1 + (TUN) stable character.
13 Agency Fitch Ratings: is an international rating industry agency, which assigns notes to Great International Firms yearly, based on each industry report, production technology and the export volume reduced.
14 The agency report was published recently in August 10, 2009.

2011) allowing it to reach the horizon of this plan an estimated production of 9.5 million tones of Tunisian phosphate.

Moreover, facing this economic crisis that has severely affected most countries of the world together with their companies irrespective of their economic size, the great Tunisian Mining Company TCGP expected in future years more difficult economically, maintain production at least at the current level, improve their technological capabilities (ICT) in productivity, operating and recovery of minerals while reducing costs at various stages of business and marketing.

In this framework, Fitch Ratings has confirmed, in fact, its ratings in 2009 at the international level for Tunisian Mining Company, TCGP.

The new ratings reflect the strong performance of the Tunisian phosphate industry, despite these difficult[15] economic changes worldwide, which further contributes a remarkable development of the financial base of the Tunisian economy.

However, these ratings assigned by Fitch Ratings to the Tunisian large public Mining Company reflect the excellence of the financial health of this great Mining Company that is directly related to the high demand for phosphate fertilizer quality worldwide for agriculture fertilization. This explains the surplus in trade balance in late 2008, when the price per tone of phosphate product has *triple*, exceeding 400 Dollars per tone, representing a huge win for the Mining Company and, Tunisian economy too (the Tunisian GDP has been growth remarkably).

From an economic standpoint, the Tunisian phosphate industry has continued in recent years (2006-2009), to take advantage of favorable global environment characterized by continued demand ever higher and the pursuit of increase in sales prices of phosphate and fertilizers.

Table 6: Financial situation of the CPGT between 2006 - early 2009

	2006	2007	2008
Incomes of the company (in Million Dinars)	295.2	414	1420,4
Operating Margin EBITDA *in%	23.7	37,5	78,1
Level of debt (in million Dinars)	109.5	91,3	54,8
Treasury Business (in Million Dinars)	178,9	215,4	961

Source: Annual reports of Fitch Ratings (2006, 2007, 2008, early 2009)
Note: * EBITDA can be calculated from the account of the result in two ways:
- Additive Method (EBITDA = Net income + interest expenses + tax + depreciation expense)
- Subtractive method: (EBITDA = turnover-shopping-other external costs-personnel costs).

This Leader Tunisia Mining Company TCGP has made in the end 2008 earnings 1420.4 MTD cons 414 MTD in 2007, a profit of 243%. Boasting the world price of phosphate is strongly increased after several years of stability (prices triple from medium 60 dollars / tone in the 2007 to over 400 dollars / tone in the 2008 and up to half of the year following 2009). Thus, the operating EBITDA margin increased from 37.5% in 2007 to 78.1 in late 2008, a differential gain of 40.6%.

It is obvious to remark that this Tunisian Mining Company exhaled, finally in 2008 and early 2009, a strong cash flow exceeding 961 Million Tunisian Dinars, four times over the year before. Although, debt levels are unpacking a rate of 36.5% to end 2008, into lower debt to the order of 54.8%.

However, it is important to remember that this great public Tunisia mining Firm has signed a joint-venture under the *partnership* in the phosphate with *Indian Companies* for the installation of a phosphoric acid plant in Skhira Sfax and another in Gafsa Mdhila. The TCGP Mining Company and its subsidiary Chemical group hold more than 70% share in the joint-venture Tunisian-Indian. It is

15 Faced to this financial crisis and global economic conditions, the Tunisian Government played a key role in aid and support for Enterprises (SMEs, etc .) most affected in order to keep out at less economic damage.

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estimated that the production capacity of these plants located in the region of Sfax -in Tunisia- is the order of 360,000 tones per year with an increase in production rate for previous years.

To this end, TCGP Tunisian Mining Company consider from the end of 2010, under the partnership agreement the Tunisian-Indian, to increase its own production of the phosphate mining in region of Gafsa Tunisia to reach 9 million tones per year, in order to cover actually basic needs of new plants already installed in areas of Sfax and Gafsa to the recovery of phosphoric acid in high demand in world market of phosphate fertilizer WMPF.

CONCLUSION

Tunisian phosphate industry has continued to thrive since its discovery in 1897 in the mining region of south-west of Tunisia. After independence, Tunisia has merged all mine operators to increase their competitiveness and their ability to produce in a great single Company named Tunisian Company of Gafsa Phosphates TCGP and its subsidiary Chemical group for recovery and enrichment phosphate fertilizers that are in high demand for agriculture by importing countries (mainly European Union and India) in the world market for phosphate fertilizers.

Nowadays, the Tunisian phosphate industry has continued, despite the recent global economic crisis of 2008, take advantage of this international situation following the increase of high demand for phosphate products to enhance agriculture, adding to this fact, the unprecedented price soared phosphate rock in late 2008 that has more contiguous triplet (3 x) near the 400 dollars per tone of phosphate.

To this end, the Tunisian phosphate industry, which represents a major economic base activity for the country, has been able to generate surplus cash bypassed for the development of the sector itself a part. The second is intended as a value added to national GDP and increase the capital base of the country as a direct result.

Currently, in late 2009 and early 2010, prices have almost stabilized with a sort of equilibrium between supply and demand for the fertilizers phosphate product into world market fertilizer phosphate WMFP. Thus, the Tunisian phosphate industry continues to grow with a steady pace with their production opportunities at the future while pressing:

- Diversification of phosphate fertilizers
- Improving the overall quality
- Reducing production costs and any kind of waste
- *Use of ICTs* as tools for *technological modernization* to confront foreign competition (before entering the new entrants: in 2020 Algeria and Saudi Arabia in 2016) and armed with technological potential from the phase of operations until marketing of mining product.

These are articulators points of the strategy implemented in recent years, despite the remarkable effort of all officers and managers are an essential support to achieve this targeted objective by senior management of this Tunisian Mining Company.

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PROFILING HIGH-GROWTH ENTERPRISES IN PORTUGAL

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Abstract. This paper describes employer enterprise dynamics in Portugal for high-growth and gazelle enterprises for the period 1990-2007, using the methodology by Eurostat/OECD. It discusses stylized facts related to performance and employment by size, region and sector, to a detail which has not been previously considered, uncovering potential business areas of growth which are of prime importance for the country's economic growth and development. Two parallel perspectives are provided, by turnover and by employment. We also provide a comparison between Portuguese firms and some of their European counterparts. This contrast highlights differences in performance related to underlying national framework conditions, and specifically to the regulatory and cultural environment in which Portuguese firms operate, which seems to be instrumental to the understanding of their poorer performance.

Keywords: Firm Demography, Framework Conditions, Gazelles, High-growth firms, Portugal

Resumo. Este artigo descreve a dinâmica de empresas portuguesas de elevado crescimento e de gazelas, para o período 1990-2007, utilizando a metodologia do Eurostat/OCDE. Foram também adoptadas duas perspectivas diferentes para o apuramento destas empresas, a perspectiva do volume de negócios e por outro lado, do emprego. Ao longo do estudo, abordam-se alguns fatos estilizados relacionados com o desempenho e volume de emprego destas empresas, desagregados com um nível detalhe considerável, por região, dimensão e sector de actividade, relevando alguns sectores de negócios com maior potencial de crescimento que são de suma importância para o crescimento económico do país e do desenvolvimento. Fornecemos igualmente uma comparação entre as empresas portuguesas e algumas das suas congéneres europeias. Este contraste evidencia algumas diferenças, como um mais fraco desempenho, associado às "framework conditions" existentes a nível nacional, designadamente que diz respeito ao ambiente regulatório e cultural que estas empresas enfrentam.

Palavras-chave: Demografia Empresarial, Framework conditions, Gazelas, Empresas de Elevado Crescimento, Portugal

1. INTRODUCTION

The emergence and proportion of high-growth and gazelle firms provides a clear indication of how well individual countries are laying the foundations for growth among new and existing businesses. These high-growth firms are known to play an important role in job creation, fostering innovative behaviour, enhancing productivity and are key players in economic growth (OECD, 2002). During the last decade, high-growth firms have attracted considerable attention from researchers, policy-makers and more recently also from practitioners.

The Portuguese economy experienced a process of structural transformation during the latter part of the twentieth century, which culminated in rapid economic expansion in the second half of the 1990s, followed by a deceleration of economic growth since 2001, contributing to a considerable creative destruction of industries, which has consequently impacted on firm dynamics. The emergence of high-growth firms can be a statement of the capacity of the country to deliver the right conditions for producing dynamic and rapidly growing firms.

This paper characterises Portuguese high-growth and gazelle employer enterprises for the period 1990-2007 and discusses performance and employment, by size, region and sector. Two parallel perspectives are provided, defined by a turnover and an employment criteria.

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No internationally accepted definition exists of what constitutes a high-growth firm (Herenkson and Johansson, 2008, 2009). The literature offers several definitions inspired by the work of David Birch (1987). We will use the methodology by Eurostat and OECD (2007), which has been internationally accepted and used widely in the business demography field (OECD, 2008 and 2009).

This paper is organised as follows. The next section intent is to describe the data and methodology applied to our data. Once the main features regarding the dynamics of high-growth and gazelle firms in Portugal are introduced, concerning their distribution, employment and size (section 3), a sectoral and regional disaggregation is provided in sections 4 and 5, respectively. In the following section, we offer a brief note on high-growth and gazelles´ firm survival, which is then followed by international data comparisons between Portuguese firms and its European counterparts. This comparison enables to explore the differences in national framework conditions in section 7 and conclude that the regulatory environment in which Portuguese firms operate seem to be instrumental to the explanation of their poorer performance. Finally, section 8 offers concluding remarks.

2. DATA AND METHODOLOGY

The main data source in Portugal for the universe of employer enterprises (enterprises with more than one employee) is *Quadros de Pessoal*. This annual mandatory survey, conducted by the Portuguese Ministry of Labour and Social Security[16], provides a rich and comprehensive matched employer-employee-establishment dataset. According to the registrars of the Portuguese Social Security, it is composed of all active enterprises with at least one paid employee during the period 1985 to 2009.

The database obtained from the cleaning of *Quadros de Pessoal*, adheres to the Eurostat and OECD methodology "Manual on Business Demography Statistics" (Eurostat/OECD, 2007).

Experience has shown that the scope and methodology of business demography statistics have a significant impact on results (Eurostat, 2008). The Eurostat/OECD (2007) methodology is being widely (e.g. OECD, 2008, 2009; Eurostat, 2008; NESTA, 2009a and 2009b) used and allows for easier international comparisons within Europe, but also with the US. It focuses on employer enterprises, which are an important source of job creation. The derived dataset from the application of this methodology consists of an annual average of 215.903 active employer enterprises, with an annual average of 36.803 births and 23.743 enterprise deaths over the period 1985-2007.

Although the dataset covers the period 1985 to 2009, two years at the beginning and end of the period are lost due to the application of the Eurostat/OCDE´s (2007) methodology, when calculating enterprise births[17] and deaths[18]. It is recommended looking two years into the past from the reference period, to check for reactivations, before enterprise births are actually considered (Eurostat/OECD, 2007). Thus, births were only calculated from 1987 onwards, instead of 1985, the starting year of the dataset (Figure 1).

16 Gabinete de Estratégia e Planeamento, Ministério do Trabalho e da Segurança Social.

17 According to the Eurostat and OECD definition, the core measure of births reflects the concept of employer enterprise birth. It corresponds to the birth of an enterprise with at least one employee. This population consists of enterprise births that have at least one employee in the birth year and of enterprises that existed before the year in consideration, but were below the threshold of one employee. A birth occurs when an enterprise starts activity. Births do not include entries into the population which result from break-ups, spit-offs, mergers, restructuring of enterprises or reactivations of units which are dormant within a period of two years. Births do not include reactivations of units which are dormant within a period of two years. Thus, this population consists of enterprises that have at least one paid employee in its birth year and also of enterprises that, despite existing before the year in consideration, were below the one employee threshold. An employer enterprise birth is thus counted in the dataset as a birth of an employer enterprise after it recruits its first employee, while complying with the above mentioned requisites.

18 A death can occur because the enterprise ceases to trade or because it shrinks below the one employee threshold. The Eurostat/OECD (2007) manual recommends waiting for two years after the reference period to allow for reactivations, before deaths are calculated. Deaths do not include exits from the population due to mergers, take-overs, break-ups or restructuring of a set of enterprises. Moreover, deaths do not include exits from a sub-population if it results from a change of activity.

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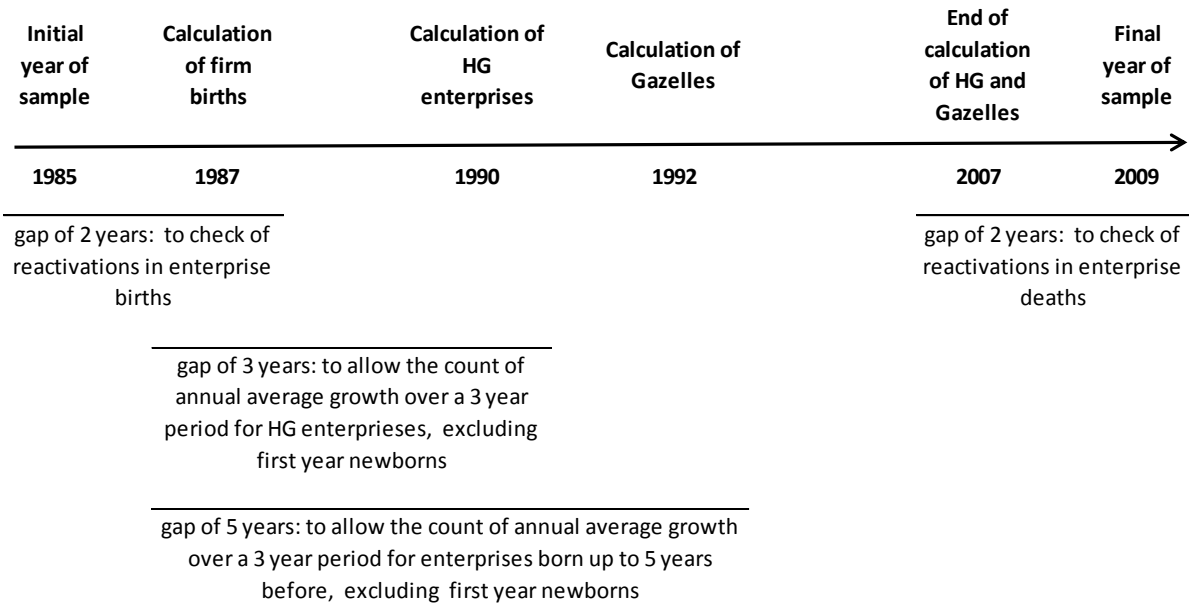

Figure 1: The application of the methodology and the timings required for the calculation of high-growth and gazelle firms
Source: Own elaboration.

A high-growth enterprise is any employer enterprise with 10 or more employees in the beginning of the observation period, with average annualised growth greater than 20% per annum, over a three year period. Growth can be measured according to two distinct definitions, either by the number of employees or by turnover (Figure 2).

Given the time period of the dataset, the calculation of the number of high-growth firms was only possible after 1990, 3 years after 1987, where enterprise births could start being calculated. To fully comply with the methodology, growth rates have to be always identified from the same base population, thus excluding enterprises born in the first year from the growth measurement. Consequently, the data on high-growth enterprises should be cleaned so as to remove firms that were born in year *t-3* (in our case, 1987), when measuring growth from *t-3* to *t.*

Gazelle enterprises are a subset of high-growth enterprises. Gazelles, measured by employment (or turnover), are all employer enterprises employing at least 10 employees in the beginning of the 3 years period, which have been employers for a period up to 5 years, with an annual average growth in employment (or turnover) greater than or equal to 20%, over a 3 year period. In other works, they reflect high-growth enterprises born 5 years or less before the end of the 3 year observation period. Moreover, the data on gazelles should also be cleaned by removing firms that were born in year *t-5*, when measuring growth from *t-5* to *t.*

A size threshold of 10 employees, for both turnover and employment, is set at the start of the observation period, to avoid the small size class bias contained in the above definition of high-growth and gazelles (Figure 2). In setting the employment threshold, the methodology needed to balance two competing criteria. If the threshold was set too low, it would cause a disproportionate number of small enterprises appearing in the statistics, but on the other hand, would reduce disclosure problems related to the statistical confidentiality of the microdata. If it was set too high, disclosure problems could increase, in particular for smaller economies where large enterprises are less numerous than smaller sized ones.

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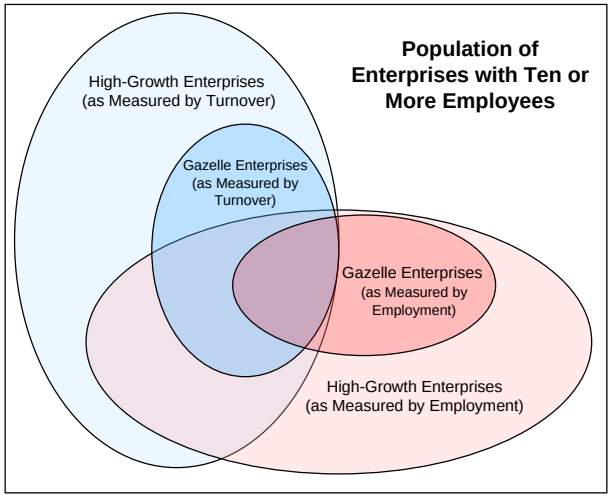

Figure 2: Conceptualisation of the population of High-growth and Gazelles by turnover and employment criteria in the subset of enterprises with more than 10 employees
Source: Own elaboration.

The employment measurement of high-growth and gazelle firms is generally preferred and is more widely used (NESTA, 2009a; NESTA, 2011; NESTA, 2009b; OECD, 2002), as employment is a real variable, whereas turnover is a nominal variable, influenced by local and national economic factors like inflation and the structure of a country´s fiscal system. Moreover, in our data, the turnover criteria show higher volatility than employment, when we account for both enterprises and employment in high-growth and gazelles. According to the OECD (2011), there are also greater discrepancies among countries when the turnover definition is used, particularly at the sectoral level.

As referred, the dataset has been cleaned complying fully to the Eurostat/OECD (2007) methodology. Thus, we tried to identify and exclude mergers and acquisitions, when known, from the dataset. Thus, most of the growth reported here is mainly firm organic growth (growth through new appointments in a firm) and not to acquired growth (growth through acquisitions and/or mergers).

Lastly, only employer enterprises classified in sectors from sections A to Q of the Portuguese Economic Classification of Economic Activities (CAE-Rev.2.1) were considered for the purposes of this research.

3. PROFILING OF HIGH-GROWTH AND GAZELLES IN PORTUGAL

Before proceeding into a more detailed analysis of performance, it is useful to review some of the main characteristics of the population of high-growth and gazelles along this period. We will start by approaching its representativeness in overall employer enterprise population, according to both employment and turnover criteria for the calculation.

3.1 Overview of the data on high-growth and gazelles

In 1985, employer enterprises with over 10 employees represented 27% of the total population and had 85,2% of all employment. In 2007, these shares dropped to 15,1% of all firms and 72,2% of all workers (the share on employment decreased relatively more).

The application of the Eurostat/OECD (2007) methodology for the calculation of the amount of high-growth and gazelle firms in any given year is exemplified in Figure 3, where the final year of 2007, is set as an example. Of the total amount of employer enterprises active in 2004 (312.938), 3 years before the calculation year (2007), 49.070 (16%) employed more than 10 employees. From this subset, there is a further selection of enterprises having an annual average growth of 20% over a 3 year period (2004-2007), either by employment or by turnover. For the determination of Gazelles,

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departing from the initial enterprise population, we isolate firms born five years or less before the end of the 3 year observation period (2002-2007). From that subset, a further selection step takes place, whereby only young enterprises with over 10 employees remain. From this group, we apply the growth criteria in employment and turnover to obtain the final count for Gazelles.

Tables 1 and 2 summarise the results obtained for high-growth and gazelles and their employment, according to both criteria employment and turnover criteria. In the 17 year period, ranging from 1990 to 2007, Portuguese high-growth firms and gazelles by turnover decreased both in number and employment (Table 1). However, when measured by employment, its number and employment increased for both High-growth and Gazelles. Employment in high-growth firms, by employment, was in fact the sole to register an increase in the share in total population, between 1990 and 2007 (7,4% to 7,6%).

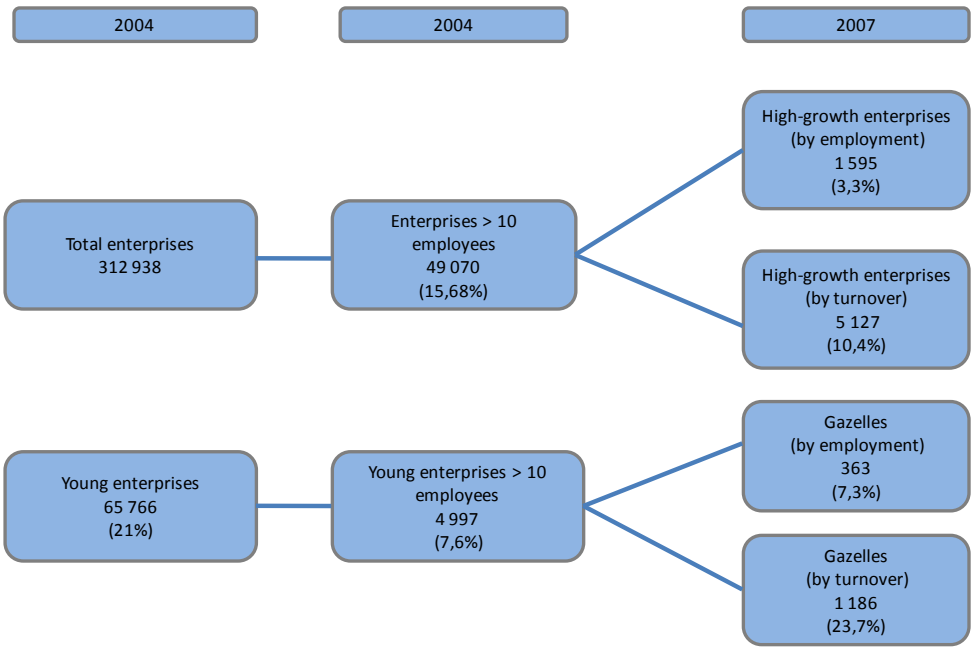

Figure 3: High-growth Enterprises and Gazelles, outlook for 2007
Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

In 1990, there were 8.557 high-growth firms by turnover and 1.453 according to the employment criteria (24,6% and 4,2% of the enterprises with over 10 employees, respectively). By 2007, the number of high-growth firms by turnover decreased 40% (to 9,5% of the population considered), while those by employment definition, increased around 10% (to 3% of the population).

The number of gazelles by turnover is also higher than when measured by turnover. In 1992, reported gazelles were 1.726 and 420, by turnover and employment, respectively. Gazelles by turnover also faced a considerable decrease relatively to 2007 (-31%), although not as high as high-growth firms, as well as Gazelles by employment definition, which decreased by around 14%.

Gazelles (employment definition) represent 23% of high-growth firms in 2007 and 34% in 1992.

Table 1: High-growth enterprises, employment and turnover definition (number and % in employer enterprises with more than 10 employees)

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	High-growth (employment definition)				High-growth (turnover definition)			
	Enterprises		Employment		Enterprises		Employment	
	Number	%	Number	%	Number	%	Number	%
1990	1.453	4,2	134.331	7,4	8.557	24,6	532.866	26,9
1991	1.370	3,8	132.390	7,2	7.885	22,1	488.411	24,4
1992	1.231	3,3	110.471	6,0	7.556	20,4	513.731	25,4
1993	1.007	2,7	92.613	5,3	6.405	17,4	384.010	19,6
1994	1.017	2,7	108.766	6,4	5.177	13,9	325.282	16,6
1995	948	2,6	108.433	6,3	4.412	11,9	275.119	13,9
1996	1.043	2,8	118.724	7,0	3.880	10,5	245.748	12,5
1997	1.171	3,0	139.456	7,9	4.586	11,7	256.267	12,4
1998	1.387	3,4	164.941	8,9	5.150	12,5	330.966	15,2
1999	1.466	3,4	191.704	10,0	5.422	12,4	335.700	14,8
2000	1.623	3,5	196.627	9,9	5.737	12,5	316.615	13,4
2001	1.827	3,7	207.052	9,9	5.894	12,0	327.354	13,1
2002	1.640	3,3	165.879	8,2	5.723	11,5	303.128	12,4
2003	1.370	2,8	142.951	7,0	4.878	9,9	286.725	11,6
2004	1.308	2,7	152.610	7,3	4.271	8,7	268.591	10,6
2005	1.339	2,6	135.622	6,2	4.858	9,4	248.396	9,2
2006	1.463	2,8	159.660	7,2	5.079	9,8	261.463	9,6
2007	1.595	3,0	175.259	7,6	5.127	9,5	280.861	10,0

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

Table 2: Gazelles, employment and turnover definition (number and % in employer enterprises with more than 10 employees)

	Gazelles (employment definition)				Gazelles (turnover definition)			
	Enterprises		Employment		Enterprises		Employment	
	Number	%	Number	%	Number	%	Number	%
1990								
1991								
1992	420	1,1	28.512	1,6	1.726	4,7	68.619	3,39
1993	336	0,9	22.192	1,3	1.574	4,3	68.493	3,49
1994	342	0,9	31.866	1,9	1.254	3,4	52.413	2,68
1995	267	0,7	28.090	1,6	963	2,6	45.871	2,32
1996	286	0,8	28.592	1,7	836	2,3	38.320	1,94
1997	286	0,7	27.422	1,6	1.011	2,6	40.845	1,97
1998	412	1,0	42.642	2,3	1.353	3,3	67.788	3,12
1999	433	1,0	50.533	2,6	1.392	3,2	68.871	3,04
2000	345	0,8	35.210	1,8	1.211	2,6	49.951	2,11
2001	402	0,8	41.039	2,0	1.272	2,6	55.166	2,22
2002	390	0,8	31.686	1,6	1.402	2,8	63.360	2,59
2003	335	0,7	32.778	1,6	1.310	2,7	55.722	2,25
2004	365	0,7	37.154	1,8	1.336	2,7	57.261	2,25
2005	394	0,8	33.996	1,5	1.918	3,7	64.403	2,39
2006	407	0,8	28.080	1,3	1.532	3,0	46.280	1,70
2007	363	0,7	33.998	1,5	1.186	2,2	46.968	1,67

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

The difference between the two measurement criteria, employment and turnover for high-growth enterprises, shortens over time (Figures 4 and 5), as the proportion of firms ´turnover meet the share of employment and possibly gets more in line with that of the remaining firms with more than 10 employees, hinting at a possible decrease of turnover by employee and profitability in high-growth firms over time. %. For Gazelles, it also happens, to a lesser extent for employment, but it is not so clear in terms of the convergence between the two criteria for the number. Over the period, the proportion of Gazelles by employment is kept around 30% of that by turnover.

In 1990, the share of high-growth according to employment criteria was 17% of those accounted with the turnover criteria, whereas in 2007 this share increased to 31%. Put differently, in 2007,

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there were relatively more high-growth firms accounted by the employment criteria than 17 years ago, although this is due to a particular rise of its number in 2007 (and not verified for the previous years). Its share on the population of firms with more than 10 employees has however decreased when compared with 1990 (3%), although keeping a somehow stable performance since 2003. The fact that the growth in contracting employees might accompany the growth in turnover more closely than in the past has still to be looked at in this research[19].

While the decreasing share of high-growth firms (turnover definition) in the population is sustained throughout the whole period (24,6% to 9,5%), (Figure 7), the pattern of high-growth firms by employment shows considerable variation over time (Figure 6).

The worst performing period is the aftermath of the 1993 crisis where economic conditions deteriorated severely, due to a widespread international economic crisis and speculative currency attacks within the European Monetary System. In 1993, Portugal's GDP growth was negative. Firms with over fifty employees were particularly hit (Sarmento and Nunes, 2012a).

In the following year, the overall rate of growth in the number of employer enterprise firms was the highest of all the 1987-2007 period, in particular for the size class of over 250 employees, coinciding with the start of the second community support framework (QCAII). However, the amount of firms verifying such an amount of growth as required either to be considered a high-growth or gazelle kept on decreasing until 1995 (by the employment definition) and 1996 (by the turnover definition). In fact, 1995 is the only year where the number of high-growth dropped below the 4.000 threshold and gazelles below 1.000. It is precisely 3 years after the peak of the crisis in 1993. That is, during the following 3 years, many firms could not add up an annualised average growth of 20% (in employment and in turnover) and thus classify in these categories. Gazelles are in a similar circumstance, but they seem to perform the worst during the three year period of 1994 to 1996, dropping below 300 according to the employment criteria.

During the last half of the 1990s, general economic conditions were more favourable, and Portugal experienced a period of economic growth. High-growth firms, as well as gazelles, showed a sustained growth path in both number and amount of employees. The start of the millennium brought about a period of economic deterioration which contributed to the slowdown in Portuguese domestic demand, leading to a sharp deceleration of activity. The readjustment process of balance sheets among households and firms in order to correct economic imbalances was partly related to general cyclical developments in the European economy but also to downward adjustment of expenditure patterns, bringing spending more in line with incomes and revenues. Although this coincided largely to what has happening in the European Union (EU) economy at large, the amplitude of the downsizing was more pronounced in Portugal. Noticeably, the number of high-growth firms started to decrease after 2001, as they were not able to sustain such a rhythm of growth (a high-firm in 2001 had to sustain 20% growth p.a. from 1999-2001), and most probably could have been excluded due to not complying with the growth requirement following 2000. In terms of employment, this is revealed only after 2002, perhaps because in 2000 firms had not yet adjustment employment to the new macroeconomic conditions.

3.2 Employment

A number of studies maintain that high-growth firms account for a disproportionately large part of net job creation (Schreyer, 2000; OECD, 2002; NESTA, 2009a and 2009b). It is also well documented in the literature the disproportionate contribution of young and small firms to the generation of employment and earnings, to productivity growth and thus to overall wealth creation (Storey, 1994; Birch *et al.,* 1995; Acs and Mueller, 2008; Praag and Versloot, 2008; Henrekson and Johanson, 2010).

19 Some evidence has pointed out that growth is first consummated in terms of turnover and only later on feeds into employment (from the nominal to the real side the economy). From the visible fluctuations of our data, we have no account of that phenomenon, but it is an issue worth looking at in subsequent work.

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In this section, we will approach high-growth and gazelle employment, making use of an array of indicators, common to these types of studies.

For the count of job creation several distinctions have to be made, namely flows of gross job creations and losses must be distinguished from net job creation (the difference between job gains and job losses). Although obtaining net job creation is commonly the target, information on gross flows can also be of interest to policy, as simultaneous job creation and destruction shows evidence of labour market churning, which is part of the dynamic process of market adjustment.

Secondly, in net job creation, measures are needed which reflect the aggregate level, but also the relative importance of firm characteristics, and the role played by groups of firms, as net job creation may differ substantially across levels and collections of firms. For instance, even though total employment may decrease, certain groups of firms (e.g. large ones) may enjoy net job growth. One of the most common measures is net job creation rates for different firm characteristics, notably different size classes to account for the contribution of small and large firms.

Thirdly, net job creation rates are percentage ratios relating net job gains to the total number employees[20]. However, a large job creation rate does not necessarily mean a large absolute contribution to the total number of net jobs created[21]. Thus, a size class with a small share of initial employment but on the other hand which displays a high net job creation rate, may still have a minor impact on overall job creation, whereas a size class that accounts for a large share of employment may contribute more substantially to overall net job creation, even with a small rate of net job creation.

It might be useful to consider more in detail the way in which high-growth firms are measured in the methodology we adopted. In this paper, we are not measuring job creation in 3 year spans and thus accounting for employment growth that each single firm had from its first to its third year of growth. Clearly, this count will most often be positive and large, as the best performing firms are being measured precisely during the periods they perform the best, leading to the conclusion that high-growth firms are responsible for a much greater share in employment than in the total amount of enterprises.

In our methodology, as reported in the methodology section, firms have to comply with a 3 year annualised average growth (in either employment or turnover) of 20%, in order to be classified as a high-growth and this type of measurement in repeated each year. After being classified as a high-growth in a given year, if in the following year that particular firm does not add up to that amount of annualised growth in the previous 3 years, it is removed from the group of high-growth firms. When a given firm leaves this "group", it takes away its employees, representing a king of "job destruction", which will only be cancelled out if newly incoming high-growth firms that same year bring along an equivalent amount of employees. Thus, net job creation might be negative in a given year, if the amount of employment of excluded high-growth firms (that are not able to sustain that amount of averaged growth that year) is greater than the amount of employment of incoming firms (that were included that year in the new count of high-growth firms). It can also happen if the outgoing firms are on average larger employers than incoming firms. So net job creation results from the combination of the quantity of firms entering and leaving this group of firms each year, with the amount of employment they bring along. Thus, with such an indicator as net job creation, we can have periods of negative job creation, whereby there is an outflow of high-growth firms with a larger average employment than the group of incoming firms.

The debate concerning whether it is the rapid growth of a few firms, or the entry of many new firms, that generates employment growth is still being fuelled by new evidence for high-growth firms (Storey, 1994; Davidsson and Delmar, 2006). Henrekson and Johanson (2010) point to a complementarity between these two views, in the framework of gazelles, where employment in the average new firm is as important as the net job contribution of these firms.

20 In our case, in employer enterprises with more than 10 employees.
21 As absolute contributions are the product of net job creation rates and the share that a category occupies in total employment.

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In Figure 4, we portray net job creation in high-growth and gazelle firms (by employment definition) as compared to that of total economy. We observe it accompanies the major cycles of total economy, but its peaks are more softened, especially for gazelles that seem to suffer from a smaller volatility. Between 1996 and 2001, high-growth net job creation was 98.619 jobs (379.479 for total economy), in comparison to the net destruction 47.392 jobs in the period comprehended between 2002 and 2006 (139.681 for total economy).

In this study we do not provide an account of job creation rates as considered in other publications. The type of calculation of net job creation rates provided by research such as FORA and NESTA´s (2008) and NESTA (2009a and 2009b) can be misleading, also given the conclusions and the kind of policy advice they provide. High-growth firms are said to be responsible for most of the job creation in an economy. But this is fact happens due to the way job creation is measured. These studies measure job creation within 3 year spells, accounting for job creation growth as the measurement between the first and third year of this spell for firms which were already selected precisely because they were already growing. It is then that obvious that job creation has to be positive as no job destruction is accounted for when they leave the group of high-growth firms, and substantial, especially if they are composed by large firms.

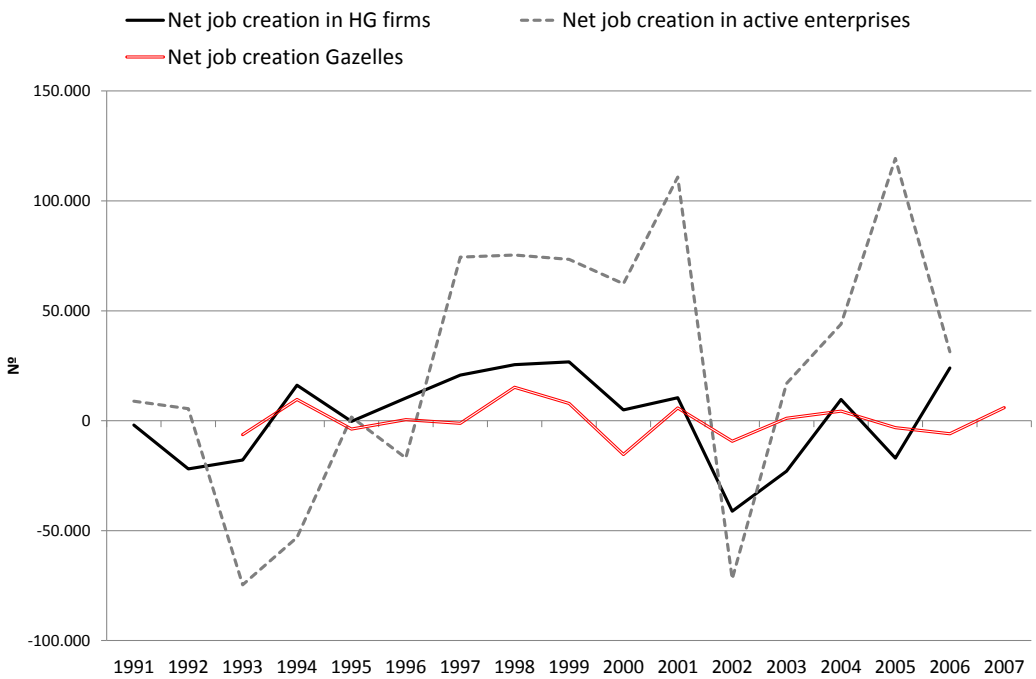

Figure 4: Net job creation in high-growth firms and gazelles (employment definition) and in active enterprises with over 10 employees (nº), 1991-2007

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

Note: Job creation here is given by net job creation (difference between job gains and job losses) in any given year.

Large high-growth firms generate more than half of employment, on average throughout the period, whereas firms from the 20-49 size class only have a share of 16% (Figure 5). We can observe that high-growth enterprises with 20-49 and 50-249 employees tend to decrease their share in total high-growth employment to large firms (+10 p.p. from 1990 to 2007).

Gazelles´distribution of employment among different size classes portray a larger volatility over time (Figure 6). Firms in the largest size class have over 50% of employment in most years, but they only average 45% over the period. However, gazelles´employment in the 50-249 and 20-49 size class in particular, is relatively larger than that of high-growth firms´.

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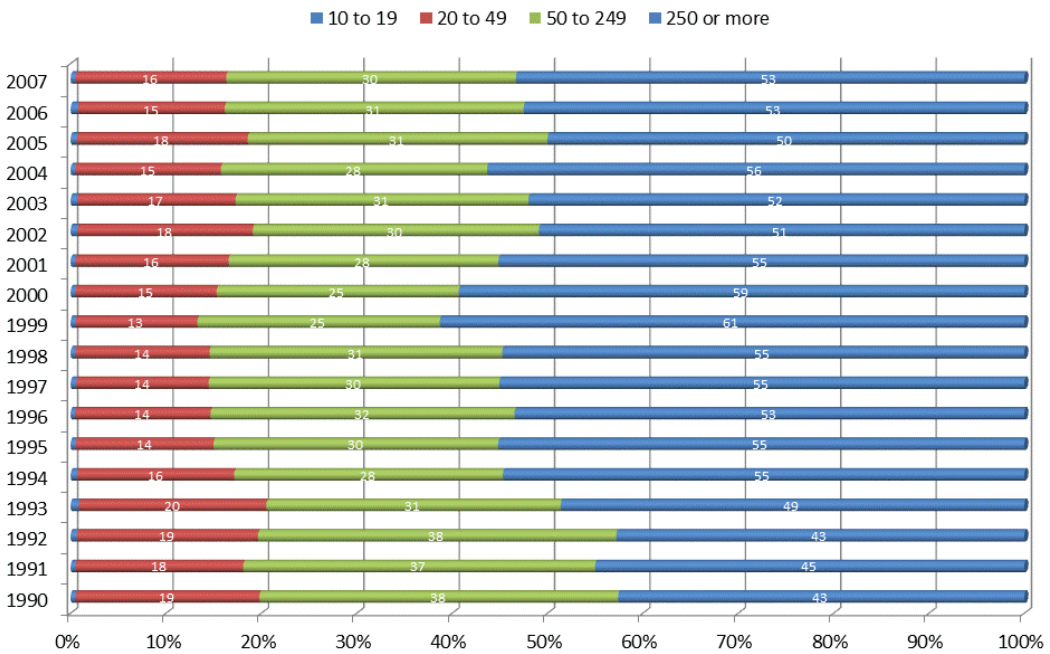

Figure 5: Share of high-growth employment in high -growth enterprises (employment definition), by size class

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

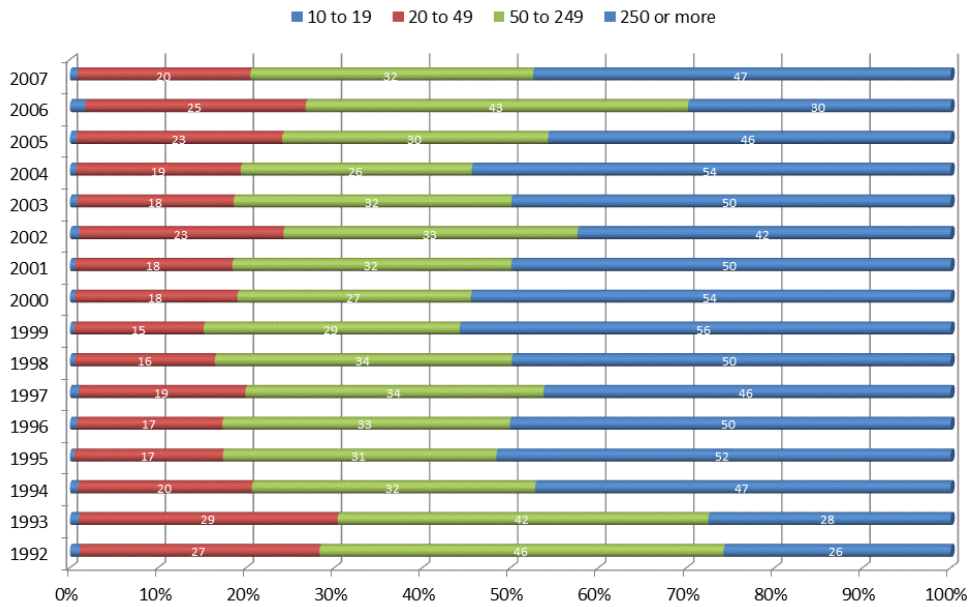

Figure 6: Share of employment in gazelles (employment definition), by size class

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

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3.3 Firm dimension

During the last twenty years, Portugal has experienced a growing number of smaller sized enterprises and a decrease of firm size across all main sectors, for both observed entrants and exiters in the market (Sarmento and Nunes, 2012b). Although the increasing predominance of small firms in the enterprise population is not unique to Portugal (Eurostat, 2009; OECD, 2008; Cabral, 2007; Bartelsman *et al.,* 2005), the country presents sharp evidence of what can be roughly called as a smaller firm dominance "trend". In fact, this is observed for enterprise births and deaths, for all regions, broad sectors and most size classes (Sarmento and Nunes, 2012b). The combination of firm demography factors, such as the smaller nascent firms, with structural effects, such as a service sector dominance (whose firms have a smaller average size than manufacturing), has caused an overall decline in average firm size, reflecting the influence of specialization effects towards industries with a smaller efficient scale, but particularly of within sector effects. Sarmento and Nunes (2012b) shifht-share decomposition of the determinants of firm size reveal that within sector effects have played a more important role in explainning differences in firm size across the period 1995-2006 in Portugal. Even controlling for sectoral specialisation, intrinsic characteristics of sectors seem to be a fundamental determinant of its size structure.

High-growth and gazelle firms have kept an average size significantly higher than the average employer enterprise in Portugal, whose size decreased consistently over time, from 16 employees in 1990 to 9 in 2007 (Figure 7).

In the aftermath of the 1993 economic crisis, the average high-growth and gazelle firms still managed to increase in size up to 1999 (92 to 131 and 66 to 117 employees, respectively). But this was not sustained when the macroeconomic conditions deteriorated during the following years. From 2000, the slowdown in overall business demography dynamics in Portugal is rather compelling (Sarmento and Nunes, 2012a) and this also shows in gazelle and high-growth dynamics and average size evolution over the period.

Notwithstanding the unfavourable economic conditions during the 2000s, a high-growth firm averaged 110 employees and a gazelle 94 in 2007, a higher size than at the start of the 1990s. The average high-growth firm is also larger than a gazelle by 18 employees, on average, throughout the period.

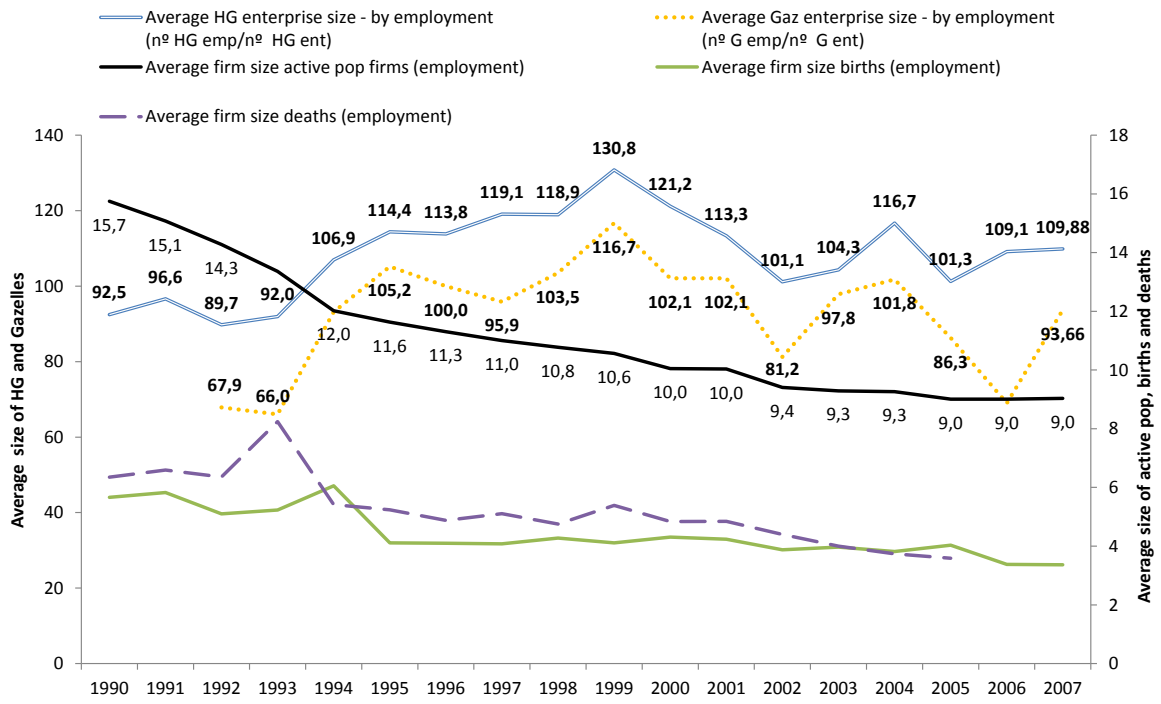

Figure 7: Average firm size of high-growth and gazelle firms (employment definition) and total active population, births and deaths of employer enterprises

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

According to Figure 8, there is little variation in the share of high-growth firms by firm size, except for the largest size class, where firm size seems to have been decreasing since 2000.

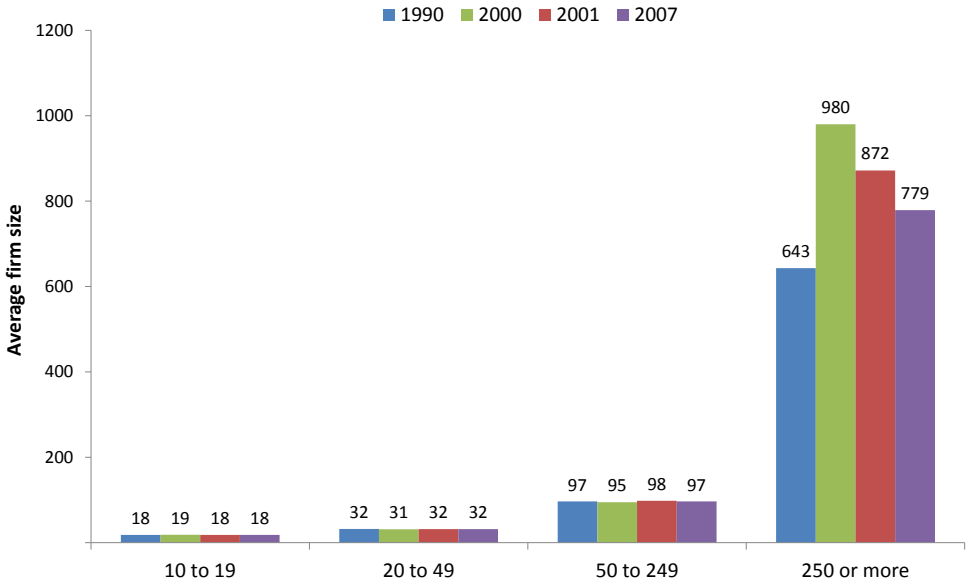

Figure 8: Average firm size of high-growth enterprises (employment definition) by size class

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

Three-fifths (58%) of high-growth firms (employment definition) employed fewer than 50 employees on average during the period, with 3% employing between 10 and 19 people (Figure 9). More than half of high-growth firms (employment definition) belong to the 20-49 size class, whereas only 7% (on average over the period) are large firms.

When we calculate the proportion of high-growth firms in each employment size category we find very little variation over time, beyond some small fluctuations related to the business cycle (it peaks in 2000 and decreases from then on). The same happens with gazelles though the variance is greater in the greatest size class (+250). There is therefore little variation in the share of high-growth firms by firm size.

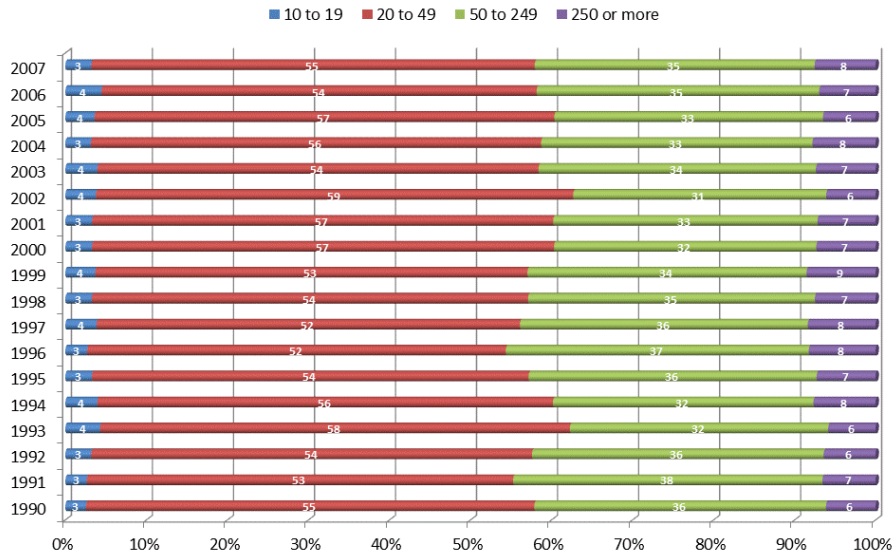

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Figure 9: Share of high-growth enterprises (employment definition), by size class
Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

Similarly to high-growth, the majority of gazelles are SMEs, belonging to the 20 to 49 employees size class. A smaller share though, 6% on average throughout the period, are large firms. The composition of size-classes for gazelles is also stable over time (Figure 10).

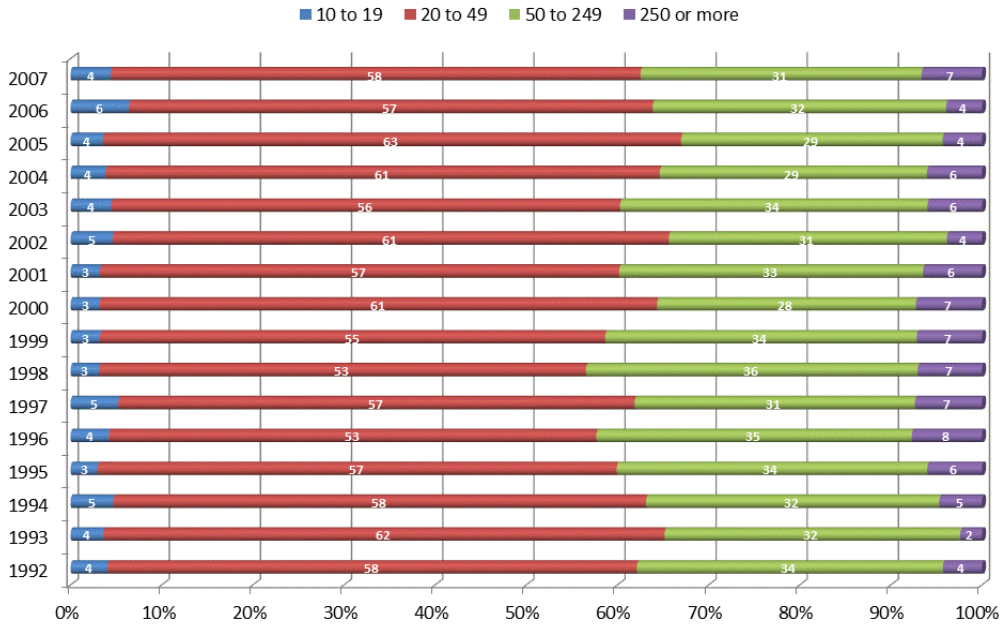

Figure 10: Share of Gazelles (employment definition), by size class
Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

Enterprises in general exhibit large heterogeneity in size, industry affiliation and realized growth performance. In the following sections, we will approach these dimensions for high-growth and gazelle firms.

4. HIGH-GROWTH AND GAZELLES BY INDUSTRY AFFILIATION

In Portugal, the industrial structure is still segmented and characterized by a large primary sector, despite the existence of a number of modern productive sectors. The country still exhibits a considerable dichotomy between a minority of small scale modern activities, which are highly productive and a majority of low skill and low productivity sectors. There is also substantial degree of heterogeneity between firms, even within the same sectors (OECD, 2010; Sarmento and Nunes, 2012b).

Over the period 1987-2007, industrial structure has evolved towards the reinforcement of the service sector in the economy and the decline of the manufacturing sector. According to *Quadros de Pessoal* dataset, the service sector leads both in the number, share of employer enterprises and employment, mainly after 2001. In 2006, the service sector was responsible for 72% of all new ventures. Moreover, 62% of total employment was generated by start-ups in services, which is higher than service sector´s share in total employment (Sarmento and Nunes, 2012a).

As seen before, the application of the two different measurement definitions (employment and turnover) for the calculation of high-growth and gazelle firms often leads to different results and a note should be specifically made on the sectoral approach. Services tend to be, by their own nature, more prevalent if considered according to the employment criteria, as they are relatively more

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labour intensive, whereas manufacturing tends to be more enhanced when considered through the perspective of the turnover definition.

In Portugal, high-growth firms and gazelles are emerging considerably more in service and commerce sectors. In Figures 11 and 12, where they are portrayed according to the employment criteria, we observe a clear shift in the distribution of high-growth firms over the period of analysis, away from manufacturing (34% in 1995, down to 20% in 2007) to services and commerce (49% in 1995 up to 56% in 2007), as well as construction (15% in 1995, up to 20% in 2007). A similar pattern is observed for gazelles, although the drop in manufacturing sector is higher, it decreases by almost a half in 13 years (42% in 1995 to 20% in 2007). A significant number of high-growth firms in Portugal operate in the construction sector, which has been particularly hit by variations in the business cycle.

This sectoral rebalancing reflects trends already existing for the overall population of employer enterprises (Sarmento and Nunes, 2012a) and are not totally new to other European countries, even if at a lesser extent.

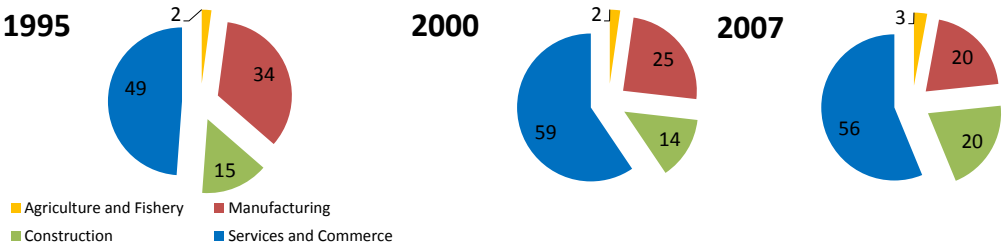

Figure 11: Share of high-growth enterprises (employment definition), %
Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.
Note: One letter level of the statistical classification, NACE, Rev. 2.1.

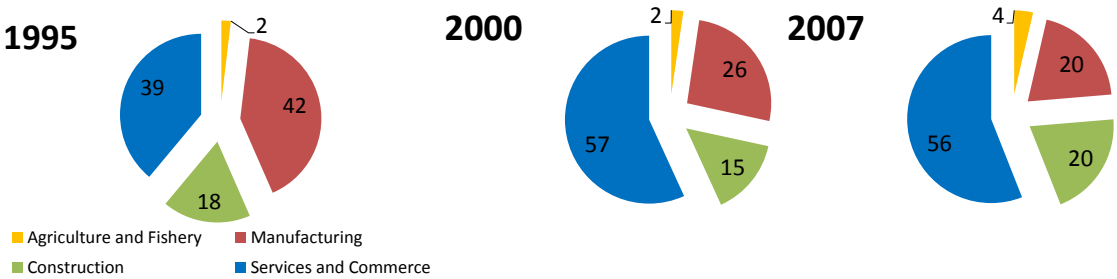

Figure 12: Share of Gazelle Enterprises (employment definition), %
Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.
Note: One letter level of the statistical classification, NACE, Rev. 2.1.

Comparing sectoral employment in 1995[22] and 2007 in detail, we observe that general high-growth firms´ employment in production activities, such as agriculture and manufacturing decrease their share in employment, construction increases slightly (11,3% in 2007) and services in general, and real estate in particular, increase considerably (49,2% to 65,7% and 14,6% to 38,3% from 1995 to 2007, respectively). Financial services, which only represented 1,6% of total employment in 1995 increased more than threefold to 5,4%, by 2007 (Figure 13).

22 In analyzing the sector dimension, we only take into account the period from 1995 to 2007. This has to do with the start of European System of Accounts (ESA) in 1995 and to compatibility issues introduced by the new Portuguese Classification of Economic Activities Revision 3, implemented in 2007.

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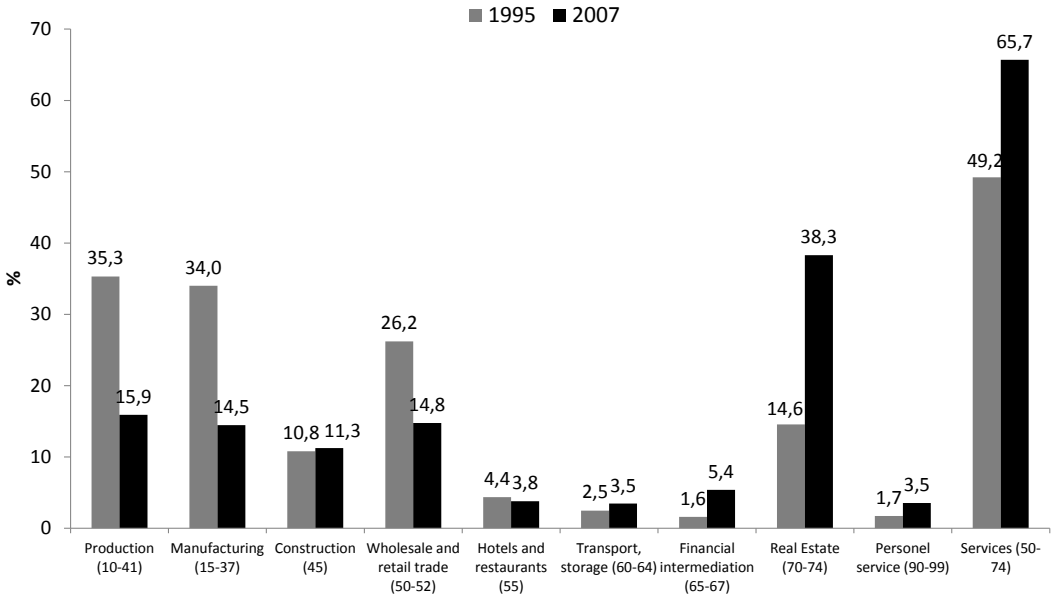

Figure 13: Sector decomposition of employment in high-growth firms (by employment)
Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

4.1. Knowledge Intensive Business Services

Knowledge Intensive Business Services (KIBS) are a subset of business services which have in general displayed more rapid and sustained growth rates than those of other economic sectors (Mamede *et al*., 2007; Arundel *et al.,* 2007). Based on a larger contribution of services to the economy, KIBS are likely to become one of the main factors of potential growth within the European Union (EU). Its economic weight has been increasing in many countries (EC, 2007) and its role in value added, employment and even trade has therefore come under scrutiny from national authorities. Its importance grows as they become increasingly influential sources for the generation of new knowledge, the performance of organisations that are their clients and for the dynamism of the whole economy. But KIBS[23] have attracted policy interest not only because of its rapid rates of growth, but mostly because they are a highly innovative sub-sector within services, especially due to its role as inductors of innovation of firms in other sectors and as facilitators of the innovation process in the economy (Kubota, 2009; Arundel *et al*., 2007; Howells, 2006; Hertog, 2000; Hargadon, 1998; Miles *et al.,* 1995). KIBS are also considered to contribute positively to the increase in productivity (Katsoulacos and Tsounis, 2000), through their three main interaction functions, as facilitators, carriers and sources (Kubota, 2009). Furthermore, their almost symbiotic relationship with client firms, often converts them into co-producers of innovation (Hertog, 2000).

Despite their higher growth and better survival performance, most knowledge-based firms in Portugal do not qualify either as high-growth or gazelles. High-growth KIBS firms are less than 2% of total KIBS (by turnover) and less than 1,2% (employment definition). Gazelle KIBS present more volatility throughout time and correspond to a lower amount of total KIBS (below 1% over the period 1995 to 2006 in both turnover and employment terms).

23 KIBS firms may show similar innovation patterns with manufacturing firms. This is supported by the fact that the R&D intensity of this type of services is above the average of manufacturing companies (EC, 2007).

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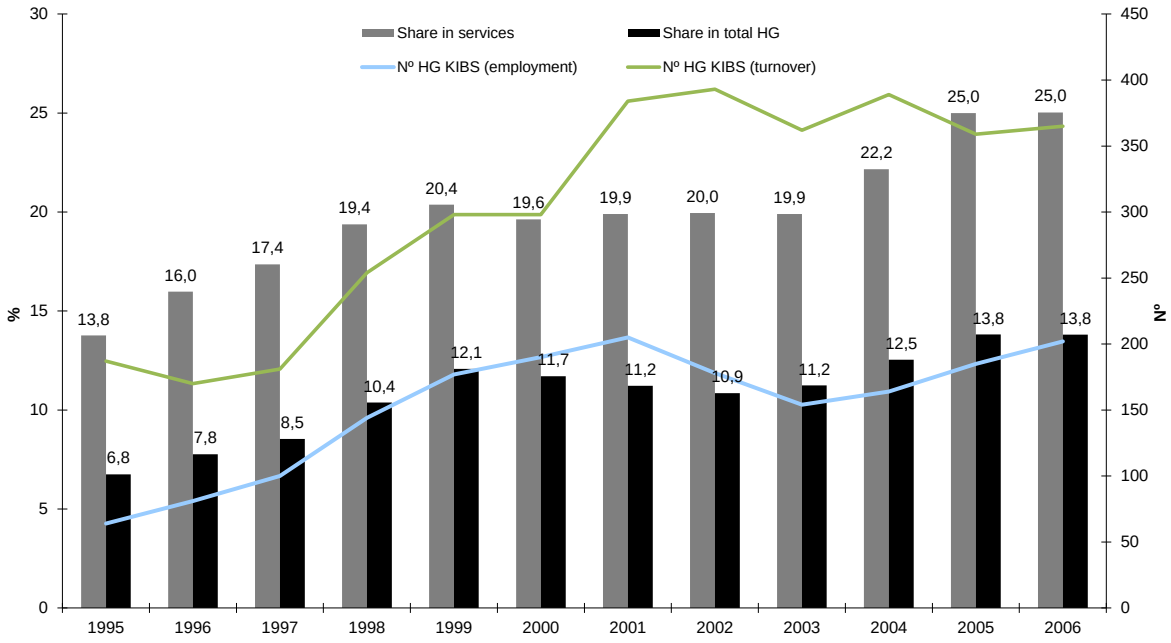

Figure 14: High-growth KIBS share in total high-growth and services firms (%), and number measured by employment and by turnover

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

Note: KIBS are defined as NACE 72 to 74.

Still, evidence points to the more prevalent emergence of high-growth firms in knowledge-intensive sectors than at both the broad service sector, showing a widening gap over time, particularly in terms of turnover (Figures 15 and 16).

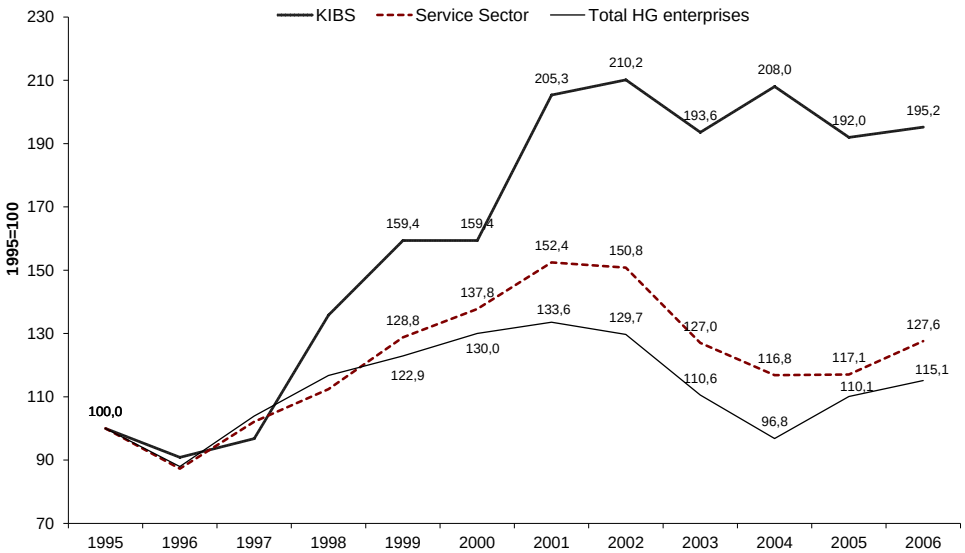

Figure 15: Growth of high-growth employer enterprises (turnover definition), disaggregated into KIBS, service sector and total high-growth enterprises (1995=100)

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

Note: KIBS are defined as NACE 72 to 74.

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This analysis also reveals that knowledge-intensive high-growth firms have been performing better than both the broad service sector and the overall population of high-growth enterprises in terms of the rate of growth of employment and number of firms (Figures 16 and 17).

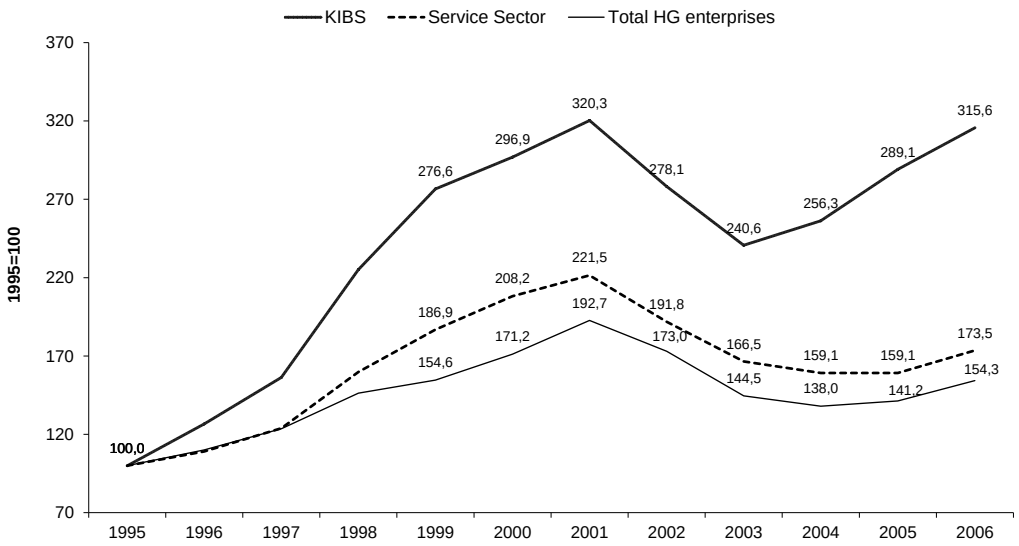

Figure 16: Growth of high-growth employer enterprises (employment definition), disaggregated into KIBS, service sector and total high-growth enterprises (1995=100)

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

Note: KIBS are defined as NACE 72 to 74.

When comparing employment in KIBS with other sectors over time, we again verify its better faster growth rate, especially relatively to manufacturing, which shows a sustained decrease over time.

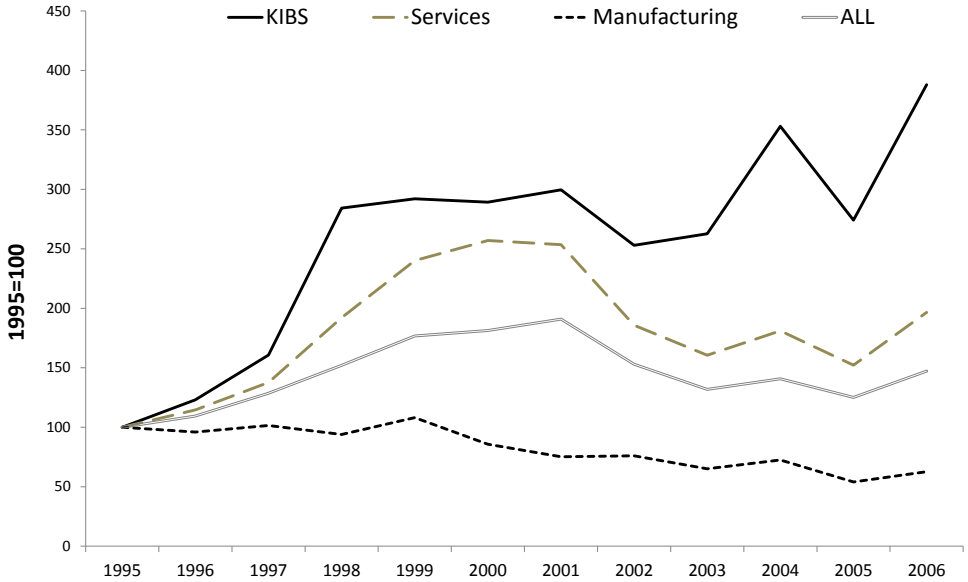

Figure 17: Growth of employment in high-growth employer enterprises (employment definition), disaggregated into KIBS, service and manufacturing sector and total high-growth enterprises (1995=100)

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

Note: KIBS are defined as NACE 72 to 74.

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5. REGIONAL OUTLOOK

In this section, we will examine the regional distribution of high-growth and gazelle enterprises by NUT II regions.

We find high-growth firms in every region of Portugal, but to different degrees. In absolute terms, the region which concentrates over 46% of high-growth firms in 2007 (by both criteria), is the capital region of Lisbon. Over time, both high-growth and gazelles have become more concentrated in the Lisbon area, becoming less represented in almost every Portuguese NUT II region, in particular in Centro, Algarve, and Alentejo (Figures 19 and 20). This contrast becomes sharper when the employment definition is used. The north/south dichotomy seems to have widened over time (Figure 18).

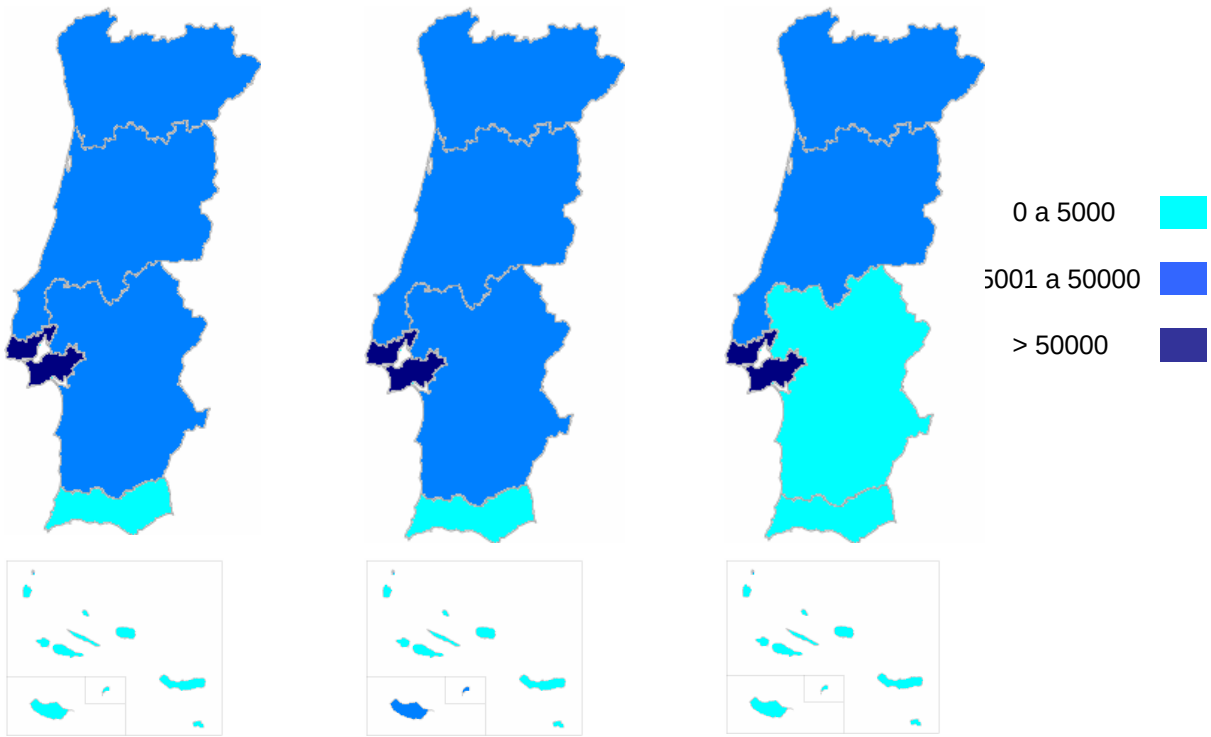

Figure 18: Number of employees in high-growth firms according to the employment criteria, by NUTII (1997, 2004 e 2007)
Source: Own elaboration.

In 1990, the share of high-growth firms in the NUT II region of Lisbon, according to the employment definition (41,8%) was close, though smaller, of that accounted for with the turnover criteria (42,2%). After 17 years, this gap widens substantially and the high-growth count with the employment definition is now 8,5 p.p. larger, indicating that in Lisbon there are comparatively more firms growing faster in employment than in turnover. This might be caused by increasing specialisation in services, which causes high-growth firms to become relatively more employment intensive. Lisbon concentrates various public sector administrations and is particularly intensive in services such as financial and real estate activities. Furthermore, we must have caution in interpreting these results, as this might also be due substantially to the fact that a considerable amount of firms´ headquarters are located in the Lisbon area.

On the other hand, the loss of prevalence of high-growth firms in the Norte region is quite clear. In 1990, 33% of high-growth firms (by employment) and a greater amount by turnover (35,8%), emerged in this region due to the predominance of manufacturing activities (the turnover definition tends to heighten the manufacturing sector). In 2007, after 17 years, Norte had lost 6,2 p.p. of its high-growth firms according to the employment criteria, and more in terms of turnover (-6,6 p.p.),

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ending up with a total share of 27% and 29,2% (Figures 19 and 20). More peripheral regions, such as the Archipelagos of Madeira and Açores, have not experienced significant changes in the share of high-growth firms between 1990 and 2007 when accounted to the employment definition, although with the turnover criteria they both increase their high-growth share by 1,2 p.p..

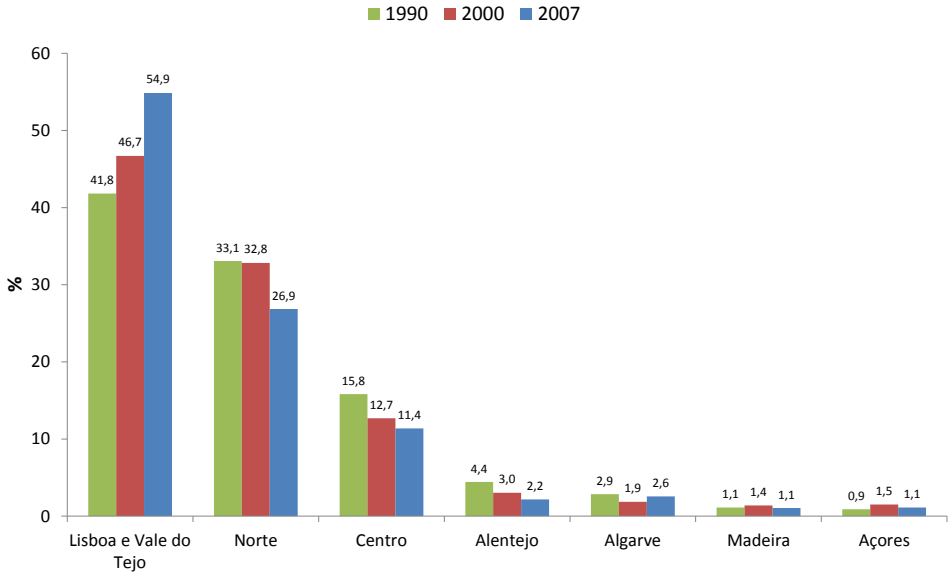

Figure 19: Distribution of high-growth firms (employment criteria) by NUTII regions
Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

Now turning to gazelles, an immediately visible fact is that Norte lost the prevalence as the region with most gazelles in the country at the start of the 1990s (Figure 21). In 1992, Norte had 44,3% of gazelles according to employment definition and 52,3% according to the turnover.

By 2000, this share reduced to a quarter, by the employment criteria, and to 35,2%, according to the turnover definition. After EU´s accession in 1986, the manufacturing sector, in which Norte is specialised, was severely affected by the restructuring of many firms. By 2007, there are signs of a slight recovery in this regions quota of gazelles.

Another aspect worth highlighting is that the share lost by the Norte, seems to have moved south, to the Lisbon area, where the share of the employment criteria surpasses that of turnover, indicating a higher concentration of services in this region (56,1% by employment and 39,3% by turnover, a 16,8 p.p. of difference, twice as much as in high-growth firms).

Algarve is the sole region that manages to recover slightly its share of gazelles in 2007 (2,6%, by employment), whereas Centro faces loses throughout the period.

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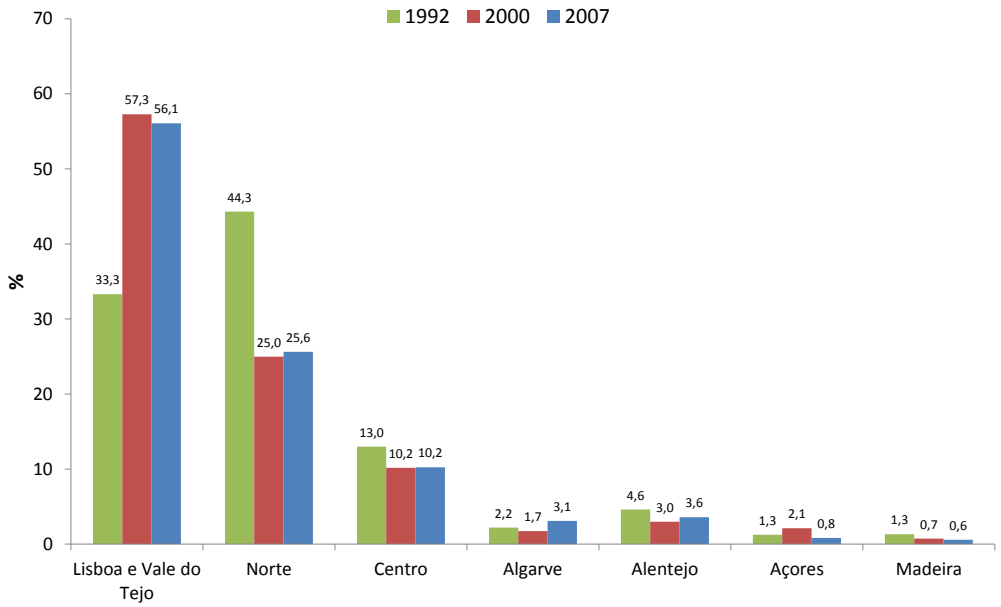

Figure 20: Distribution of gazelles (employment criteria) by NUTII regions

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

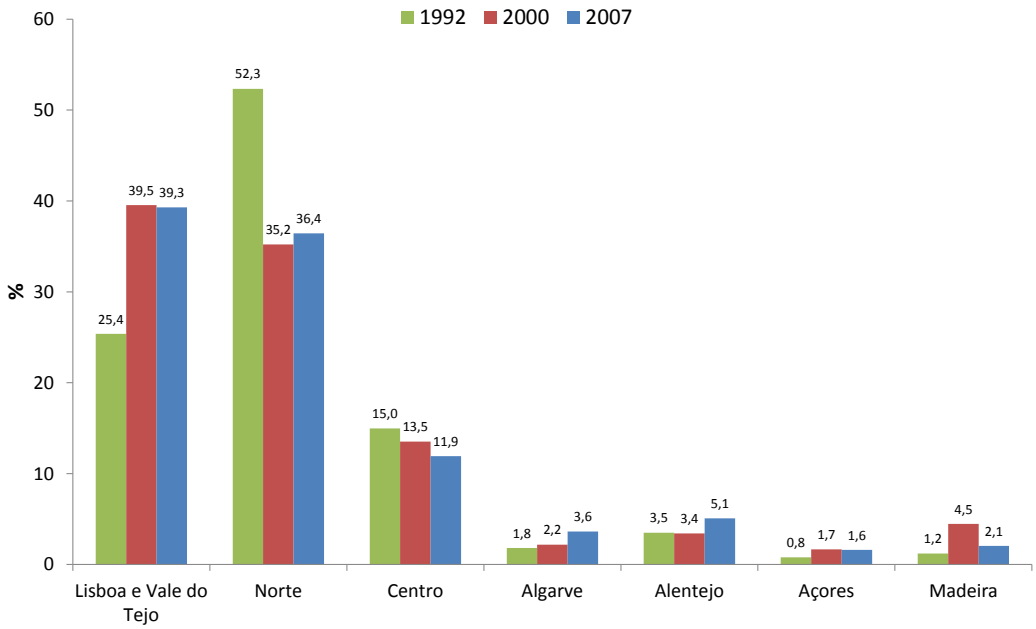

Figure 21: Distribution of gazelles (turnover criteria) by NUTII regions

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

The perspective of high-growth and gazelle´s importance on regional employment also confirms the loss of importance of these types of firms for all regions, except that of Lisbon (Figures 22 and 23). Within the region´s employment, Lisbon displays a higher proportion of high-growth firms´ in 2007 (10,5%) than it had in 1990 (7,6%). Norte ended up a smaller share of high-growth employment in the region in 2007 (6,6% in 1990 to 6,1%). Comparing 2007 shares, employment in high-growth firms in Lisbon (10,5%) is almost twice as much as that verified in Norte (6,1%) and in the Algarve (6%). On the other hand, in all other regions, high-growth firms´share of regional employment has reduced by almost a half of the its share in 1990 (Algarve, -6,1 p.p.; Açores, -5 p.p.; Madeira, -2,1 p.p.; Alentejo, -5,5 p.p.; Centro, -2,7 p.p.).

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Gazelles´ employment representativeness is less than 1% of total employment in all regions in 2007. Considering its share in regional employment is increases slightly, but is still quite modest in every region, not overcoming 2,1% in 2007.

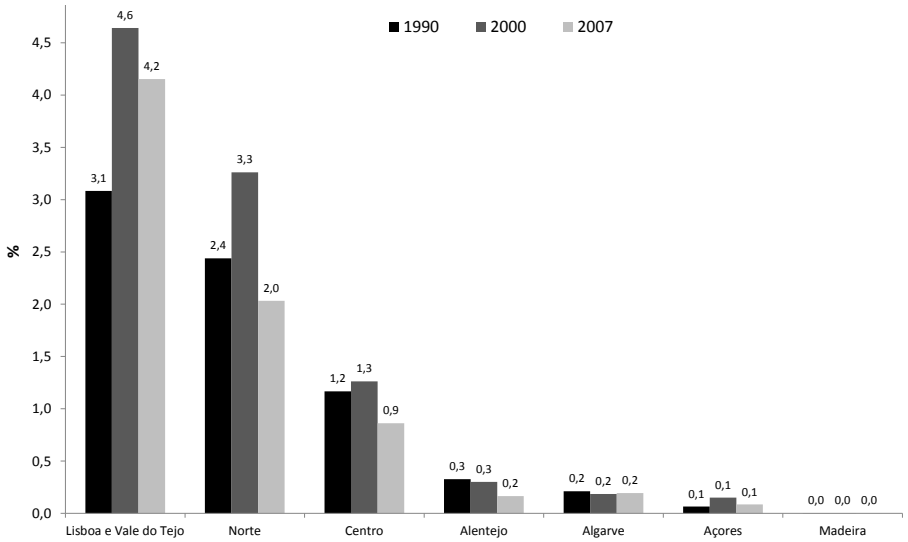

Figure 22: Distribution of high-growth employment (employment definition) in total employment in enterprises with over 10 employees by NUT II regions

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

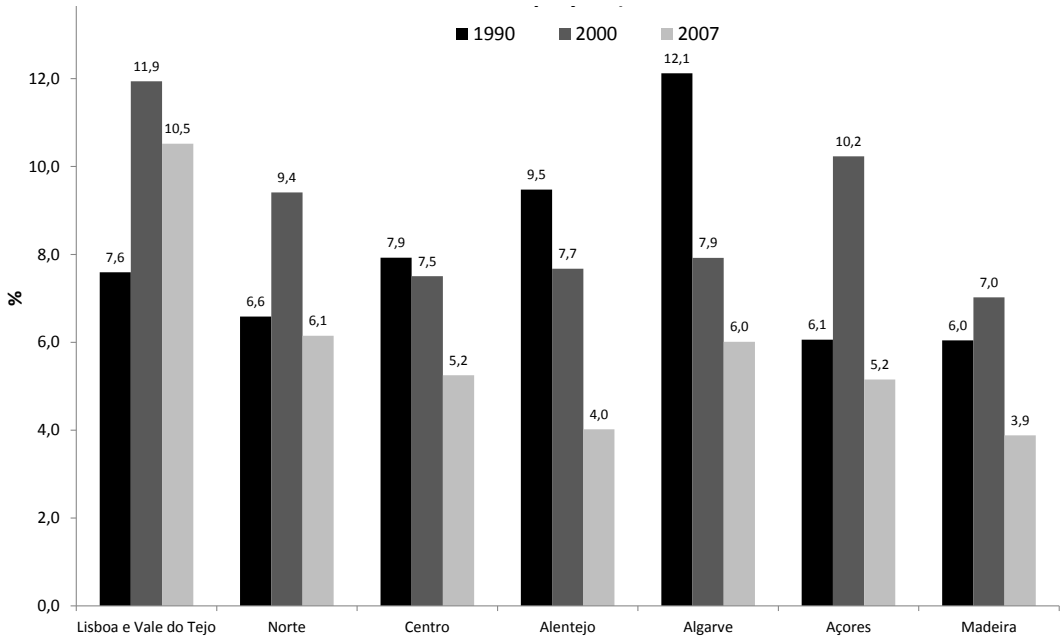

Figure 23: Distribution of high-growth employment (employment definition) in regional employment (enterprises with over 10 employees) by NUT II regions

Source: Own calculations, based on "Quadros de Pessoal", GEP, Ministério do Trabalho e da Solidariedade Social and the OECD/Eurostat´s (2007) methodology.

6. A NOTE ON SURVIVAL OF HIGH-GROWTH FIRMS AND GAZELLES

Portuguese firms suffer from survival problems, particularly when compared to their European counterparts, which is also a reflection of the enduring lack of competitiveness of the Portuguese economy. This has been often been associated with the growth of the small sector, the decreasing

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average size of employer enterprises and the servicisation of the economy (Sarmento and Nunes, 2012a and 2012b).

In Portugal, the estimated median duration of a new born enterprise lies between 5 and 6 years (Nunes and Sarmento, 2012), while in other countries, such as the US, UK, Germany, Italy, and Spain the maximum of the unconditional hazard function is reached before the sixth year (Wagner, 1994; Audretsch *et al*., 1999; Bartelsman *et al*., 2005 ; Bhattacharjee, 2005 ; López-Garcia and Puente, 2006). It is noticeable that Portuguese firms keep on failing for a longer period, before the hazard rate[24] starts declining.

Firm's size has been found of extreme importance in determining the probability of survival of Portuguese firms (Geroski *et al*., 2010; Mata and Portugal, 1994). There is a significant relationship between size and chance of survival particularly for new start-ups, who face the greatest uncertainty regarding market conditions and for firms in the service sector. Moreover, at the sectoral level firms in the construction sector exhibit the highest risk of failure, while firms in the service sector display the highest survival rates (Nunes and Sarmento, 2012).

A full scale survival analysis for Portuguese high-growth firms has not been conducted yet. But for Spanish high-growth firms, there is evidence that being a start-up increases the probability of fast growth, as well as for firms with initial higher relative wages and debt ratio, up to a certain point (López-Garcia and Puente, 2011).

However, the work conducted by the Bank of Portugal (BP, 2010), using a dataset known as *Central de Balanços,* which also complies with the Eurostat/OECDs (2007) methodology, shed some light on survival issues. Its dataset comprehends 380.000 non-financial societies in 2009, where 87% of firms in are micro-firms[25] (84% in 2000), 99,7% are SME´s[26] and 0,3% are large firms, responsible for 28% of employment and 41% of turnover. Around 11% of all firms are high-growth firms over the period (10% in 2009 and 13% in 2000).

According to the Bank of Portugal´s data, around a quarter of high-growth firms and gazelles "died" during the period 2000 to 2009. They find that the share of high-growth firms ceasing activity over the period decreases substantially as firm´s size increase (Table 3). By economic sector, the highest records of firms "closure"[27] occurred in Commerce and secondly in the Manufacturing sector, while the sector of Electricity and Water records the lowest closure rates.

Table 3: Share of high-growth and gazelles closed during 2000-2009 by dimension, district, juridical nature and sector

24 The hazard rate measures the rate at which risk (in this case of a firms´ closure) is accumulated and can vary from zero (no risk at all) to infinity.

25 According to the Commission Recommendation 2003/361/EC of 6 May 2003 (Official Journal L124 of 20.05.2003), a microenterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million.

26 This definition includes micro-firms.

27 Firms that have left the dataset.

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		Structure	High-Growth	Gazelles
	Total Universe of non financial firms		23,8%	25,8%
By dimension	Microfirms	83,6%	23,6%	26,5%
	SMEs	16,2%	20,0%	21,9%
	Large firms	0,2%	14,6%	18,8%
By district	Lisbon	29,7%	25,9%	28,2%
	Porto	17,4%	24,6%	26,3%
	Other locations	52,9%	22,4%	24,3%
By juridical nature	Limited liability companies	94,3%	23,6%	25,5%
	Public limited companies	3,1%	17,7%	21,2%
	Other	2,6%	38,9%	43,9%
By sector	Agriculture and Fisherires	2,7%	19,1%	22,2%
	Manufacturing	13,7%	26,6%	28,9%
	Electricity and Water	0,3%	12,7%	14,7%
	Construction	14,8%	23,2%	25,5%
	Commerce	28,4%	28,4%	30,2%
	Other Services	40,1%	20,3%	21,8%

Source: Banco de Portugal (2010), based on *Central de Balanços* database and the Eurostat/OECD´s (2007) methodology.

Bank of Portugal (2010) also looked into what was the maximum dimension attained by those enterprises, using the data for high-growth or gazelles firms that survived throughout 1991 to 2009[28] (Table X).

Most microfirms maintained its dimension throughout their lifetime (86% of high-growth and 88% of gazelles) with a minority of firms reaching the status of SMEs (13,6% of high-growth and 12,2% of Gazelles). This growth is associated, according to the Bank of Portugal, to short-run factors associated with the business cycle, which do not grant an "organic" growth. They also mention that some firms´ closing down are due to acquisitions, although they are residual given the total amount of firms. From the 87% microfirms in the dataset, only 10 grew into large firms between 2000 and 2009 (Table 4).

These results demonstrate that enjoying high growth does not necessarily grant better survival prospects in Portugal. Gazelles seem more prone to dying than high-growth enterprises, hinting at rapid growth, based on short-run factors not granting either longevity or sustained growth. Further work is still needs to be conducted to approach survival determinants for Portuguese high-growth firms and gazelles.

Table 4: Maximum size attained by high-growth firms and gazelles throughout their life

Microfirms: 1991-2009

Dimension	HG firms	Gazelles
Microfirms	86,4%	87,8%
SMEs	13,6%	12,2%
Large firms	0,0%	0,0%

Source: Banco de Portugal (2010), based on *Central de Balanços* database and the Eurostat/OECD´s (2007) methodology.

7. INTERNATIONAL COMPARISONS

28 Bank of Portugal (2010), used the data of all high-growth or gazelles that were classified as such during some period of their lifes, between 1991 and 2009.

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There is a considerable lack of internationally comparable data on high-growth firms, thus limited research exists as to how Portuguese high-growth firms compares to other countries. However, recent developments at the OECD, the academic community and government level, have made important advancements (OECD, 2008 and 2009; Bravo-Biosca, 2011; NESTA, 2009a and 2009b).

One of the first papers cross-comparing high-growth firms across countries has been that of Hoffman and Jung (2006), who looked at 17 countries during three year periods, ending between 1999 and 2001, using Bureau van Dijk´s Amadeus and Orbis database. These authors use a high-growth definition which is comparable to that of the OECD/Eurostat[29] (2007). In trying to harmonise the data among different countries, they only considered firms between 15 and 200 employees.

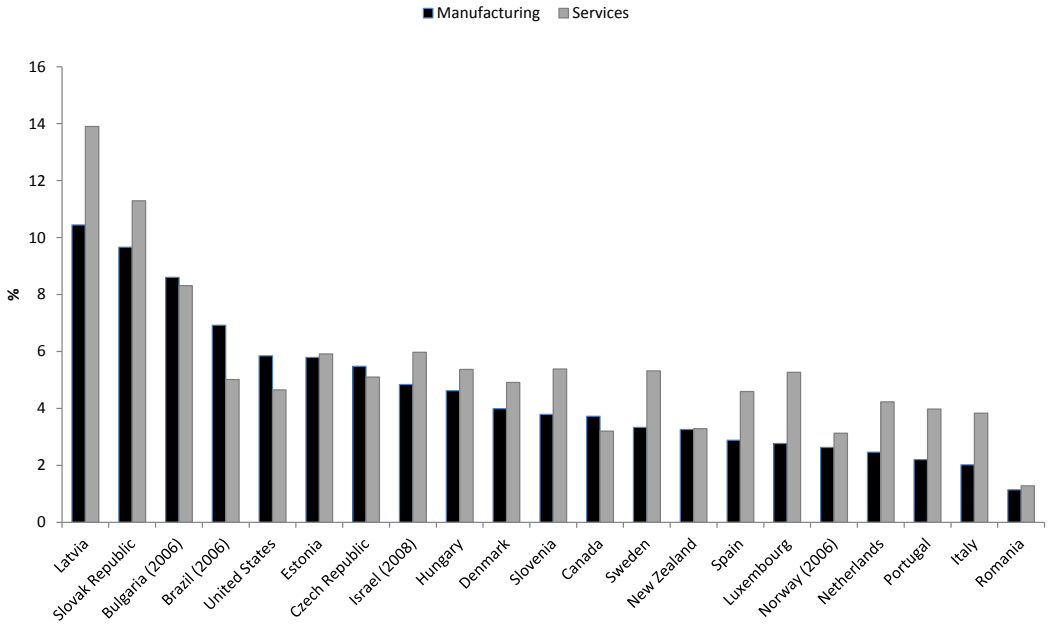
According to Hoffman and Junge´s (2006) research, Portugal has relatively few high-growth start-ups relatively to other countries. In 2001, among 17 countries, Portugal is ranked as the 16th with the highest proportion of high-growth firms by turnover and 9th by employment.

The OECD Business Demography Statistics provides data on business demography that complies with the Eurostat/OECD (2007) methodology for high-growth firms only. Due to data breaks and methodological changes in the official business statistical series published by Statistics Portugal[30] (INE) and the requirements of the Eurostat/OECD (2007) methodology, data is only provided from 2007.

High-growth enterprises represent for most countries a small share of the total population, typically between 3,5% and 6%, when measured by employment growth (OECD, 2011). There are greater discrepancies among countries when the turnover criteria is used, which can in some cases overcome 20% of the population of firms.

For most countries, the usage of these different measurement criteria also brings about differences among sectors. When measured by employment criteria, high-growth firms are more predominant in services, but when measured by turnover their prevalence is higher in manufacturing.

Portugal seems to rank slightly higher with the turnover than with the employment definition, as confirmed as well by our data, highlighting its relatively small-sized enterprise fabric. In 2007, Portugal ranked 14th in the share of high-growth enterprises in manufacturing and 12th in services (turnover definition), among 16 countries, while according to the employment definition it ranked 19th in manufacturing and 16th in services, among 21 countries (Figure 24).



29 According to Hoffman and Junge (2006), a high-growth firm is reported as a firm with a growth rate (in either employment or turnover) higher than 60% in the period from t to t+2. Moreover, they require a positive growth in both time periods of at least 20%.
30 Namely the introduction of Informação Empresarial Simplificada.

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Figure 24: Share of high-growth enterprises (employment definition) in 2007
Source: OECD (2011).

Considering solely total industry without the construction sector (employment definition), we observe that Portugal displays a smaller amount (2,2%) of high-growth firms in 2007 than most countries, except that for Italy and eventually the Netherlands (Figure 25). However, considering construction in isolation, we observe that the share increases to 4,1% (Figure 26), indicating greater dynamics of employment growth in this sector, above the Services´ sector (4%). In fact, having a higher share of high-growth firms in construction than in total industry except construction is a common feature to most countries during these two year period, namely in the US, Slovenia, Canada, Spain, Sweden, Italy, Denmark and Norway.

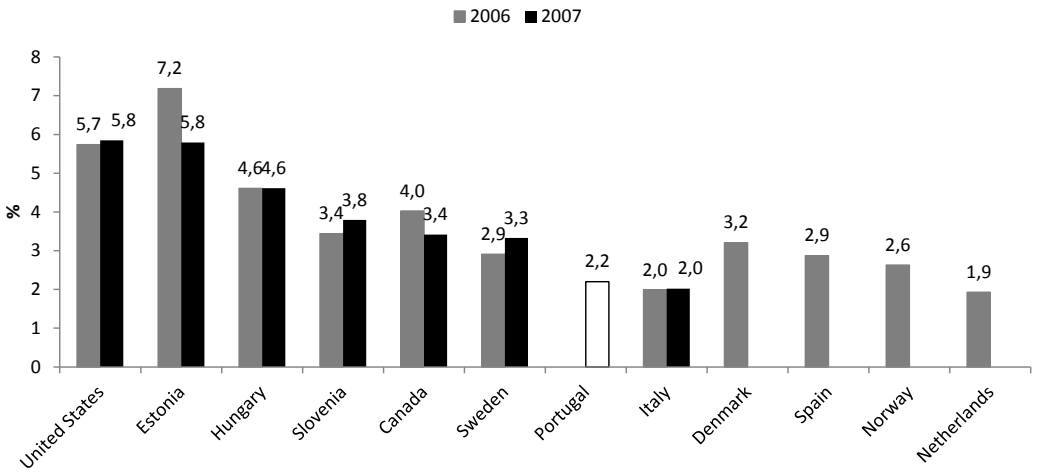

Figure 25: Share of high-growth firms (employment definition) in total active population of employer enterprises, total industry except construction (NACE 10-41), ranked by 2007
Source: OECD SDBS - Business Demography Statistics.

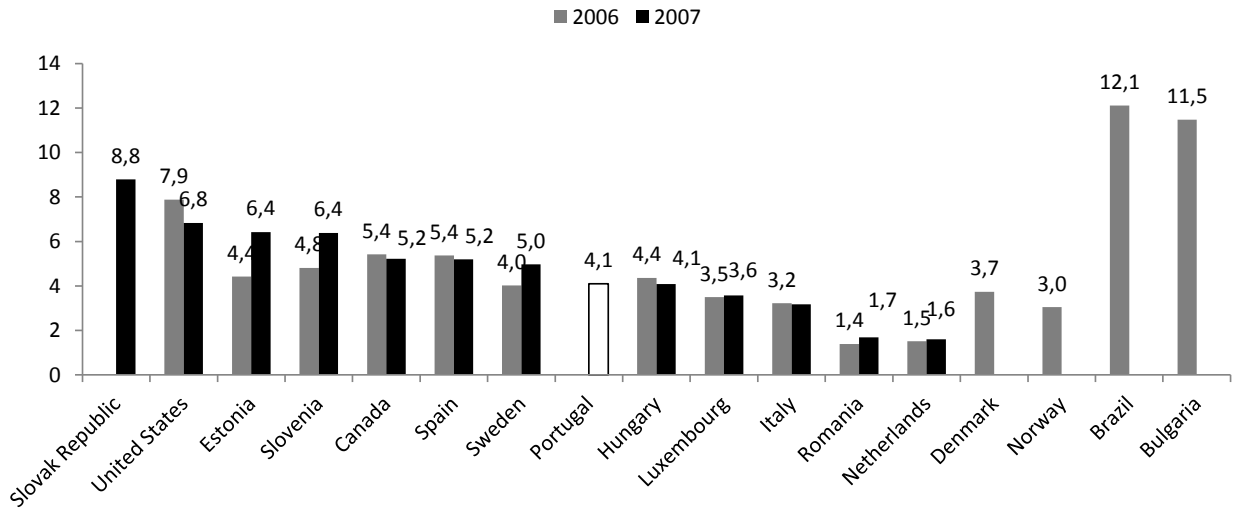

Figure 26: Share of high-growth firms (employment definition) in total active population of employer enterprises, construction (NACE 45), ranked by 2007
Source: OECD SDBS - Business Demography Statistics.

We not turn to the comparison of Portugal and the UK (NESTA, 2009a and 200b). In the UK, high-growth firms accounted for 6,4% of the total population of UK firms during 2002-2005 and 5,8%

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during 2005 and 2008. In particular during the period 2002-2005, the UK had one of the largest shares of high-growth firms among OECD economies (NESTA, 2009b).

Considering the period 2002-2005, the number of high-growth firms in the UK are twice as much as in Portugal when accounted with the employment criteria, but when accounted by turnover definition, Portugal has 87% of the number of high-growth firms of the UK[31] (Figure 27). By comparing the UK period 2005-2008 with the period 2005-2007, there is also evidence that only around half that share was generated in Portugal[32], according to the employment definition. Yet again, this underlines the relative small average size of Portuguese firms, which is particularly observed when the employment definition is used for international comparisons.

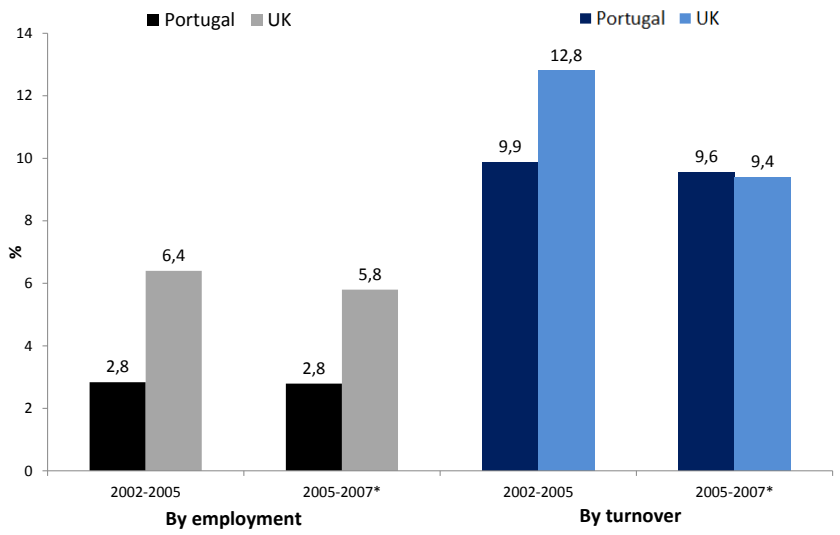

Figure 27: Share of high-growth firms in Portugal and in the UK
Source: Own calculations, based on "Quadros de Pessoal", GEP/MTSS for Portugal and NESTA (2009b), based on OECD/Eurostat´s (2007) methodology.
Note: * For the UK the period is 2005-2008.

The average high-growth company in the UK tripled its employment over each three-year periods, 2002-2005 and 2005-2008 (2009a). Given the differences in the way employment is accounted for in our paper and in NESTA´s research (NESTA, 2009a and 2009b), as we do not calculate employment growth for the same cohort in three year spells, we are only able to fully compare the year 2005.

In 2005, UK high-growth firms generated 11,6% of total employment, compared to 4,4% of their Portuguese counterparts. This to not only shows that high-growth firms are relatively more abundant in the UK, but hints at the possibility of UK high-growth firms being larger than the Portuguese.

In fact, the enterprise fabric in the UK is quite distinct from that of Portugal. For a start, the number of large firms in the UK is amongst the highest in Europe, comparable to the US, when adjustments are made to reflect variations in size of the economies (BERR, 2008, p. 15).

In trying to confirm these size discrepancies, we not turn to the analysis of average high-growth firm size in 2005. In Portugal, they averaged 101 employees, while in the UK they employed more than twice this amount (235 employees).

Table 5 compares average size of firms in year 2005 and 2008 (end of period) for the UK and 2005 and 2007 for Portugal, according to size class. Despite the different size disaggregation for the largest size classes, it is clear that for all size classes, UK firms display more than twice the size of Portuguese

31 There is a sharp decrease in the turnover measurement for high-growth firms during the second period, 2005-2008, in the UK (NESTA 2009b).
32 Data for Portugal for the second period refers to 2005-2007 while UK data refers to 2005-2008.

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firms. Even comparing within the (larger) size class for Portuguese firms of 50-250 employees with the 50-99 of UK firms, we notice that UK firms are three times larger in 2005 and twice as much when the last years of Table 5 are compared (2007 for Portugal and 2008 for the UK). This difference tends to widen as we move on to the largest size classes, where the size discrepancy gets enlarged.

Table 5: Average firm size (employment definition) by size class, in Portugal and in the UK

	UK			Portugal	
	Average size in 2005 (end 3 year period)	Average size in 2008 (end 3 year period)		Average size in 2005	Average size in 2007
10-19	46	42	**10 to 19**	18	18
20-49	130	92	**20 to 49**	32	32
50-99	323	197	**50 to 249**	96	97
100-249	541	465			
+500	3.251	2.684	**+250**	779	779
All HG firms	235	171	**All HG firms**	101	110

Source: Own calculations, based on "Quadros de Pessoal", GEP/MTSS for Portugal and NESTA (2009b), based on OECD/Eurostat´s (2007) methodology.

8. CONCLUSIONS

The contributions of this paper to the literature is three-fold: firstly, it focuses on the profiling of high-growth and gazelle firms to a detail which has not been previously considered. The analysis carried out in this study is based on a comprehensive dataset which provides the platform for uncovering features of these firms which have not been examined to such a detail before.

The results show that in 2007, only 9,5% of all Portuguese employer enterprises (with more than ten employees) have a turnover that is in line with that of high-growth firms. If instead of turnover, we consider the growth in the number of employees, then the percentage of high-growth firms drops by 6,5p.p. to just 3 %. In addition, firms that can be classified as gazelles constitute only 2,2% of the total number of Portuguese employer enterprises if turnover is the criteria considered and 0,7% if we focus on employment growth. These percentages are significantly lower than at the beginning of the period considered in this study. In 1985, 24,6% were high-growth firms, of which 3,7% were gazelles according to turnover and 4,2% and 1,1% respectively if we take into account employment growth instead.

The analysis also provides evidence of a narrowing gap between the two measurement criteria, the ratio of high-growth firms according to turnover to the respective employment. A similar pattern has been observed for gazelle firms, indicating that more firms are now growing faster in employment than in turnover.

Most high impact firms are SMEs, but it is the largest size class firms, over 250 employees, that accounts for most employment creation.

This research also provides evidence of significant differences of high-growth firms across regions, with more than half concentrated around the area of Lisbon and a quarter in the North. Over the years, a pattern emerges whereby more and more high-growth firms become concentrated around the Lisbon area.

It should also be noted that there has been an important shift in the distribution of both high-growth firms over the period of analysis, away from manufacturing to services and commerce, as well as construction. A similar pattern is observed for firms classified as gazelles.

High-growth firms are not a homogeneous group of firms. Firm's growth differences in Portugal go beyond high-growth firms and are deeply rooted in the structure of Portuguese entrepreneurial fabric. High-growth is a stage in the development of firms with potential and ambition to grow.

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Secondly, by establishing a comparison between Portuguese high-growth and gazelle firms and their European counterparts, we highlight fragilities in performance and assesses the role of framework conditions, particularly in the context of the current economic, social and financial climate.

Portugal produces less high-growth firms than most European countries. This lower ability to generate high-growth firms in Portugal raises concerns about the incapacity to generate such a track of growth, highlighting the laggard growth dynamism across the Portuguese entrepreneurial fabric.

The small size of these industries hinders growth and particularly survival in globalised markets. These have also been considered to be partly a reflection of the country's substantial educational gap (OECD, 2010). However, wider barriers to growth need to be removed in Portugal. This relates to addressing a whole array of structural factors that lay deep in the bottom of the country´s culture and education. Entrepreneurial culture needs to be targeted with long term structural policies, so as to foster a more risk-taking individual attitude towards business.

Thirdly, we conclude that the sort of overreaching structural problems the country faces means that policies should not be confined to specific kinds of firms, even if high-growth. This means addressing a whole range of framework conditions underlying overall firms ´poor performance in terms of growth and survival.

Portugal still "remains one of the poorest OECD countries" (OECD, 2010, p. 9). The country is in need of policies which are effective at delivering productivity growth. In the short to medium term, there seems to be significant margins to increase productivity, if efficient firms are encouraged to entry the market, while inefficient firms are forced out, in particular in the services sector.

Policies need to be more focused in providing the platform for entrepreneurial activities to thrive, particularly in those sectors earmarked as pivotal to economic growth. In practice, policymakers could assist in the process of firm creation and growth, by reducing red tape and bureaucracy, working with financial institutions towards easing access to credit and improving labour and product regulations. More generally, policymakers should contribute to the establishment of an environment which is appealing to venture capitalists and business angels, and which can be ultimately regarded as conducive to investing in the country.

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OS INSTRUMENTOS DE POLÍTICAS PÚBLICAS ESTADUAIS IMPORTAM NA DINÂMICA DO CRESCIMENTO ECONÔMICO E CONCENTRAÇÃO INDUSTRIAL? EVIDÊNCIAS PARA O BRASIL

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Resumo. O presente trabalho tem como objetivo identificar se os instrumentos de políticas públicas estaduais somados a características sócio-demográficas influenciam o crescimento da renda *per capita*, convergência de renda e a participação do emprego industrial como medida para a concentração industrial entre o estados brasileiros no período de 1986 a 2006. Para responder estes objetivos utilizou-se da técnica econométrica para dados em painel fazendo uso de diferentes métodos de estimação, especialmente, o método de momentos generalizados (GMM) que corrige os problemas de endogeneidade das variáveis. As evidências indicam, de forma geral, que principalmente o capital humano e os gastos em infra-estrutura social têm contribuído para o crescimento econômico e convergência de renda *per capita* entre os estados brasileiros no período de análise. Por outro lado, a participação do emprego industrial passada, bem como, o potencial do mercado vizinho e o próprio tamanho do mercado local tem sido mais relevantes do que os instrumentos escolhidos de políticas públicas estaduais para explicar os determinantes da participação do emprego industrial dos estados brasileiros no período analisado. Estes resultados permitem caracterizar diferentes padrões destes mecanismos e, portanto, pode subsidiar processos de planejamento e coordenação das políticas regionais mais descentralizadas.

Palavras chaves: crescimento, aglomeração, gasto público estadual

THE INSTRUMENTS OF STATE PUBLIC POLICIES MATTER IN THE DYNAMICS OF ECONOMIC GROWTH AND INDUSTRIAL CONCENTRATION? EVIDENCE FROM BRAZIL

Abstract. This study aims to identify if the instruments public policies of state completed with the socio-demographic characteristics influence the growth of per capita income, income convergence and the participation of industrial employment as a *proxy* of industrial concentration among the Brazilian states from 1986-2006.To meet these goals, used the technique for econometric panel data using different estimation methods, especially the generalized method of moments (GMM) that corrects the endogeneity of variables. The evidence indicates that in general, especially human capital and spending on social infrastructure have contributed to economic growth and per capita income convergence among Brazilian states in the period of analysis.Moreover, the share of industrial employment past, as well as market potential and the actual size of the neighbor local market has been more relevant than the chosen instruments of state public policies to explain the determinants of participation in industrial employment of the Brazilian states the period analyzed.These results allow to characterize different patterns in these mechanisms and can therefore subsidize planning processes and coordination of regional policies more decentralized.

Key words: growth, agglomeration and state public spending

1. INTRODUÇÃO

A Nova Geografia Econômica (NGE) explica que a existência de mobilidade de fatores (capital e mão-de-obra) permite a aglomeração das atividades em uma região em detrimento de outra e, conseqüentemente, determinando as diferenças de porte econômico entre as regiões. Desta forma,

o padrão de desenvolvimento regional é determinado pelo nível de concentração dos fatores de produção e, por sua vez a distribuição espacial desses fatores também depende do padrão de desenvolvimento da região. É este padrão de concentração das atividades econômicas e de pessoas que define o desenho do desenvolvimento regional.

Dentro desse contexto, encontra-se o Brasil que é inegavelmente um país com grandes desigualdades regionais, em que as regiões do Nordeste e Norte são as de menor Produto Interno Bruto (PIB) *per capita* entre as regiões brasileiras. Nesta direção, as políticas públicas de cunho regional representam uma tentativa do setor público em corrigir os desequilíbrios que podem surgir devido à concentração de fatores em determinadas regiões. Os governos regionais possuem como instrumentos de política para o combate a estes desequilíbrios, dentre muitos outros, os gastos públicos em infra-estrutura social e econômica, bem como, a utilização de transferências constitucionais, como, por exemplo, o Fundo de Participação Estadual (FPE).

Entretanto, será que estes tipos de mecanismos são suficientes para superar as forças responsáveis pela distribuição das atividades e afetar o desempenho da economia? Portanto, as políticas públicas ao procurar modelar o crescimento econômico regional precisam levar em consideração as peculiaridades regionais que possam explicar as decisões racionais de localização das atividades econômicas e das pessoas.

Levando-se em consideração os fatores analisados acima, a questão central deste estudo será a obtenção de evidências que permitam inferir de que forma aqueles instrumentos de política pública mencionados anteriormente, relacionam-se com as taxas de crescimento do PIB *per capita* estadual e sobre a participação do emprego industrial nos estados brasileiros entre o período de 1986 e 2006.

O estudo proposto aqui está sumariado da seguinte maneira: além desta introdução, é apresentado na segunda seção o modelo teórico, enfatizando o modelo de crescimento econômico com convergência de renda. Na seqüência, explica-se a estratégia empírica adotada para atingir os objetivos deste trabalho. Na quarta seção são apresentados os resultados das regressões por meio dos dados em painel para os modelos propostos neste trabalho e, por fim, a última seção apresenta as conclusões do estudo em questão.

2. MODELO TEÓRICO

O modelo de convergência - β aqui tratado baseia-se no trabalho de Túlio e Elias (2006) e decorre do modelo neoclássico de crescimento de Solow (1956) baseado na função de produção *Cobb-Douglas* com o progresso técnico aumentador de trabalho dado por:

$$Y(t) = K(t)^{\alpha}\left[A(t)L(t)\right]^{1-\alpha} \text{ com, } 0 < \alpha < 1 \qquad (2.1)$$

Em que *Y* é o produto, *K* e *L* são respectivamente, os fatores de produção, capital e trabalho; *A* examina o efeito cumulativo do progresso tecnológico através do tempo, *a* é a elasticidade do capital com relação ao produto e *t* é o tempo. O modelo pressupõem que *L* e *A* crescem exogenamente a uma taxa constante *n* e *g,* dado por $L(t) = L(0)e^{nt}$ e $A(t) = A(0)e^{gt}$, respectivamente. Por sua vez, a taxa de poupança *s* é uma fração constante do produto, ($S = sY, 0 < s < 1$) e *K* deprecia a uma taxa exógena constante δ, assim, $\dot{K} = \frac{dK}{dt} = I - \delta K$. Por sua vez, uma quantidade constante de capital δK, em cada período *t*, não é utilizado.

Partindo da hipótese neoclássica padrão de retornos constantes à escala, a função de produção, em termos de unidade efetiva de trabalho, é dada por

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$\bar{y} = \bar{k}^{\alpha}$, com $\bar{y} = \frac{Y}{AL}$ e $\bar{k} = \frac{K}{AL}$. (2.2)

A especificação dinâmica do modelo com progresso técnico toma a seguinte forma:

$$\dot{\bar{k}}(t) = s\bar{k}(t)^{\alpha} - (n+g+\delta)\bar{k}(t) \quad (2.3)$$

Em que a taxa de crescimento do estoque de capital no estado estacionário se iguala a zero $(\dot{\bar{k}}(t) = 0)$, $\bar{k}^*$ atende a condição seguinte:

$$s\bar{k}^*(t)^{\alpha} = (n+g+\delta)\bar{k}(t)^* \Leftrightarrow \bar{k}^* = \left(\frac{s}{n+g+\delta}\right)^{\frac{1}{1-\alpha}} \quad (2.4)$$

Substituindo a expressão encontrada para $\bar{k}^*$ na função de produção (2.2), encontra-se o valor do produto no estado estacionário

$$\bar{y}^* = \left(\frac{s}{n+g+\delta}\right)^{\frac{\alpha}{1-\alpha}} \quad (2.5)$$

Dado a definição de produto em termos de unidade efetiva de trabalho, $\bar{y} = \frac{Y}{AL}$ e da expressão encontrada para o nível do produto no estado estacionário, equação (2.5), é possível derivar uma expressão para a renda *per capita* no estado estacionário:

$$\ln\left[\frac{Y(t)}{L(t)}\right] = \ln A(0) + gt + \left(\frac{\alpha}{1-\alpha}\right)\ln(s) - \left(\frac{\alpha}{1-\alpha}\right)\ln(n+g+\delta) \quad (2.6)$$

Em que *gt* é uma constante, haja vista que a taxa de progresso tecnológica é a igual para todas as economias. Por sua vez, $A(0)$ pode ser diferente entre as economias, pois este termo não reflete somente o nível de tecnologia, mas também a dotação de fatores específica de cada economia, instituições, condições econômicas, dentre outros fatores (MANKIW *et al.,* 1992).

Neste sentido, considera-se então a equação que descreve o comportamento da renda *per capita* fora (em torno) do estado estacionário:

$$\frac{d\ln\bar{y}(t)}{dt} = \beta\left[\ln\bar{y}(t)^* - \ln\bar{y}(t)\right] \quad (2.7)$$

Em que $\beta = (n+g+\delta)(1-\alpha)$ é a taxa de convergência que está em função da taxa de crescimento da população, tecnologia, depreciação do capital e da elasticidade com respeito ao capital. Esta equação implica que:

$$\ln\bar{y}(t_2) = \left(1-e^{-\beta T}\right)\ln\bar{y}^* + e^{-\beta T}\ln\bar{y}(t_1) \quad (2.8)$$

Onde $\bar{y}(t_1)$ é a renda por trabalhador efetivo em algum ponto inicial do tempo e $T = t_2 - t_1$ o período considerado. Subtraindo $\ln\bar{y}(t_1)$ de ambos os lados da equação (2.9) encontra-se uma especificação que representa o processo de ajustamento parcial:

$$\ln\bar{y}(t_2) - \ln\bar{y}(t_1) = \left(1-e^{-\beta T}\right)\left[\ln\bar{y}^* - \ln\bar{y}(t_1)\right] \quad (2.10)$$

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Neste modelo o crescimento da renda por trabalhador efetivo entre o período t_2 e t_1 é determinado pela distância entre o seu nível inicial e o valor do estado estacionário. Substituindo a expressão (2.5), que representa $\bar{y}^*$, em (2.10) obtém-se a seguinte expressão:

$$\ln \bar{y}(t_2) - \ln \bar{y}(t_1) = \left(1 - e^{-\beta T}\right)\left[\left(\frac{\alpha}{1-\alpha}\right)\ln(s) - \left(\frac{\alpha}{1-\alpha}\right)\ln(n+g+\delta) - \ln \bar{y}(t_1)\right] \quad (2.11)$$

Na equação acima o crescimento da renda por trabalhador efetivo é explicado pelo seu valor inicial e pelos determinantes principais de estado estacionário, admitindo que $(n+g)$ são os mesmos para todas as economias[33].

Partindo da definição de renda por trabalhador $\bar{y} = \frac{Y(t)}{A(t)L(t)} = \frac{Y(t)}{L(t)A(0)e^{gt}}$ e tirando os logaritmos a equação da renda *per capita* passa a ser expressa da forma abaixo:

$$\ln \bar{y}(t) = \ln\left(\frac{Y(t)}{L(t)}\right) - \ln A(t) \Leftrightarrow \ln y(t) - \ln A(0) - gt \quad (2.12)$$

Em que $y(t)$ é a renda *per capita*. Fazendo as substituições na equação (2.12) obtemos a usual equação de convergência em termos de renda *per capita*:

$$\begin{aligned}\ln y(t_2) - \ln y(t_1) &= \left(1 - e^{-\beta T}\right)\left(\frac{\alpha}{1-\alpha}\right)\ln(s) - \left(1 - e^{-\beta T}\right)\left(\frac{\alpha}{1-\alpha}\right)\ln(n+g+\delta) \\ &\quad - \left(1 - e^{-\beta T}\right)\ln y(t_1) + \left(1 - e^{-\beta T}\right)\ln A(0) + g\left(t_2 - e^{-\beta T}t_1\right) + v_{i,t}\end{aligned} \quad (2.13)$$

Onde $\left(1 - e^{-\beta T}\right)\ln A(0)$ é o efeito individual específico de cada economia e $v_{i,t}$ é o termo de erro que varia entre as economias e ao longo do tempo. Uma apresentação convencional simplificada da equação (2.14) com dados em painel com efeito fixo é a seguinte:

$$\Delta \ln y_{i,t} = \gamma - b \ln y_{i,t-1} + \eta_i + \mu_{i,t} \quad (2.14)$$

Em que a taxa de crescimento da renda *per capita* de cada economia é relacionada com o nível inicial de renda, o único fator de convergência. À medida que a distância do nível inicial de renda *per capita* do seu estado estacionário aumenta, maior será a taxa de convergência. O termo constante (γ) refere-se ao estado estacionário de renda *per capita* comum dependente de fatores como *s*, *n*, *g*, δ e $A(0)$. O parâmetro $b = \left(1 - e^{-\beta T}\right)$ é conhecido como o coeficiente de convergência, enquanto β representa a velocidade de convergência dada por $\beta = -\frac{\ln(1-b)}{T}$. O termo $\eta_i = (1 - e^{-\beta T})\ln A(0)$ representa o efeito fixo de cada estado, e $\mu_{i,t}$ é o erro que varia entre as regiões e entre períodos, tendo média zero e variância constante. Finalmente, *T* é a dimensão do tempo no qual a renda *per capita* é medida.

33 A equação de convergência neoclássica (2.11) determinada em termos de renda por trabalhador efetivo não mostra a correlação existente entre o termo não observável $A(0)$ e as variáveis incluídas no modelo. Este problema é mais aparente quando a equação é expressa em termos de renda per capita.

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Se a equação (2.14) é ampliada para conter as diferenças estruturais (*s*, *n*, *g*, δ e $A(0)$) e mais genericamente outros fatores tais como capital humano, P&D, comércio internacional, setor público, etc.) para controlar os diferentes estados estacionários, então tem-se o caso de convergência *condicional* dada por:

$$\Delta \ln y_{i,t} = \gamma + b \ln y_{i,t-1} + \phi_j X_{i,t} + \eta_i + \mu_{i,t} \qquad (2.15)$$

Notam-se duas observações importantes que diferem a convergência *condicional* da convergência *absoluta*. A primeira é que as economias convergem para estados estacionários distintos, representados por γ_i, já a segunda, esclarece que, em uma especificação mais geral, existem algumas atividades, como, por exemplo, capital humano e inovação, dentre outras, que podem apresentar retornos crescentes à escala no longo prazo **(**Barro e Sala-i-Martin, 1995). Essas atividades com características de retornos crescentes à escala podem compensar os retornos decrescentes do estoque de capital na função de produção. As atividades com características de retornos crescentes são incluídas no vetor $X_{i,t}$. A suposição de convergência *absoluta* é aceita quando $\gamma_i = \gamma$ e $\phi_j = 0$, de outra maneira, a convergência é *condicional*.

3. METODOLOGIA

3.1. Método de estimação

Os dados em painel apresentam diversas vantagens relativamente aos dados em corte transversal ou às séries temporais. Dentre elas destaca-se o maior número de observações, que proporciona um aumento dos graus de liberdade e da eficiência dos estimadores, por reduzir o problema da colinearidade entre as variáveis explicativas. A especificação de dados em painel proporciona duas hipóteses alternativas para se modelar o comportamento específico de cada indivíduo, quais sejam: o Modelo de Efeitos Fixos e o Modelo de Efeitos Aleatórios[34].

O Modelo de Efeitos Fixos admite que haja um intercepto η_i, que difere para cada indivíduo *cross-section*, mas que, no entanto não distingue o que é específico para cada indivíduo de outros efeitos que estão agindo no tempo. O Modelo de Efeitos Aleatórios admite que o termo μ_{it} pode ser decomposto de forma que $\mu_{it} = \delta_i + \xi_{it}$, onde δ_i representa o efeito individual de cada unidade seccional que varia entre as mesmas, no entanto é fixo no tempo. Este efeito pode ou não estar correlacionado com as variáveis independentes da matriz X_{it}. E, ξ_{it} é sistematicamente independente nas unidades *i* e no tempo *t.*

A abordagem mais adequada depende da natureza dos dados analisados. Segundo Johnston e Dinardo (1997), se o vetor δ_i é ortogonal a matriz X_{it} (não estão correlacionados), então o modelo será especificado como Modelo de Efeitos Aleatórios $(E(\delta_i X_{it}) = 0)$, ou seja, o intercepto η_i captará o efeito de δ_i, e, portanto, será tratado de forma aleatória. Isto é, a especificação no Modelo de Efeitos Aleatórios implica numa distribuição aleatória dos efeitos individuais "em torno" do intercepto comum a todos os indivíduos. Esta suposição requer que os efeitos individuais sejam não correlacionados às variáveis independentes, mas apresenta a vantagem de permitir a inclusão de características específicas dos indivíduos invariantes no tempo (ou no período considerado) para o modelo a ser estimado.

34 Grande parte da discussão está baseada em Greene (2000).

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Já se δ_i e X_{it} estiverem correlacionados, o intercepto η_i será tratado de forma determinista, e o modelo será especificado como Modelo de Efeitos Fixos $(E(\delta_i X_{it}) \neq 0)$. A adoção desta hipótese proporciona uma vantagem (do ponto de vista de estimação) de dispensar à necessidade de se aceitar a suposição de que características específicas a cada indivíduo não sejam correlacionadas com as variáveis independentes. Assim sendo, a especificação do Modelo de Efeitos Fixos é implementada com o estimador de Mínimos Quadrados Ordinários com variáveis *Dummy* (LSDV)[35].

Hausman (1978) propõe um teste para verificar estatisticamente a plausibilidade da hipótese de correlação zero (ortogonalidade) entre o componente individual u_i do choque estocástico e as variáveis independentes X_{it} para discernir sobre qual o estimador é mais adequado para uma dada amostra. Caso a hipótese de ortogonalidade não seja rejeitada, o modelo de Efeitos Aleatórios é aceito. No entanto, a rejeição da hipótese de ortogonalidade conduz à utilização do Modelo de Efeitos Fixos.

Uma crítica que é comumente dirigida aos estudos empíricos de convergência é que as estimações convencionais usadas falham em considerar a endogeneidade dos regressores explicativos. Quando as variáveis independentes são endógenas as regressões são enviesadas e inconsistentes. Para considerar a endogeneidade alguns autores sugeriram o uso de variáveis instrumentais para estimar a equação de convergência (Barro e Lee (1993), Barro e Sala-i-Martin (1995), Caselli et al (1996), entre outros). Neste trabalho, estimamos a equação de convergência utilizando a abordagem do método de momentos generalizados (GMM)[36] proposta por Arellano-Bond (1991) e aplicada inicialmente à equação de convergência por Caselli et al (1996)[37].

3.2. Modelo empírico

A especificação para o modelo de crescimento do PIB *per capita* estadual será baseada no modelo de Crescimento de Solow-Swan convencional descrito anteriormente. Para este caso, testa-se também a hipótese de convergência da renda *per capita*. É sabido também que as políticas públicas brasileiras exibem uma forte influência histórica no direcionamento da alocação dos recursos industriais. Desta forma, neste trabalho, há um interesse em saber a respeito das evidências sobre papel dos instrumentos de poder público estadual, como fonte de explicação para a participação do emprego industrial estadual[38].

O primeiro modelo é estimado para o crescimento do PIB *per capita*, enquanto, o segundo modelo é estimado para variável que mede o peso do emprego industrial dos estados sobre o emprego industrial nacional. De forma geral, as equações estimadas nesse estudo são dadas pelas equações abaixo:

Modelo (1)

$$\Delta y_{i,t} = \gamma + by_{i,t-1} + \phi_1 ch_{it} + \phi_2 dens_{it} + \phi_3 pm_{it} + \phi_4 pei_{it} + \phi_5 gisgt_{it} + \phi_6 giegt_{it}$$
$$+\phi_7 fpercorren_{it} + \eta_i + \mu_{i,t}$$

Modelo (2)

$$pei_{it} = \phi_0 + \phi_1 Y_{it} + \phi_2 ch_{it} + \phi_2 dens_{it} + \phi_3 pm_{it} + \phi_4 gisgt_{it} + \phi_5 giegt_{it} + \phi_6 fpercorren_{it}$$
$$+\eta_i + \mu_{i,t}$$

35 Least Square Dummy Variables
36 Generalized Method of Moments.
37 Para maiores detalhes ver: Caselli, F., Esquivel, G.; Lefort; F. (1996). "Reopening the Convergence Debate: A New Look at Cross-Country Growth Empirics". Journal of Economic Growth 1, no. 3, p. 363–389.
38 Entretanto, estes determinantes estão baseados por teorias distintas, o que expõem uma inexistência de um único modelo teórico que apreenda todos os argumentos para a concentração. Desta forma, é preciso ter cautela na descrição dos resultados apontados.

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No modelo (1) a variável dependente refere-se ao crescimento da renda *per capita* ($crespibpc_{i,t}$) para o estado *i* no período t; $y_{i,t}$ representa o logaritmo da renda *per capita* do estado *i* no período *t*; a variável $y_{i,t-1}$ diz respeito ao logaritmo do nível da renda *per capita* para o estado *i* no tempo inicial. (*ch*) capital humano, (*dens*) densidade demográfica, (*pei*) participação do emprego industrial estadual no emprego industrial nacional, (*pm*) potencial de mercado, além destas variáveis explicativas sócio-demográficas, inclui-se também as variáveis explicativas de política pública, tais como: (*gisgt*) gasto em infra-estrutura social, (*giegt*) gasto em infra-estrutura econômica e (*fpercorren*) o peso do Fundo de Participação Estadual (FPE) sobre a receita corrente estadual. Todas estas variáveis são referentes ao estado *i* no período t [39].

Para o modelo (2), tem-se como variável dependente a participação do emprego industrial ($pei_{i,t}$) no estado *i* para o período t; a diferença das variáveis explicativas deste modelo pelo primeiro refere-se, apenas pela substituição da variável participação do emprego industrial estadual no emprego industrial nacional (*pei*), para o logaritmo do produto interno bruto em nível (*Y*) no estado *i* para o período t, visando captar os efeitos do tamanho do mercado local.

3.3. Dados e amostras

Para este estudo, utiliza-se a combinação de diferentes bases de dados. Uma delas é da Secretaria do Tesouro Nacional, órgão do Ministério da Fazenda[40]. Este banco de dados serviu para compor as duas categorias de gastos em infra-estrutura utilizada no modelo empírico, quais sejam: os gastos em infra-estrutura social, bem como, os gastos em infra-estrutura econômica[41]. Fazendo uso ainda da mesma base de dados, completa este conjunto de variáveis a transferências de renda, que para este estudo, diz respeito ao Fundo de Participação Estadual (FPE). Os dados foram selecionados para um total de 26 estados brasileiros[42].

Utilizou-se também a banco de dados elaborado pelo Instituto de Pesquisa Econômica Aplicada - Ipeadata[43]. Nesse banco de dados, foram obtidos o Produto Interno Bruto *per capita* estadual, os anos médios de escolaridade da população total acima de 25 anos (*proxy* para capital humano) para os estados da amostra entre o período citado acima, bem como, a densidade demográfica dos estados.[44] A variável potencial de mercado foi construída de forma alternativa a partir da reconhecida contribuição de Harris (1954) a economia regional. A demanda potencial da vizinhança é representada pelo PIB *per capita* e este é calculado para cada estado através da seguinte expressão, $pm_j = \sum_{n=1}^{i} \frac{PIBpc_i}{d_i^2}$, onde *d* representa a distância do estado *j* em relação aos demais estados *i* (de fato, entre suas as capitais) [45].

Para a construção da variável participação do emprego industrial estadual no emprego industrial nacional, como uma medida de concentração industrial, utilizou-se a Relação Anual de Informações

39 Todas as variáveis explicativas para modelo (1) foram estimadas em logaritmo, para um melhor ajuste do referido modelo. Em modelos lineares nos logaritmos podem-se obter diretamente os coeficientes de elasticidade, isto é, estes são os próprios coeficientes associados às variáveis explicativas.

40 www.tesouro.fazenda.gov.br

41 Esta variável refere-se à soma da participação dos gastos referentes às funções de despesas com segurança e defesa, educação e cultura; saúde e saneamento, habitação e urbanismo no gasto total do estado. Enquanto, os gastos em infra-estrutura econômica estar associado à soma da parcela das despesas em transporte, energia e comunicação.

42 Devido à indisponibilidade de dados para o período de tempo analisado, o estado de Tocantins não foi considerado na amostra.

43 www.ipeadata.gov.br

44 Esta variável será encontrada através da relação entre a população da região e área geográfica desta região, (Hab/Km2).

45 Tal medida é mais permissiva quanto à influência espacial, já que permite influências não apenas dos vizinhos (estados adjacentes), embora tal influência seja ponderada de forma decrescente de acordo com a distância.Os valores das distâncias entre Macapá e as demais capitais brasileiras, referem-se às distâncias aéreas, visto que, não há ligação rodoviária entre elas. Estes valores podem ser obtidos pelo endereço eletrônico: http://www1.dnit.gov.br/rodovias/distancias/distancias.asp.

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Sociais – RAIS[46]. Vale salientar que uso deste banco de dados está sujeito à crítica em função de disponibilizar apenas dados para o emprego industrial formal, entretanto, para o propósito deste estudo o mesmo atende os objetivos propostos[47]. O período de tempo considerado neste estudo diz respeito aos anos de 1986 a 2006. A escolha deste período está associada a limitações de dados disponíveis entre as variáveis analisadas no referido estudo.

4. RESULTADOS ECONOMÉTRICOS

A análise deste modelo começa pela escolha de qual estimador é mais indicado aos dados, por meio do teste de Hausman[48]. A estatística computada para o referido teste e para a amostra em questão tem um p-valor de 97,23 com probabilidade de 0,00%, corrobora a rejeição da hipótese nula. Portanto, o estimador indicado neste caso é o LSDV (efeitos fixos).

Vale destacar que o processo de escolha não se restringiu aos aspectos estatísticos abordados no teste de Hausman. Além disso, utilizou-se dos aspectos descritos anteriormente quanto ao problema de pesquisa a que se está estudando e a natureza da coleta de dados. Por exemplo, por se considerar todos os estados brasileiros não é plausível assumi-los como uma amostra aleatória, como também, pela pesquisa buscar entender a realidade concreta e restrita dos estados brasileiro, não sendo o mesmo um estudo genérico. A partir dessas considerações é possível sugerir que a escolha mais acertada para a abordagem estática será a da utilização do modelo de efeitos fixos.

Ao utilizar o LSDV, assume-se que as características específicas a cada indivíduo não são correlacionadas com as variáveis independentes, dispensando a análise de correlação serial. Para testar a hipótese nula de homocedasticidade dos resíduos foi utilizado o teste Wald modificado para dados em painel com efeito fixo[49]. O resultado do referido teste apresenta um $\chi^2_{(26gl)} = 393,40$ e com probabilidade de 0,00%, desta forma rejeita-se a hipótese nula de homocedasticidade, apresentando fortes indícios da presença de heterocedasticidade. Assim sendo, para o problema de heterocedasticidade, foi utilizado o mecanismo de correção de variâncias e erros padrão de White. Para a detecção da multicolinearidade foi utilizado o Fator Inflação de Variância (VIF)[50]. Entretanto, o resultado do VIF é de 2,84, assim a multicolinearidade não se mostrou como um problema sério.

Além o modelo de efeitos fixos "Least Square Dummy Variable (LSDV)" onde as diferenças entre os países podem ser representadas nos diferentes termos constantes, a partir da inclusão de variáveis "dummies" para cada economia, utilizou-se também dados em painel dinâmico por meio do Método de Momentos Generalizados (GMM), "Generalized Method of Moments" conforme sugerido por Arellano-Bond (1991). A vantagem deste método, como visto na seção 3.1, é que o mesmo corrige possíveis problemas de endogeneidade das variáveis explicativas, levando em consideração não somente a causalidade reversa (como, por exemplo, a taxa de crescimento do produto interno bruto per capita pode afetar os gastos públicos), mas, também, outros problemas, como a omissão de variáveis importantes e/ou erros de medida.

Antes de analisar os estimadores do GMM, faz-se necessário verificar primeiro o teste de Sargan de restrições sobre-identificadas como instrumento de avaliação da especificação do modelo, validando ou não as variáveis instrumentais empregadas. O referido teste foi utilizado sucessivamente a partir de cada etapa realizada para se conseguir a melhor especificação dada à natureza de escolha, por

46 www.rais.gov.br

47 Acredita-se que a geração do emprego formal é fruto em grande parte do desempenho do setor industrial o que justifica o uso deste banco de dados.

48 O Teste de Hausman permite verificar a hipótese nula da ortogonalidade (correlação zero) entre os efeitos individuais δ_i e os regressores X_{it} contra a hipótese alternativa de correlação não-zero.

49 Este teste esta disponível por meio do comando xttest3 no stata 10.0.

50 Variation Inflation Factor. Alguns autores sugeriram que se qualquer fator de inflação da variância exceder 10, então a multicolinearidade será um problema. Outros autores consideram esse valor muito liberal e sugerem que os fatores de inflação da variância não devem exceder 4 ou 5.

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exemplo, entre o estimador de primeiro e segundo estágio, e do número de defasagens (neste caso) da variável dependente que seria usada na especificação.

Contudo, ao se ter obtido a rejeição dos instrumentos para o GMM em primeiro estágio foram utilizados os estimadores de segundo estágio que identificaram a possibilidade de viés no processo de estimação apontando a necessidade de se estimar os modelos com o emprego de um estimador robusto para correção de viés.

No que tange à rejeição dos instrumentos pelo teste de Sargan, Arellano e Bond (1991), consideram que isso poderia acontecer em função da presença de heterocedasticidade, enfatizando, dessa maneira, a necessidade de estimação do modelo com a utilização do estimador robusto para correção de viés. Sendo assim, utilizou-se o estimador proposto por Windmeijer (2005) para a obtenção de estimativas robustas.

Entretanto, ao se utilizar o estimador de segundo estágio, não foi possível adotar o teste de Sargan de restrições sobre-identificadas, reincidindo de sobremaneira na qualidade da especificação sobre o teste de autocorrelação proposto por Arellano e Bond (1991) descrito acima. Assim sendo, dada a natureza de geração de resíduos a partir das primeiras diferenças, e se esses, por conseguinte, forem independentemente e identicamente distribuídos (*i.i.d*) tem-se como resultado autocorrelação de primeira ordem. Desse modo, o teste de autocorrelação de segunda ordem presente em Arellano e Bond (1991) deverá necessariamente apresentar aceitação da hipótese nula de ausência de autocorrelação de segunda ordem para que seja possível utilizar as estimativas obtidas para avaliação do possível impacto das variáveis sócio-demográficas, bem como, os instrumentos de políticas públicas estaduais sobre o crescimento econômico dos estados brasileiros no período de estudo.

Fazendo-se uso desses testes para autocorrelação residual, observou-se, como destacado pelo Quadro 4.1, que os resultados dos mesmos corresponderam ao esperado e desejado, onde foi identificado para a regressão, autocorrelação em primeira ordem e rejeitado para o de segunda ordem, insinuando a validade dos resultados obtidos para cumprir com o objetivo proposto nesse estudo.

Desse modo, as estimativas são válidas neste método mesmo sob condição de autoregressão de primeira ordem, m^1, mas não de segunda, m^2. As estatísticas confirmam estas condições, sendo a probabilidade de não autocorrelação de primeira ordem zero e de segunda ordem 79%, portanto rejeita autocorrelação neste nível. Além destes, o teste de Hansen (1982) testa a condição de validade dos instrumentos utilizados, a probabilidade dos instrumentos serem ortogonais é de 100%. A análise de significância conjunta dos coeficientes é realizada por meio do teste de Wald e indica que os coeficientes são estatisticamente significantes conjuntamente.

Para testar a hipótese de convergência condicional, utiliza-se a regressão de crescimento conforme visto no modelo (1) na seção 3.2. Os efeitos de cada variável explicativa no crescimento da renda *per capita* estão apresentados no Quadro 4.1. Os resultados mostram que nas duas regressões os coeficientes estimados do logaritmo da renda inicial são negativos e estatisticamente diferentes de zero ao nível menor que 1%.

Verifica-se que em todas as regressões estimadas o capital humano (*ch*) contribui positivamente na taxa de crescimento da renda *per capita*. Enquanto, a variável densidade demográfica (*dens*) foi estatisticamente significante apenas para a segunda equação. Enquanto que os coeficientes estimados para variável participação do emprego industrial, como uma medida para concentração industrial (*pei*), foi estatisticamente significante ao modelo de LSDV. Os resultados obtidos indicam que o potencial de mercado (*pm*) influem positivamente no crescimento econômico somente na segunda regressão.

Os gastos em infra-estrutura social foram positivos e significantes tanto no modelo LSDV quanto no GMM, enquanto, os em gastos em infra-estrutura econômica não foram significantes em nenhum dos dois modelos estimados. Com relação ao impacto do peso do FPE na receita corrente estadual

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(*fpercorren*) na taxa de crescimentos econômico *per capita* estadual, observa-se que esta variável foi estaticamente significante nos dois modelos estimados.

Vale ressaltar que as interpretações econômicas dos resultados serão apresentadas para estimações realizadas para dados em painel dinâmico estimado pelo GMM, haja vista que o mesmo leva em consideração a endogeneidade das variáveis analisadas, sendo assim, os resultados pelo referido método são considerado mais adequados.

Conforme o Quadro 4.1, observa-se que o coeficiente estimado para o logaritmo da renda inicial (*dlogpibpc*) é igual a -0.1966. Verifica-se que a velocidade da convergência apresenta um aumento após controlar possíveis problemas de endogeneidade, reduzindo-se a metade do tempo necessário para que os estados brasileiros reduzam as desigualdades da renda *per capita* entre eles de 114 anos para 66 anos, mostrando assim uma velocidade de convergência consideravelmente menor quando comparada ao primeiro método[51].

Observa-se que a variável que mede o capital humano (*ch*) foi positiva e estatisticamente significante, esses resultados reforçam as contribuições de Lucas (1988). Segundo o referido autor, o investimento em capital humano tem dois resultados: o primeiro é a melhora da produtividade dos indivíduos que se educam e o segundo, e mais importante, a economia como um todo se beneficia por ter indivíduos mais educados, pois estes são capazes de gerar inovações que melhorem a produtividade de toda a economia. Essas externalidades e as inovações, segundo Lucas, seriam os motores do crescimento econômico. Vale destacar também que esta variável apresenta o maior impacto quando comparado as demais variáveis do modelo, apontando para sua importância no que diz respeito ao papel na redução das desigualdades estaduais e no crescimento econômico dos Estados.

A variável densidade demográfica (*dens*) mostrou-se negativamente relacionada ao crescimento da renda *per capita* estadual e estatisticamente significante. Tal resultado sugere possíveis problemas de congestionamento, tais como poluição e criminalidade, nos estados que apresentaram maiores taxas de crescimento. Estas externalidades negativas diminuem a produtividade dos trabalhadores e, por conseqüência, reduzem o crescimento econômico. O coeficiente estimado para o peso do emprego industrial no emprego total dos estados (*pei*) não foi estatisticamente significante neste método. Desta maneira, não é possível fazer qualquer inferência sobre esta variável.

O potencial de mercado do vizinho (*pm*) representa uma larga tradição da economia regional em explicar o crescimento econômico das regiões considerando os custos de transporte e sua importância para a decisão de localização das empresas e, conseqüentemente, das pessoas[52]. O resultado obtido indica que o potencial de mercado do vizinho (*pm*) foi positivo e estatisticamente significante, isto é, tal variável tem contribuído para o crescimento econômico dos estados. Isso sugere que os estados estejam se beneficiando de um bom mercado local e um bom mercado na vizinhança, favorecendo o processo de escolha da localização e levando a aglomeração das atividades econômicas e, conseqüentemente, aumentando o potencial de mercado, atraindo mais atividades econômicas e gerando um processo em que a aglomeração gera mais aglomeração em uma espécie de causalidade circular (FUJITA, KRUGMAN E VENABLES, 2002).

Sabe-se que o papel do governo no crescimento econômico é um assunto controverso na teoria econômica. No que diz respeito às variáveis de gastos em infra-estrutura social e econômica, observa-se que apenas os gastos em infra-estrutura social apresentaram coeficiente estimado positivo, além de estatisticamente significante. Nesse sentido, os resultados evidenciam que os referidos gastos têm importado no processo de crescimento e redução de desigualdade de renda *per capita* estadual.

51 A fórmula de cálculo do número de anos para metade da convergência é discutida em Barro e Sala-i-Martin (1985) capítulo 1. Os valores acima são encontrados fazendo: exp(-bt) = 1 / 2.

52 Estas idéias originalmente foram discutidas na economia espacial de Isard (1956) e, mais recentemente, resgatadas pelos trabalhos de Krugman (1991) e Fujita, Krugman e Venables (2002).

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Com relação ao impacto do peso do FPE na receita corrente estadual (*fpercorren*) na taxa de crescimentos econômico *per capita* estadual, observa-se que este mecanismo tem efeito negativo e estatisticamente significante no modelo analisado. Uma explicação plausível para este resultado pode ser reportada aos argumentos de Amaral Filho (2008). Para o referido autor, embora haja uma inegável descentralização experimentada pelo sistema federal brasileiro e do esforço desempenhado pelo governo federal no sentido de proporcionar o desenvolvimento regional, a federação brasileira continuou sofrendo de dois problemas estruturais, a saber: o conflito de interesses e de funções entre os entes federados, especialmente pela falta de mecanismos de controle; e de comprometimento no momento adequado, e a desigualdade regional.

Desse modo, mesmo considerando a existência de instrumentos de compensação financeira, como, por exemplo, o FPE, esse mecanismo apresentou, no período analisado, pouco efeito no que tange à redução dos desequilíbrios regionais. Essas questões expõem os limites da descentralização em países que apresentam profundas desigualdades regionais. Assim, este contexto sugere que um processo de descentralização dos poderes dentro de um sistema federal não significa necessariamente em desconcentração do poder econômico, alertando que a transferência, pura e simples, de recursos financeiros para estados não são suficientes para combater esse tipo de problema.

Quadro 4.1: Convergência Condicionada (86/06)

Variável dependente: Crespibpc		
Variáveis	LSDV	GMM
L.crespibpc		-0.2304***
		(0.000)
dlogpibpc	-0.1203***	-0.1966***
	(0.000)	(0.000)
logch	0.1632***	0.2015***
	(0.000)	(0.000)
logdens	-0.0073	-0.0293*
	(0.144)	(0.016)
logpei	0.0187**	-0.0024
	(0.062)	(0.879)
logpm	0.0009	0.0164**
	(0.843)	(0.084)
loggisgt	0.0186**	0.0334*
	(0.058)	(0.015)
loggiegt	0.0009	-0.0103
	(0.881)	(0.410)
logfpercorrn	-0.0183**	-0.0658**
	(0.007)	(0.003)
cons	0.7854***	1.3420**
	(0.000)	(0.001)
Velocidade	0.006	0.010
Half-Life	114	66
No.Estados	26	26
No.Obs	516	492
Prob > F		0.000
Teste Hansen		1.0000
m^1		0.001
m^2		0.795
Teste Wald		0.000

Notas:p-valores estão entre parênteses, ♦ p<0.10,* p<0.05, ** p<0.01, *** p<0.001
Fonte: Elaboração própria do autor a partir dos dados do Ipeadata, STN, RAIS e DNIT (2010).

A seguir, apresentam-se evidências sobre os instrumentos de poder público estadual como fontes de explicação para a participação do emprego industrial. O teste de Hausman apresenta um p-valor de 37,85 com probabilidade de 0,00%, indicando na rejeição da hipótese nula indicando que o

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estimador mais adequado neste caso é o LSDV (efeitos fixos)[53]. O teste Wald modificado para dados em painel com efeito fixo rejeita a hipótese nula de homocedasticidade[54]. Desta forma, para corrigir o problema de heterocedasticidade utilizou-se o mecanismo de correção de variâncias e erros padrão de White. No que diz respeito à presença de multicolinearidade, o Fator de Inflação de Variância foi 2,75, indicando que a presença da mesma não representa um problema sério[55]. Analogamente ao modelo anterior utilizou-se também o Método de Momentos Generalizados (GMM), que leva em consideração possíveis problemas de endogeneidade das variáveis explicativas. A seguir, no Quadro 4.2 estão os resultados das estimações destes métodos.

Conforme o referido quadro, observa-se que a estimativa é válida neste método mesmo sob condição de auto-regressão de primeira ordem, m^1, porém não de segunda, m^2. As estatísticas confirmam estas condições, sendo a probabilidade de não autocorrelação de primeira ordem zero e de segunda ordem é 68%, portanto rejeita autocorrelação neste nível insinuando a validade dos resultados obtidos para cumprir com o objetivo proposto nesse estudo. O teste de Hansen (1982) confirma a validade dos instrumentos utilizados, a probabilidade dos instrumentos serem ortogonais é de 100%. O teste de Wald aponta que os coeficientes são estatisticamente significantes conjuntamente.

Ainda na mesma tabela apresentam-se os resultados que mostram que o nível de participação do emprego industrial defasado em um período apresenta-se como positivo e significante, sendo um importante elemento para o nível de participação futura. O tamanho do mercado, expresso aqui pelo logaritmo do produto interno bruto em nível, foi estatisticamente significante, demonstrando a importância deste elemento na explicação do peso do emprego industrial sobre o emprego total dos estados. Desta forma, é provável que quanto maior for o tamanho do mercado local maior será participação do emprego industrial. A variável de anos de estudo como medida de capital humano (*ch*) mostrou-se estatisticamente insignificante.

O coeficiente da densidade demográfica (*dens*) é negativo e estaticamente significante, este resultado indica um possível efeito de congestionamento nas economias o que reduz a demanda local e, conseqüentemente, a participação do emprego industrial. O potencial de mercado (*pm*) mostrou-se positivo e estatisticamente significante sugerindo que o potencial de mercado do vizinho tem contribuído, especialmente, para atração de mais atividades, o que favorece a participação do emprego industrial no emprego total dos estados.

Os resultados obtidos por este método de estimação revelam que o nível de participação do emprego industrial no emprego total dos estados tem sido influenciado positivamente pelo setor público por meio dos gastos em infra-estrutura econômica. E, que tanto os gastos em infra-estrutura social e o peso do Fundo de Participação Estadual (FPE) nas despesas correntes não se mostraram estatisticamente significante o que impede de qualquer inferência sobre eles. De maneira geral, para o período em analisado, acredita-se que existiram outros fatores que mais contribuíram na determinação do nível de emprego industrial no emprego total dos estados do que os instrumentos de políticas públicas aqui estudados.

Quadro 4.2: Determinantes da Participação do Emprego Industrial (86/06)

Variável dependente: Pei		
Variáveis	LSDV	GMM
L.pei		0.3887***
		(0.000)

53 O processo de escolha não se limitou aos aspectos estatísticos abordados no teste de Hausman. Além disso, utilizou-se dos aspectos descritos anteriormente, onde deve-se levar em consideração ao fato de não assumir que todos os estados brasileiros representam uma amostra aleatória.

54 O resultado do teste Wald modificado para dados em painel com efeito fixo apresenta um $\chi^2_{(26gl)} = 2785,67$ e com probabilidade de 0,00%, assim, pode-se rejeitar a hipótese nula de homocedasticidade.

55 Variation Inflation Factor. Alguns autores sugeriram que se qualquer fator de inflação da variância exceder 10, então a multicolinearidade será um problema. Outros autores consideram esse valor muito liberal e sugerem que os fatores de inflação da variância não devem exceder 4 ou 5.

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logpib	0.0074	0.0217*
	(0.323)	(0.020)
ch	0.0027	-0.0020
	(0.487)	(0.416)
dens	0.0002	-0.0005*
	(0.231)	(0.011)
pm	0.0162	0.1759♦
	(0.652)	(0.074)
gisgt	-0.0267	0.0054
	(0.281)	(0.632)
giegt	0.1004♦	0.0311♦
	(0.063)	(0.073)
fpercorren	-0.0364	0.0034
	(0.183)	(0.858)
cons	-0.0604	
	(0.705)	
No.Estados	26	26
No.Obs	546	494
Prob > F	-	0.000
Teste Hansen	-	1.0000
m^1	-	0.001
m^2	-	0.689
Teste Wald	-	0.0062

Notas: p-valores estão entre parênteses, ♦ p<0.10, * p<0.05, ** p<0.01, *** p<0.001
Fonte: Elaboração própria do autor a partir dos dados do Ipeadata, STN, RAIS e DNIT (2010).

5. CONCLUSÕES

A questão central deste estudo foi obter evidências que permitam deduzir de que forma os gastos em infra-estrutura (econômica e social) e as transferências constitucionais, relacionam-se com o crescimento do PIB *per capita* e com o processo de convergência condicional da renda *per capita* entre o período de 1986 e 2006. Além desse objetivo, buscou-se verificar de que maneira os mecanismos citados acima influenciam a participação do emprego industrial no emprego total dos estados brasileiros. Para tanto, utilizou-se do Método de Momentos Generalizados (GMM) para dados em painel, pois o mesmo corrige o problema de endogeneidade presente entre as variáveis adotadas neste estudo.

Observa-se que no período analisado há um processo de convergência condicional em que o capital humano se apresentou como um importante determinante na explicação deste processo. Neste mesmo período verifica-se também que quanto mais denso em termos de população for um estado, menos favorável será sua contribuição ao crescimento do PIB *per capita* estadual, sinalizando para um possível problema de efeito congestionamento nessas economias. Já o potencial de mercado da região vizinha tem auxiliado positivamente no referido processo. Este fato sugere que a proximidade a grandes mercados vizinhos tem favorecido no processo de escolha da localização e conduzindo à aglomeração das atividades econômicas e, conseqüentemente, aumentando o potencial de mercado.

No âmbito das políticas públicas, verifica-se que somente os gastos em infra-estrutura social têm contribuído positivamente para o crescimento do PIB *per capita* e para o processo de convergência da renda *per capita* entre os estados brasileiros. Enquanto, que o impacto do Fundo de Participação Estadual (FPE) sobre o crescimento econômico *per capita* estadual foi negativo. Apesar da descentralização fiscal brasileira e do esforço desempenhado pelo governo federal no sentido de proporcionar o desenvolvimento regional, sobretudo por meio de instrumentos de compensação financeira, como, por exemplo, o FPE, conclui-se que este mecanismo não tem obtido êxito no que diz respeito à redução dos desequilíbrios regionais. Este fato sinaliza que a simples transferência de recursos financeiros para estados não tem sido suficiente para atacar os desequilíbrios regionais. Com isso, é importante saber como esses serviços são providos pelos governos subnacionais e como os cidadãos estão tendo acesso a eles.

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Entre o período de 1986 e 2006, no que diz respeito aos mecanismos de políticas analisados neste estudo, apenas os gastos em infra-estrutura econômica apresentaram uma relação positiva com nível de participação do emprego industrial. Portanto, os resultados sugerem que neste mesmo período, existiram outros elementos que importaram para dinâmica da participação do emprego industrial sobre o emprego total do estado. Dentre eles podemos destacar a própria participação do emprego industrial passada, como também, o potencial de mercado dos vizinhos e, por fim, o próprio tamanho de mercado local. Esses elementos têm-se mostrado mais importantes na determinação da participação do emprego industrial dos estados do que os instrumentos de políticas públicas analisados aqui.

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EMPRESAS DE CRESCIMENTO ELEVADO: QUAL O IMPACTO DAS CARACTERÍSTICAS ESPECÍFICAS ÀS REGIÕES?

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Resumo. Este artigo analisa as empresas de elevado crescimento em Portugal e avalia o impacto das características específicas à região onde as empresas se localizam na probabilidade da empresa ser de elevado crescimento. Considerando todas as empresas activas e registadas na base de dados *Quadros de Pessoal* no período 2002-2006 foi possível concluir que o elevado crescimento não é um fenómeno aleatório e que as características das regiões determinam significativamente a probabilidade de uma empresa ser de elevado crescimento. Em particular, a diversidade de indústrias, aglomeração de serviços e a diversidade de qualificações na região explicam de forma significativa a probabilidade de uma empresa ser de elevado crescimento.

Palavras-chave: crescimento empresarial, regiões, modelo probit

HIGH-GROWTH FIRMS: WHAT IS THE IMPACT OF REGION-SPECIFIC CHARACTERISTICS?

Abstract. This paper analyses high-growth firms in Portugal and aims at assessing the impact of region-specific characteristics on the probability of the firm being high-growth. Analyzing all active firms registered in the database *Quadros de Pessoal* between 2002 and 2006, it was possible to conclude that the high-growth is not a random phenomenon and that the region-specific characteristics determine significantly the probability of the firm being high-growth. In particular, industrial diversity, services agglomeration and diversity of employees qualifications in a region explain in a significantly way the probability of firms being high-growth.

Keywords: firm growth, probit model, regions

Introdução

As empresas de elevado crescimento têm atraído a atenção dos investigadores, dada a sua importante contribuição para o crescimento económico. Estas empresas detêm, geralmente, níveis de produtividade acima da média e são responsáveis por uma contribuição desproporcional em termos de emprego, comparativamente ao restante tecido empresarial (BERR, 2008).

O rápido crescimento das empresas não é um fenómeno aleatório, mas está associado a um conjunto de factores, comportamentos, decisões e estratégias que diferenciam este grupo de empresas das restantes (Barringer *et al.,* 2005). Por este motivo, vários são os estudos que analisam quais os factores que condicionam o elevado crescimento, como é o exemplo de Moreno e Casillas (2007) e Garcia e Puente (2012) para Espanha, Falkenhall e Junkka (2009) para a Suécia e Hözl (2011) para a Áustria. Estes trabalhos tendem, no entanto, a focalizar a sua atenção em factores específicos à empresa e/ou à indústria onde operam.

Embora seja expectável que a localização de uma empresa influencie o sucesso da mesma, poucos estudos analisam o impacto das diferenças regionais no processo de crescimento empresarial. Acs *et al.* (2007) e Barbosa e Eiriz (2011) são duas excepções, as quais comprovam que a localização tem um papel importante no crescimento das empresas. Assim, este trabalho pretende contribuir para o debate dos factores que explicam a existência de empresas de elevado crescimento, avaliando empiricamente se as características específicas da região em que a empresa se encontra localizada determinam a probabilidade de uma empresa ser de crescimento elevado.

Com base em todas as empresas activas e registadas na base de dados *Quadros de Pessoal* no período 2002-2006, foram estimados os efeitos das características das regiões – NUTS3 – na probabilidade de uma empresa ser de elevado crescimento. Os resultados demonstram que a

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diversidade de qualificações dos trabalhadores, a diversidade industrial e a aglomeração de serviços a nível regional têm impacto significativo na probabilidade da empresa ser de elevado crescimento. Em particular, a diversidade de qualificações dos trabalhadores na região e a proximidade de empresas com actividades complementares à da empresa parecem ter impacto positivo na probabilidade de uma empresa ser de elevado crescimento.

Nas restantes secções do artigo analisa-se de que forma as diferenças observadas nas regiões podem explicar a existência de empresas de elevado crescimento. A secção 3 descreve a fonte e natureza dos dados usados na análise empírica e a secção 4 discute o critério usado para identificar empresas de elevado crescimento e descreve sumariamente a distribuição regional deste tipo de empresas. O modelo econométrico bem como as variáveis empíricas são apresentadas na secção 5. A secção 6 apresenta e discute os resultados obtidos, estando as principais conclusões sumariadas na última secção.

1. O papel das características das regiões no crescimento das empresas

Factores internos e externos à empresa têm sido identificados como importantes determinantes das variações nas taxas de crescimento (Dobbs e Hamilton, 2007; Hermelo e Vassolo, 2007). A especificidade das empresas que alcançam elevado crescimento, e o seu papel na dinâmica de uma dada economia, tem suscitado vários estudos empíricos

A maioria dos estudos focam a atenção em factores explicativos específicos à empresa, nomeadamente a idade e dimensão, variáveis que têm sido extensivamente escrutinadas na explicação do processo de crescimento das empresas. Através da compilação de vários estudos, que abrangem diferentes países, indústrias e períodos de tempo podemos listar os seguintes resultados:

As empresas de elevado crescimento tendem a ser jovens e de pequena dimensão, contrariando a lei de Gibrat. Embora os resultados sobre a idade sejam relativamente consensuais, os resultados sobre a dimensão tornam-se mais ambíguos (Henrekson e Johansson, 2010; Hözl, 2011).

As empresas de elevado crescimento tendem a pertencer a grupos empresariais, sendo que as ligações com a empresa-mãe oferecem à empresa um conjunto de facilidades que potenciam o seu crescimento (Falkenhall e Junkka, 2009; O´Regan *et al*., 2006).

O nível de capital humano da empresa influencia positivamente o elevado crescimento das empresas (Falkenhall e Junkka, 2009; BERR, 2008).

A localização da empresa parece igualmente condicionar as estratégias das empresas e, por consequência, o seu desempenho. Embora a localização seja intensamente analisada como factor explicativo da entrada da empresa, são escassos os estudos que analisam a relação existente entre crescimento da empresa e a sua localização (Acs e Armington, 2004; Audretsch e Dohse, 2007; Barbosa e Eiriz, 2011). Audretsch e Dohse (2007) referem que esta omissão na literatura verifica-se a nível conceptual e empírico, não existindo modelos que relacionem o desempenho da empresa após a sua entrada com a região onde se localiza. A nível empírico, a omissão resulta da inexistência de dados que permitam realizar estas análises.

Apesar disso, Audretsch e Dohse (2007) identificam várias razões para que a localização tenha um papel importante no crescimento da empresa. As questões sobre a aglomeração e externalidades de conhecimento na região bem como as características do mercado de trabalho são identificados como determinantes das decisões de localização.

Uma aglomeração consiste num conjunto de externalidades positivas decorrentes da concentração espacial de actividade económica e consequente transmissão de conhecimentos (Glaeser *et al.*, 1992; Guimarães *et al.*, 2000). Segundo Glaeser *et al.* (1992) as teorias de crescimento das cidades diferem ao longo de duas dimensões: a difusão de conhecimento advém de interacções dentro da mesma indústria ou da interacção entre indústrias. O modelo *Marshall-Arrow-Romer* defende que a concentração de uma indústria numa cidade promove a difusão de conhecimento entre empresas (Glaeser *et al.*, 1992). As externalidades associadas à transmissão de conhecimento acontecem

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apenas entre empresas da mesma indústria. Deste modo, a difusão de conhecimento entre indústrias é assumida como não existente.

Contudo, na literatura também são identificadas um conjunto de condições que incentivam a localização de empresas num *cluster* de uma determinada indústria (Krugman, 1991; Guimarães *et al*., 2000). A concentração de várias empresas da mesma indústria numa região permite o contacto com um mercado de trabalho especializado, com determinadas competências e será mais provável a existência de fornecedores intermediários na região bem como a existência de recursos naturais (Krugman, 1991; Guimarães *et al*., 2000). Por fim, a difusão de informações permite que a empresa obtenha uma melhor função de produção comparativamente a empresas isoladas (Krugman, 1991).

Restringir o impacto da difusão de conhecimento apenas ao interior da mesma indústria, poderá ignorar uma importante fonte de conhecimento inter indústria (Glaeser *et al.*, 1992; Feldman e Audretcsh, 1999). Glaeser *et al.* (1992) defendem que é a variedade e diversidade que conduzem ao crescimento económico, contrariamente à especialização. Feldman e Audretsch (1999) concluem que a diversidade de indústrias numa região promove a difusão de conhecimento, a actividade inovadora e consequentemente o crescimento económico. No entanto, os autores acrescentam que deverá existir uma base de interação entre as diversas actividades, que facilite a troca e a criação de novas ideias, ou seja, que sejam actividades complementares. Por sua vez, Guimarães *et al.* (2000) consideram que existem duas importantes externalidades resultantes da aglomeração, sendo a primeira a dimensão da indústria em que a empresa se insere na região e os serviços existentes na mesma que terão impacto na produtividade da empresa, pelo que irá atrair mais empresas.

Estudos empíricos comprovam a importância da diversificação (por exemplo, Glaeser *et al.*, 1992; Figueiredo *et al.*, 2009, Barbosa e Eiriz, 2011). Glaeser *et al.* (1992) verificam que é a variedade e não a especialização regional que conduz ao crescimento do emprego das indústrias. Os autores concluem que a difusão de conhecimentos entre a mesma indústria é menos importante para o crescimento que a difusão de conhecimentos entre indústrias. Já Figueiredo *et al.* (2009) e Barbosa e Eiriz (2011) verificam que empresas localizadas em regiões com maior diversidade industrial exibem maiores taxas de crescimento. A actividade inovadora das indústrias e da empresa tende a ser menor em regiões especializadas numa dada indústria (Feldman e Audretsch, 1999).

Guimarães *et al.* (2000) no estudo da escolha da localização por novas empresas estrangeiras em Portugal comprovam que as economias de aglomeração têm impacto na decisão de localização dos investidores. Na mesma linha, Acs *et al.* (2007) concluem que a intensidade de estabelecimentos de serviços está positivamente relacionado com a sobrevivência das empresas. No entanto, este resultado apenas se verifica quando são analisados o número de estabelecimentos e não a dimensão dos mesmos. Segundo os autores, este resultado poderá sugerir a importância do número de estabelecimentos de serviços contrariamente ao número de trabalhadores com experiência nestes sectores.

O papel da educação tem sido reconhecido como um factor importante na teoria do crescimento económico (Acs e Armington, 2004). O principal aspecto referido na literatura sobre o tema é a dimensão e características do mercado laboral, nomeadamente o custo de trabalho, as capacidades e competências da força de trabalho (North e Smallbone, 1995; Acs e Armington, 2004). Acs e Armington (2004) afirmam que regiões com a mesma procura e características dos negócios, as diferenças nas taxas de criação de novas empresas estão associadas às qualidades específicas do capital humano e ao estímulo à inovação, incentivando a criação de novas empresas. Deste modo, regiões com maior nível educacional tendem a registar taxas de criação de novas empresas mais elevadas.

Armington e Acs (2002) admitem que um elevado nível de habilitações gera um conjunto de competências e capacidades específicas importantes para a criação de uma empresa. Indivíduos com habilitações ao nível superior, nomeadamente em áreas específicas, como o caso das engenharias, constituem uma importante oferta de trabalho para as empresas locais. Deste modo, será de esperar

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que a criação de novas empresas e o desempenho após entrada estejam positivamente relacionadas com o nível de habilitações dos trabalhadores da região.

Acs *et al.* (2007) apesar de referirem a importância de indivíduos com elevados níveis de habilitação, acrescentam que os baixos níveis educacionais são também eles importantes para a sobrevivência das empresas. Várias empresas na indústria dos serviços surgiram e desenvolvem-se com recurso a trabalho pouco qualificado, como é o caso de serviços de limpeza, segurança e administrativos. Quando é analisado o crescimento das empresas, Audretsch e Dohse (2007) sugerem que o mercado de trabalho qualificado é um dos motivos com maior impacto no crescimento das empresas.

Estudos empíricos verificam que uma região com elevado capital humano influencia positivamente a criação (exemplo, Armington e Acs, 2002; Acs e Armington, 2004) e o crescimento da empresa (Audretsch e Dohse, 2007). Armington e Acs (2002) acrescentam que esta relação verifica-se sobretudo em indústrias tecnologicamente mais avançadas. No estudo sobre entrada de empresas japonesas nos EUA, Woodward (1992) conclui que estas tendem a implementar a sua actividade em locais com maior nível educacional. Contudo, as habilidades específicas não demonstraram ser importantes. Por sua vez, Acs *et al.* (2007) acrescentam que a sobrevivência das empresas está positivamente relacionada com as elevadas habilitações dos trabalhadores, embora esta relação não se verifique em períodos de recessão. Barbosa e Eiriz (2011) referem a necessidade de existirem vários tipos de qualificações de modo a alcançar o crescimento. Segundo os autores, empresas localizadas em regiões com elevada concentração de níveis de qualificações tendem a crescer menos do que empresas localizadas em regiões onde a distribuição do nível de qualificações dos trabalhadores seja mais equitativa.

2. Dados

Os dados utilizados no presente estudo foram obtidos através da base de dados *Quadros de Pessoal,* fornecida pelo Ministério do Trabalho e da Solidariedade Social. A base de dados torna-se adequada na medida em que fornece informações sobre a estrutura das empresas portuguesas e características dos seus trabalhadores. Deste modo, entre outras informações relevantes os *Quadros de Pessoal* permitem aceder a informações como o volume de negócios e localização das empresas bem como dados relacionados com os seus recursos humanos, referindo o número de pessoas ao trabalho, remunerações e duração do mesmo.

Esta base de dados fornece ainda informações sobre o ano de início de actividade da empresa, possibilitando estudar, nomeadamente o impacto da idade, as qualificações do capital humano e localização da empresa ao nível do concelho, do distrito e de NUTS. Os *Quadros de Pessoal* ao serem o resultado de um inquérito obrigatório e regular às empresas, possibilita a recolha de informação para a quase totalidade de empresas activas em Portugal.

O período de análise do estudo está compreendido entre 2002 a 2006, utilizando como unidade de análise a empresa. Todas as empresas de Portugal Continental são consideradas, independentemente da forma legal ou propriedade (pública ou privada). Na identificação das empresas de elevado crescimento todas as indústrias são incluídas. Contudo, na literatura empírica relacionada com o tema por vezes são excluídas algumas indústrias, sobretudo caracterizadas pela sua sazonalidade, como o caso da construção, hotéis, restaurantes e empresas que seguem processos de crescimento diferentes, como é o exemplo da agricultura, minério e comércio a retalho (Hözl, 2011; Garcia e Puente, 2012).

A análise da localização é realizada por NUTS III. As NUTS III são sub-regiões estatísticas, com um nível de desagregação maior que o distrito e menor que o concelho. Apesar de não terem qualquer significado do ponto de vista administrativo, estas regiões tornam-se adequadas para análises estatísticas e atribuição de fundos estruturais. Esta divisão torna-se importante uma vez que agregam municípios contíguos, com alguma interacção económica, mobilidade laboral, que têm desafios e problemas semelhantes.

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3. Identificação de Empresas de elevado crescimento

Não existe um único método para definir uma empresa de elevado crescimento. Na literatura encontra-se um longo debate sobre a definição de empresas de elevado crescimento a utilizar e a sua forma de medição. São vários os indicadores utilizados para medir o crescimento das empresas, como a evolução do número de trabalhadores (Delmar *et al.*, 2003; Oliveira e Fortunato, 2006; Bos e Stam, 2011; Garcia e Puente, 2012), o crescimento do volume de negócios (Teruel e Wit, 2011), quota de mercado, lucros ou vendas (Delmar *et al.*, 2003; Moreno e Casillas, 2007; Henrekson e Johansson, 2010) e o total de activos (Serrasqueiro *et al.*, 2010; Barbosa e Eiriz, 2011).

Com a base de dados *Quadros de Pessoal*, apenas será possível analisar as empresas de elevado crescimento, utilizando como indicadores a evolução do número de trabalhadores ou volume de vendas. Contudo, a medição do crescimento através do volume de vendas implicaria realizar uma análise a preços constantes, uma vez que este indicador é sensível às taxas de câmbio, inflação e moeda, o que não acontece com a utilização do emprego. O emprego é um indicador intensamente utilizado na medição de empresas de elevado crescimento, como se conclui na compilação de estudos sobre o tema, realizado por Henrekson e Johansson (2010).

Este torna-se um bom indicador do crescimento quando é analisado o impacto das empresas de elevado crescimento na criação de emprego (Delmar *et al.*, 2003). Coad e Hözl (2010) consideram ainda um indicador eficaz na comparação de empresas de várias indústrias e países. Contudo, Delmar *et al.* (2003) referem que a utilização do crescimento do emprego como forma de medir o crescimento da empresa é influenciada pela produtividade do trabalho e o grau de substituição homem-máquina. Segundo os autores, uma empresa pode crescer consideravelmente na produção e nos activos sem sofrer alterações no crescimento do emprego.

Na mesma linha, Teruel e Wit (2011) argumentam que o emprego poderá não reflectir adequadamente o crescimento das empresas comparativamente a indicadores económico-financeiros. Os autores concluem que a legislação laboral de cada país influencia o número de empresas de elevado crescimento aí existentes. Um país com uma forte protecção na legislação laboral reduz a presença de empresas de elevado crescimento, aferidas através do indicador emprego.

Para além da heterogeneidade na escolha de indicadores, também a definição de empresas de elevado crescimento não é consensual. Nos estudos realizados sobre o tema, é usual definir um nível de crescimento a partir do qual se considera elevado crescimento. A definição proposta pela OCDE-Eurostat considera uma empresa de elevado crescimento aquela que verifica, em média, um crescimento de 20%, durante três anos consecutivos e que emprega no mínimo 10 trabalhadores (OCDE, 2010). No entanto, Delmar *et al.* (2003) bem como Bjuggren *et al.* (2010) concluíram que a escolha entre o crescimento absoluto e relativo é um factor a ter em atenção, pela relação existente com a dimensão da empresa. Segundo os autores as grandes empresas verificam um crescimento elevado em termos absolutos e as pequenas empresas quando este é medido em termos relativos.

De modo a atenuar o impacto da dimensão da empresa no indicador do crescimento, Birch (1979) usou uma combinação entre o crescimento absoluto e relativo. O índice de Birch é calculado com base na diferença entre o número de trabalhadores durante o período de estudo e o número de trabalhadores três períodos anteriores a este. O indicador de crescimento é descrito da seguinte forma:

$$\left(E_{i,t} - E_{i,\,t-3}\right)\left(E_{i,t} \big/ E_{i,\,t-3}\right), \qquad (1)$$

sendo $E_{i,t}$ o emprego da empresa *i* no período *t*. Segundo Garcia e Puente (2012) este indicador torna-se útil, uma vez que uma medida de crescimento deve reflectir o sucesso com base num conjunto de características da empresa, como o caso da gestão e estratégias de inovação e não favorecer a classe da dimensão das empresas. Hözl (2011) realça ainda que a forma de medição do

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elevado crescimento, seja em termos relativos ou absolutos, torna-se mais importante que o indicador a usar.

O índice de Birch é uma possível forma de definir empresas de elevado crescimento, escolhendo 10% das empresas com maior crescimento (Schreyer, 2000; Falkenhall e Junkka, 2009; Garcia e Puente, 2012). Segundo Falkenhall e Junkka (2009) o índice de Birch para o 90º percentil é a demarcação tradicional para as empresas serem consideradas de elevado crescimento. Contudo Hözl (2011) refere que a imposição do limite percentual não se torna útil, quando analisa a prevalência das empresas ao longo do tempo. Deste modo, o autor sugere um índice de Birch modificado, onde assume um crescimento de 20% anual durante três anos consecutivos, sendo que estabelece uma dimensão mínima de 20 trabalhadores no início do período. Até 20 trabalhadores o índice irá exigir um crescimento relativo maior que a definição proposta pela OCDE e acima de 20 trabalhadores esta exigência é menor. O autor considera estas empresas como empresas de elevado impacto. O índice de Birch modificado pelo autor é definido como:

$$\left(E_{i,t} - E_{i,\,t-3}\right)\left(E_{i,t} / E_{i,\,t-3}\right) \geq 25.15968\,, \quad se\ E_{i,\,t-3} \geq 8 \qquad (2)$$

Hözl (2011) conclui que a criação de emprego por parte das empresas identificadas através da definição proposta é consideravelmente maior, quando comparado com a definição proposta pela OCDE. Acrescenta ainda que as empresas selecionadas apresentam uma maior persistência do fenómeno de elevado crescimento após o evento ocorrer e a taxa de sobrevivência é muito maior. Como os resultados obtidos por Hözl (2011) indiciam que esta selecção de empresas de elevado crescimento parece ter um maior impacto na dinâmica da economia, este será o indicador a ser utilizado no estudo.

A Tabela 1 apresenta a percentagem de empresas de elevado crescimento identificadas no período 2002-2006 para Portugal Continental. É claramente evidente a proporção simbólica de empresas de elevado crescimento existentes no tecido empresarial português.

Tabela 1. Empresas de elevado crescimento: 2002-2006

Ano	Empresas de elevado crescimento	%	Total de empresas analisadas
2002	2651	0,92	288678
2003	2404	0,82	294949
2004	2296	0,76	300850
2005	2224	0,68	328230
2006	2469	0,75	330967
TOTAL	12044	0,78	1543674

Fonte: Cálculos das autoras com base nos Quadros de Pessoal

Em 2002 a percentagem de empresas de elevado crescimento regista o maior valor, embora o número de empresas analisadas seja menor comparativamente aos restantes anos. A partir de 2003 o número de empresas de elevado crescimento diminui, tendência que se prolonga até 2005, apesar do número de empresas analisadas aumentarem.

A Tabela 2 apresenta a distribuição de empresas de elevado crescimento por NUTS III, durante o período em estudo. Os resultados demonstram que as empresas de elevado crescimento estão presentes em todas as regiões.

Tabela 2. Distribuição de empresas de elevado crescimento por NUTS III

NUT III	2002	2003	2004	2005	2006	TOTAL	%
Minho Lima	37	38	40	38	52	205	1,70
Cávado	86	83	79	79	96	423	3,51
Ave	126	115	121	101	134	597	4,96
Grande Porto	328	277	314	275	297	1491	12,38
Tâmega	113	110	127	111	138	599	4,97
Entre Douro e Vouga	53	62	57	53	56	281	2,33

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Douro	18	22	23	23	20	106	0,88
Alto Trás-os-Montes	23	22	15	20	11	91	0,76
Algarve	129	112	102	102	100	545	4,53
Baixo Vouga	106	75	67	78	88	414	3,44
Baixo Mondego	74	70	58	58	55	315	2,62
Pinhal Litoral	103	86	73	66	66	394	3,27
Pinhal Interior Norte	23	19	20	20	24	106	0,88
Dão Lafões	66	45	47	48	49	255	2,12
Pinhal Interior Sul	4	4	5	4	5	22	0,18
Serra da Estrela	8	5	8	3	5	29	0,24
Beira Interior Norte	20	21	18	14	11	84	0,70
Beira Interior Sul	12	12	7	6	11	48	0,40
Cova da Beira	9	9	15	12	14	59	0,49
Oeste	81	77	63	62	84	367	3,05
Médio Tejo	42	48	39	50	35	214	1,78
Grande Lisboa	885	813	726	758	846	4028	33,44
Península de Setúbal	159	134	115	120	125	653	5,42
Alentejo Litoral	15	23	25	23	24	110	0,91
Alto Alentejo	12	18	22	17	24	93	0,77
Alentejo Central	35	22	30	21	18	126	1,05
Baixo Alentejo	19	18	16	17	21	91	0,76
Lezíria do Tejo	65	64	64	45	60	298	2,47
Total	2651	2404	2296	2224	2469	12044	100

Fonte: Cálculos das autoras com base nos Quadros de Pessoal

Os resultados revelam uma elevada percentagem de empresas de elevado crescimento na zona da Grande Lisboa. No total, durante o período em análise, 33,4% das empresas encontravam-se aí localizadas. Embora com uma percentagem consideravelmente menor, mas com uma concentração de empresas de destaque, encontra-se a região do Grande Porto. A distribuição das empresas de elevado crescimento pelas restantes regiões é simbólica, sendo que a sua percentagem não excede os 5.42%, correspondente à região Península de Setúbal.

Os resultados demonstram que estas empresas estão localizadas em áreas metropolitanas, que oferecem às empresas um conjunto de vantagens, que à partida, potenciam o seu desempenho. É ainda de referir que a região Península de Setúbal, dada a sua proximidade com a Grande Lisboa, poderá justificar uma maior percentagem de empresas relativamente às restantes regiões. As regiões do Tâmega e Ave apresentam de igual modo uma maior concentração de empresas de elevado crescimento. Estas regiões, à semelhança da Península de Setúbal encontram-se próximas do Grande Porto. A evolução da sua presença ao longo do período de estudo é de modo geral, homogénea, verificando-se uma diminuição a partir do ano 2002 e um ligeiro aumento no ano de 2006.

4. Modelo econométrico e variáveis empíricas

Dado o principal objectivo deste estudo ser a identificação das características das regiões que explicam a probabilidade de uma empresa ser de elevado crescimento, vamos usar o modelo probit. Assim, cada observação, y_i, com i=1,…,n tomará o valor 1 caso a empresa seja de elevado crescimento usando o critério explicitado na equação 2 ou 0, caso contrário. A variável dependente é resultado da variável latente índice de crescimento da empresa, y*, determinada em função de variáveis explicativas – vector x – e factores não observáveis. Assim, a probabilidade da empresa ser considerada de elevado crescimento é dada por

$$\boldsymbol{P}\,(\boldsymbol{y}=\mathbf{1}|\,\boldsymbol{x}) = \boldsymbol{p}(\,\boldsymbol{y_i}*>25{,}15968|x) = \boldsymbol{\Phi}(\boldsymbol{x_{i,t-3}};\boldsymbol{e_{i,t}}) \qquad (3)$$

No caso do modelo probit para dados em painel, a estimação dos parâmetros será realizada através dos efeitos aleatórios, pelo que será assumido que o efeito não observado não está correlacionado com as variáveis explicativas, em todos os períodos de tempo. Apesar de Wooldridge (2003) referir que os efeitos fixos são uma ferramenta mais eficaz em estimações *ceteris paribus,* as variáveis em estudo apresentam uma variação maior entre empresas, ao longo do tempo, pelo que se justifica a utilização de efeitos aleatórios.

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No que concerne às variáveis explicativas, dada a disponibilidade de dados e os argumentos teóricos discutidos, vamos considerar (1) qualificações da região, (2) aglomeração de serviços, (3) concentração da indústria na região e (4) quociente de localização. A Tabela 3 apresenta a descrição das variáveis explicativas bem como os efeitos esperados.

Tabela 3. Descrição e efeito esperado das variáveis explicativas

Variável	Descrição	Efeito Esperado
Aglomeração de serviços	Percentagem de trabalhadores no sector terciário, por NUTS III.	+
Qualificações da região	Soma do quadrado dos rácios das qualificações da região, definida como o número de trabalhadores com determinada qualificação, dividido pelo número total de trabalhadores.	-
Concentração da região	Soma do quadrado das quotas de cada indústria na região, definido como o número de trabalhadores da indústria na região, dividido pelo número total de trabalhadores da indústria	+
Quociente de localização	Rácio entre o número de empresas na indústria e região e o número de empresas na indústria, ponderado pelo rácio entre número de trabalhadores da região e os trabalhadores totais no país.	-

Fonte: Quadro realizado pelas autoras

De modo a controlar as características específicas à empresa foram ainda incluídas as variáveis idade e dimensão da empresa como variáveis de controlo. A variável dimensão é definida pelo logaritmo do número de trabalhadores e a idade pelo logaritmo da diferença entre o ano de estudo e de constituição da empresa.

A Tabela 4 apresenta algumas estatísticas descritivas para as variáveis explicativas e variáveis de controle. Todas as variáveis foram analisadas, de acordo com os anteriores estudos sobre o tema, com uma desfasagem de três períodos em relação ao período onde se verifica o fenómeno de elevado crescimento. De um modo geral, as variáveis apresentam alguma variabilidade, demonstrando que as regiões portuguesas diferem no que respeita aos parâmetros em análise.

Os resultados demonstram que as qualificações dos trabalhadores tem uma baixa variabilidade inter-regiões, o que sugere, que em média, a distribuição das qualificações por região é pouco desigual. Verifica-se ainda que há uma grande diversidade na distribuição de indústrias na região. No que respeita à aglomeração de serviços, os resultados demonstram que a percentagem de trabalhadores no sector terciário é elevada. Em média, mais de metade dos trabalhadores das regiões exercem funções nesta área.

Tabela 4. Estatísticas descritivas

Variáveis	Observações	Média	Desvio Padrão	Mínimo	Máximo
Crescimento	713903	0,01297	0,11314	0	1
Qualificações trabalhadores	713903	0,22794	0,02563	0,19217	0,30862
Concentração da região	713903	0,00412	0,0304	3,97E-10	1
Quociente localização	713903	1,99488	3,34722	0,01133	193,374
Aglomeração de serviços	713903	0,52344	0,18253	0,19166	0,78358
Idade	713903	2,1238	1,02322	0	7,6019
Dimensão	713903	1,49349	1,09639	0	9,78081

Fonte: Cálculos das autoras, com base nos Quadros de Pessoal

5. Análise e discussão dos resultados

De modo a concluir sobre os efeitos parciais das variáveis explicativas associadas às características das regiões na probabilidade da empresa ser de elevado crescimento foram considerados alguns modelos *probit*. Para controlar as mudanças nas empresas que possam ser resultado de factores temporais e comuns a todas as empresas, factores específicos à indústria e à própria empresa foram

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incluídas variáveis *dummy* temporais, sectoriais (utilizando o CAE a 2 dígitos) e duas variáveis de controlo - idade e dimensão da empresa. Dado que estamos perante modelos não lineares, em que a mudança no valor da variável explicativa e o efeito estimado na probabilidade da empresa ser de elevado crescimento não é obtida directamente através das estimativas serão apresentados os efeitos marginais de cada variável explicativa de forma a facilitar a interpretação dos resultados.

A Tabela 5 apresenta dois modelos, com uma análise transversal, em que as variáveis explicativas apresentam uma desfasagem de três períodos. Dada a elevada correlação das variáveis que analisam a aglomeração de serviços e as qualificações da região, estas serão incluídas alternativamente nos modelos. Uma vez que as observações para uma dada empresa não são idêntica e independentemente distribuídas ao longo do tempo, devido aos efeitos específicos à empresa e não observados, os erros-padrão e a matriz de variância e covariâncias foram corrigidos pela correlação dos erros intra-empresa.

Tabela 5. Estimação do modelo *probit* para a probabilidade da empresas ser de elevado crescimento em Portugal: dados seccionais

	Modelo 1		Modelo 2	
	Coeficiente	dy/dx(*)	Coeficiente	dy/dx(*)
Concentração da região	-0,859***	-0,020***	-0,908***	-0,021***
	(0,191)	(0,004)	(0,193)	(0,004)
Quociente de localização	0,002	0,00004	0,003	0,00007
	(0,002)	(0,00005)	(0,002)	(0,00005)
Qualificações da região	-1,082***	-0,025***	–	–
	(0,006)	(0,006)		
Aglomeração de serviços	–	–	0,267***	0,006***
			(0,006)	(0,0094)
Dimensão	0,651***	0,015***	0,649***	0,020***
	(0,006)	(0,0002)	(0,006)	(0,0002)
Idade	-0,220***	-0,005***	-0,220***	-0,005***
	(0,007)	(0,0001)	(0,007)	(0,0002)
Dummies Temporais	Sim	Sim	Sim	Sim
Dummies Indústria	Sim	Sim	Sim	Sim
Constante	-2,870***		-3,252***	
	(0,077)		(0,049)	–
Pseudo-R2	0,33		0,33	
Nº Observações	713893		713893	

Legenda: Os valores entre parêntesis representam os erros padrão, corrigidos com a opção cluster (.) do Stata. *, **, *** representam os coeficientes que são estatisticamente significativos ao nível de 10%, 5% e 1 %, respectivamente. **Fonte:** Cálculos das autoras, com base nos *Quadros de Pessoal*

Similarmente, a Tabela 6 apresenta os mesmos dois modelos probit mas agora aplicados a dados em painel, onde os efeitos específicos à empresa são considerados aleatórios.

Tabela 6. Estimação do impacto das características regionais na probabilidade da empresa ser de elevado crescimento em Portugal: dados em painel

	Modelo 1		Modelo 2	
	Coeficiente	dy/dx(*)	Coeficiente	dy/dx(*)
Concentração da região	-0,648***	-0,005***	-0,717***	-0,005***
	(-0,157)	(0,001)	(0,157)	(0,001)
Quociente de localização	0,003	0,00002	0,005**	0,00003**
	(0,002)	(0,00002)	(0,002)	(0,00002)
Qualificações da região	-1,674***	-0,012***	–	–
	(0,339)	(0,002)		
Aglomeração de serviços	–	–	0,416***	0,003***
			(0,049)	(0,0004)
Dimensão	0,840***	0,006***	0,838***	0,006***
	(0,008)	(0,0002)	(0,008)	(0,0002)
Idade	-0,287***	-0,002***	-0,288***	-0,002***
	(0,008)	(0,00008)	(0,008)	(0,00008)
Dummies Temporais	Sim	Sim	Sim	Sim
Dummies Indústria	Sim	Sim	Sim	Sim

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Constante	-3,814***	-4,408***
	(0,099)	(0,069)
Pseudo-R2	0,38	0,38
Nº Observações	713903	713903
Nº empresas	270616	270616

Legenda: *, **, *** representam os coeficientes que são estatisticamente significativos ao nível de 10%, 5% e 1 %, respectivamente. **Fonte:** Cálculo das autoras, com base nos Quadros de Pessoal.

Os resultados dos modelos com dados seccionais e dados em painel não apresentam diferenças muito notáveis, quer em termos de significância estatística quer em termos de sinais dos coeficientes. Contudo, quando as estimativas dos coeficientes não têm em conta que a mesma empresa é observada várias vezes – dados transversais-, os efeitos marginais sugerem um maior impacto dos determinantes na probabilidade da empresa ser de elevado crescimento, motivo pelo qual serão analisados os dados em painel.

Os resultados demonstram que as características da região influenciam a probabilidade da empresa ser de elevado crescimento. Deste modo, a localização parece ter um papel importante no desempenho da empresa e no alcance de elevado crescimento. À excepção do quociente de localização, todas as variáveis apresentam significância estatística e as estimativas estão de acordo com os efeitos esperados para cada característica da região.

Através do índice de Herfindahl para a região, os resultados demonstram que uma maior especialização da indústria na região em que a empresa está localizada, conduz a uma menor probabilidade da empresa se tornar de elevado crescimento, mantendo tudo o resto constante. Estes resultados vão ao encontro de anteriores estudos (por exemplo, Barbosa e Eiriz, 2011), demonstrando que o crescimento da empresa estará positivamente relacionado com a sua localização em regiões que exibem uma maior diversidade de indústrias aí localizadas.

Estes resultados parecem questionar a importância do contacto com um mercado de trabalho especializado num determinado sector de actividade e da proximidade com fornecedores intermediários, tal como sugeriam Krugman (1991) e Guimarães *et al.* (2000). As externalidades do conhecimento e as relações que se estabelecem entre empresas de diferentes sectores parecem ter um impacto positivo na probabilidade da empresa ser de elevado crescimento. Estas ligações poderão fomentar a actividade inovadora e consequentemente influenciar o crescimento das empresas, tal como sugere Feldman e Audretsch (1999).

Os resultados sugerem também que o aumento da percentagem de trabalhadores no sector terciário aumenta a probabilidade da empresa ser de elevado crescimento. Embora as economias de aglomeração possam ser analisadas por diferentes medidas de aglomeração, apenas foi considerada a aglomeração de serviços na região. Estes resultados parecem indicar a importância da inserção da empresa numa região em que se verifique uma concentração de actividade económica. Por outro lado, demonstram ainda a importância de actividades complementar à actividade económica da empresa como uma potencial força para o seu crescimento. A proximidade de serviços financeiros, de comunicação, transportes e outras necessidades da empresa parecem ser importantes para uma dada empresa ser de elevado crescimento.

Os resultados obtidos relativamente às qualificações dos trabalhadores da região mostram que a diversidade de qualificações influencia positivamente a probabilidade da empresa ser de elevado crescimento. Deste modo, a concentração de apenas um tipo de qualificações não parece ter impacto no crescimento da empresa, à semelhança dos resultados obtidos por Barbosa e Eiriz (2011). Os resultados obtidos permitem avaliar importância não só das elevadas qualificações, tal como alguns estudos concluem (exemplo de Audretsch e Dohse, 2007), mas também das restantes qualificações para a probabilidade de uma empresa ser de elevado crescimento. Assim, podemos concluir que a concentração de competências e capacidades, associadas a um nível educacional superior, numa dada região não são suficientes para que as empresas aí localizadas sejam de elevado

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crescimento. A variável associada às qualificações da região é a que apresenta um maior impacto, reforçando a importância do capital humano da região.

6. Conclusão

Este artigo analisa o impacto das características específicas às regiões na probabilidade de uma empresa ser de elevado crescimento. Adoptando o índice de Birch modificado por Hözl (2011) como forma de identificação de empresas de elevado crescimento, os resultados sugerem que empresas situadas em regiões onde se verifique maior diversidade de indústrias e aglomeração de serviços têm uma maior probabilidade de serem de elevado crescimento. Adicionalmente, a diversidade de qualificações na região mostrou contribuir positivamente para a probabilidade das empresas serem de elevado crescimento. Vários estudos empíricos realçam a importância das qualificações a nível superior. Contudo, os resultados obtidos sugerem que é a diversificação na qualificação dos trabalhadores que potencia o elevado crescimento.

A principal contribuição deste artigo é acrescentar à literatura sobre o tema, a qual privilegia a análise do impacto das características específicas à empresa, uma análise que focaliza a atenção nas características da região onde as empresas se localizam. Contudo, em trabalhos futuros seria interessante avaliar se os resultados encontrados são robustos ao uso de diferentes medidas ou índices para identificar empresas de elevado crescimento. Adicionalmente, trabalhos similares, mas cujo período temporal de análise seja diferente, podem revelar se a importância das características das regiões na probabilidade da empresa ser de elevado crescimento varia ao longo do tempo.

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EVOLUÇÃO RECENTE DA I&D EMPRESARIAL EM PORTUGAL – TRAÇOS INCERTOS DE MATURIDADE

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Resumo. O investimento em I&D em Portugal conheceu um incremento notável em meados da última década, nomeadamente a I&D empresarial e a I&D no ensino superior. Esta evolução singular carrega a esperança de ultrapassar dois problemas estruturais do investimento em I&D em Portugal: escasso investimento global em I&D, por um lado, e fraco peso relativo da I&D empresarial, por outro. O investimento empresarial em I&D em Portugal ficou aquém do objetivo de 2% almejado pela Comissão Europeia para 2010, mas ficou próximo do objetivo de 0,8% do PIB definido no Plano Tecnológico em 2005. Não era expectável, contudo, um crescimento tão acentuado da I&D empresarial face à evolução histórica deste indicador e da taxa média de crescimento necessária para atingir aquele objetivo. O investimento em I&D foi acompanhado por um crescimento igualmente acentuado do número de investigadores ETI que, entre 2005 e 2010, duplicou nas empresas, quase triplicou no ensino superior e superou a média da OCDE. São taxas de crescimento muito elevadas face à evolução histórica destes índices, e surpreendentes face à disponibilidade de recursos humanos qualificados e pela mudança repentina face à média da OCDE. Este artigo analisa o contexto da evolução inesperada destes indicadores e discute a coexistência de sinais de maturidade e de debilidade estrutural em quatro áreas relevantes, e avalia até que ponto isso representa uma mudança consolidada no investimento em I&D em Portugal e na importância relativa das empresas enquanto setor executor de I&D. Daqui emerge a imagem dum setor empresarial com aparente motivação para investir mais em I&D, que aproveitou os incentivos públicos disponíveis, mas ainda sem confiança (ou meios) suficiente para consolidar essa estratégia com autonomia.

Palavras-chave: I&D empresarial, incentivos públicos, investigadores ETI, política de I&D

Classificação JEL: O32, O38, H25

RECENT EVOLUTION OF BUSINESS R&D IN PORTUGAL - TRAITS OF UNCERTAIN MATURITY

Abstract. The R&D investment in Portugal experienced a notable increase in the middle of the last decade, including business R&D and R&D in higher education. This singular evolution carries the hope of overcoming two structural problems of the R&D investment in Portugal: scarce overall R&D investment, on the one hand, and low relative weight of business R&D, on the other. Business R&D investment in Portugal fell short of the desired objective of 2% by the European Commission for 2010, but remained close to the target of 0.8% of GDP set in the Technological Plan in 2005. It was not expected, however, such a great growth of business R&D compared to the historical evolution of this indicator and the average growth rate needed to achieve that goal. Investment in R&D was also accompanied by a sharp increase in the number of FTE researchers which, between 2005 and 2010, doubled in companies, nearly tripled on higher education and exceeded the OECD average. Growth rates are very high compared to the historical evolution of these indices, and surprising given the availability of qualified human resources and the sudden change in relation to the average of the OECD. This article analyzes the context of the unexpected evolution of these indicators and discusses the coexistence of signs of maturity and structural weakness in four relevant areas, and assess to what extent this represents a consolidated change in the R&D investment in Portugal, and the relative importance of the business sector while a R&D performer. From this analysis emerges the image of a business sector with apparent motivation to invest more in R&D, which took advantage of the public incentives available, but that still has no sufficient confidence (or means) to consolidate this strategy independently.

Keywords: Business R&D, FTE researchers, public incentives, R&D policy

JEL classification: O32, O38, H25

1. INTRODUÇÃO

Ao fim de vários anos de crescimento modesto, o investimento em investigação e desenvolvimento experimental (I&D) em Portugal conheceu um incremento notável sensivelmente a partir de meados da primeira década do século XXI. Esta evolução recente, da I&D empresarial mas também da I&D no ensino superior, é singular na história do investimento em I&D em Portugal e carrega a esperança de conseguir debelar ou mesmo ultrapassar dois problemas estruturais que têm caraterizado o investimento em I&D em Portugal face aos países da OCDE: escasso investimento global em I&D[56] em percentagem do PIB, por um lado, e fraco peso relativo da I&D empresarial no investimento global (BERD/GERD), por outro. Embora o investimento em I&D em Portugal tivesse ficado muito aquém do objetivo global de 3% do PIB (2% pelo setor empresarial) almejado pela Comissão Europeia para a média da União Europeia (UE) em 2010 (objetivo renovado para 2020) (European Commission, 2003b, 2010), ficou muito próximo dos objetivos definidos no Plano Tecnológico (Governo de Portugal, 2005) para 2010. Os resultados alcançados são muito positivos pois não era expectável um crescimento tão acentuado da I&D global em Portugal, e da I&D empresarial em particular, tendo em conta a evolução histórica destes indicadores e a taxa média de crescimento que teriam que ter para que os objetivos políticos definidos para estes indicadores fossem alcançados (Carvalho, 2006).

O crescimento acentuado do investimento em I&D foi acompanhado por um crescimento não menos acentuado do número de investigadores ETI[57]. Em cerca de cinco a seis anos, o número de investigadores ETI por milhar de habitantes em Portugal atingiu um dos valores mais elevados dos países da OCDE. Entre 2005 e 2011, o número de investigadores ETI em Portugal mais do que duplicou nas empresas e quase triplicou no ensino superior. Por um lado, esta evolução pode ser vista como normal e mesmo expectável dado o grau de correlação elevado entre o investimento em I&D e o número de investigadores ETI. Por outro lado, são taxas de crescimento muito elevadas (sobretudo no período 2005-2009) face à evolução destes índices nos anos precedentes, e surpreendentes tendo em consideração a disponibilidade de recursos humanos qualificados em número suficiente para satisfazer tão elevada procura por parte das empresas e instituições e pela mudança repentina do número de investigadores ETI em Portugal face à média da OCDE.

Torna-se, assim, pertinente analisar o contexto da evolução positiva inesperada do investimento empresarial em I&D e do número de investigadores ETI em Portugal, não apenas para compreender melhor o fenómeno e os fatores principais que justificam esta mudança, mas sobretudo para procurar aferir o grau de maturidade que lhes está associado. Isto é, tentar perceber até que ponto isso representa uma mudança estrutural no volume de investimento em I&D em Portugal e na importância relativa das empresas enquanto setor executor de I&D. Este artigo procura assim contextualizar o fenómeno recente do investimento empresarial em I&D em Portugal e refletir sobre a coexistência de sinais de maturidade e de debilidade estrutural em várias áreas relevantes da I&D empresarial, nomeadamente da dinâmica empresarial recente face à I&D e à inovação, do contexto político e das políticas de ciência e tecnologia (C&T) nacional e da UE favoráveis, da evolução do número de investigadores ETI, e da evolução dos incentivos públicos às atividades de I&D. A análise crítica desta ambivalência de sinais ainda não foi feita e contitui um contributo relevante deste artigo. Daqui emerge a imagem de um setor empresarial com aparente motivação (e necessidade) para investir mais em I&D, que soube aproveitar a crescente generosidade dos incentivos públicos disponíveis, mas ainda sem confiança (ou meios) suficiente para consolidar a mudança estrutural recente na I&D empresarial em Portugal na ausência de políticas públicas tão generosas.

56 De acordo com o Manual de Frascati (OECD, 2002), o investimento global em I&D (cuja sigla é GERD) é constituído por quatro setores de execução de I&D: "Empresas" (BERD), "Ensino superior" (HERD), "Estado" (GOVERD) e "IPSFL" (Instituições Privadas sem Fins Lucrativos, PNP). Os setores "Empresas" e "Ensino superior" foram aqueles que tiveram o contributo mais significativo para a alteração verificada no investimento em I&D em Portugal a partir de 2005.
57 Equivalente a tempo integral.

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O trabalho está estruturado da seguinte maneira. O capítulo 2 analisa a evolução do investimento em I&D em Portugal entre 1995 e 2010 para realçar as características e grandeza do fenómeno nos anos mais recentes. O capítulo 3 faz uma análise similar à do capítulo 2 para o número de investigadores ETI. No capítulo 4 faz-se uma reflexão crítica dos sinais de maturidade e de debilidade estrutural para as quatro áreas identificadas no parágrafo anterior. Agumas conclusões e implicações de política pública concluem o artigo.

2. Evolução do investimento em I&D em Portugal

O investimento total em I&D em Portugal (em % do PIB) registou um incremento notável nos anos mais recentes, com especial destaque para os anos de 2005 a 2008. A magnitude desse incremento contrasta claramente com a tendência de crescimento moderada deste indicador desde que Portugal tem registos estatísticos sobre o investimento em I&D[58], e não encontra paralelo com a evolução recente daquele indicador nos restantes países da OCDE. Neste contexto positivo, destacou-se o crescimento do investimento em I&D do setor empresarial e uma alteração significativa da estrutura do investimento em I&D em Portugal. Esta evolução aproximou Portugal dos países que mais investem em I&D e da média da UE[59], não apenas no montante investido anualmente em I&D (em % do PIB) mas também no contributo ou peso relativo dos vários setores de execução de I&D. A Direção-Geral de Estatísticas da Educação e Ciência (DGEEC) destaca no seu estudo comparativo internacional que "Do conjunto dos países da UE e da OCDE, Portugal apresenta a maior taxa média de crescimento anual […] para o indicador despesa em I&D em percentagem do PIB: 7,7% ao ano, para o período de 1995 a 2010 e 15,4% ao ano, se considerados os últimos cinco anos - 2005 a 2010" (DGEEC, 2012b).

A Figura 1 mostra a evolução do indicador intensidade de I&D (II&D) no período entre 1995 e 2011 para os setores "Empresas", "Ensino superior" e I&D total, e a Figura 2 compara a taxa média de variação anual do indicador indicador intensidade de I&D para aqueles setores de execução naquele período.

Há vários factos relevantes a destacar neste período. Entre 2005 e 2009, o investimento em I&D total em Portugal duplicou, passando de 0,78% para cerca de 1,64% do PIB. Isto deveu-se a um aumento exponencial da I&D empresarial de 0,3% para 0,78% do PIB e da I&D no ensino superior de 0,28% para 0,60% do PIB naquele período. Embora por razões diversas, a I&D empresarial e a I&D no ensino superior registaram taxas de crescimento médio anuais de 40,9% (2005-2007) e 49,5% (2007-2008), respetivamente, e taxas de crescimento mais modestas, mesmo negativas, em anos seguintes (Figura 2). O ensino superior registou taxas de crescimento negativa entre 2001 e 2003 e após 2009, bem como a taxa de crescimento mais elevada em 2008 nos países da OCDE (OECD, 2010b). A evolução da taxa de crescimento anual da I&D empresarial foi bastante irregular entre 1995 e 2010, tendo registado dois picos de crescimento bem definidos em 1999-2001 e 2005-2007, e taxas de crescimento negativas em 2001-2003 e após 2009. A intensidade de I&D empresarial duplicou no período 2005-2007, quando nos seis anos anteriores tinha aumentado cerca de 88%. A I&D empresarial cresceu 150% entre 2005 e 2008, sensivelmente o mesmo que cresceu entre 1995 e 2005. São comportamentos instáveis e muito irregulares que alternam taxas de variação negativas com períodos de forte crescimento, mesmo de liderança, que sugerem debilidades estruturais dos setores empresas e ensino superior.

Figura 1: *Investimento em I&D em percentagem do PIB em Portugal, 1995 a 2011*

58 A recolha de dados estatísticos sobre a I&D em Portugal realizou-se de dois em dois anos de 1982 a 2007 e anualmente após esta data.
59 Por exemplo, o indicador da intensidade de I&D das empresas (BERD/PIB) português ultrapassou o espanhol em 2008 (0,75% contra 0,74% do PIB), quando em 2005 representava cerca de 50% (0,30% contra 0,60% do PIB). O indicador intensidade de I&D (II&D) resulta da divisão entre o investimento em I&D e o PIB (Produto Interno Bruto) de um determinado ano. É um indicador de uso generalizado pela OCDE e Eurostat, que permite uma rápida comparação do esforço financeiro com a I&D entre setores de execução de I&D, indústrias ou países.

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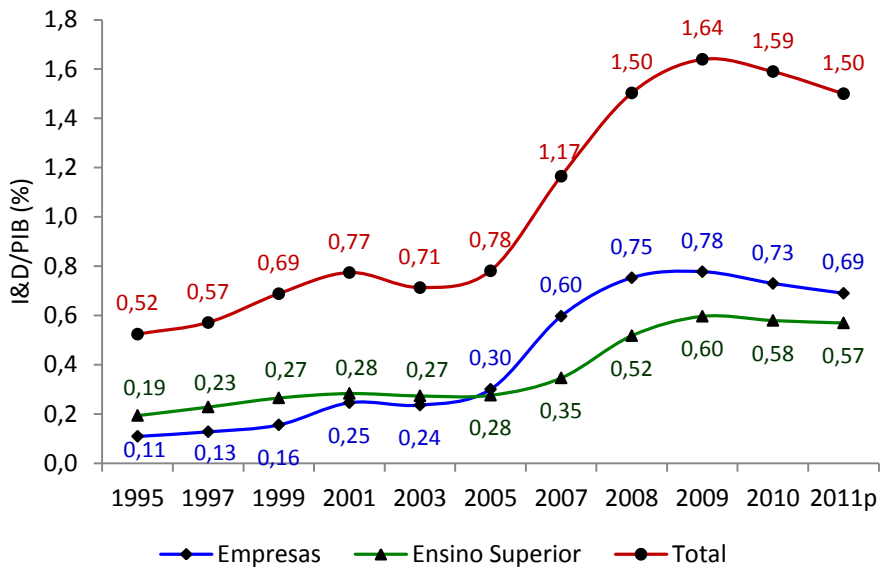
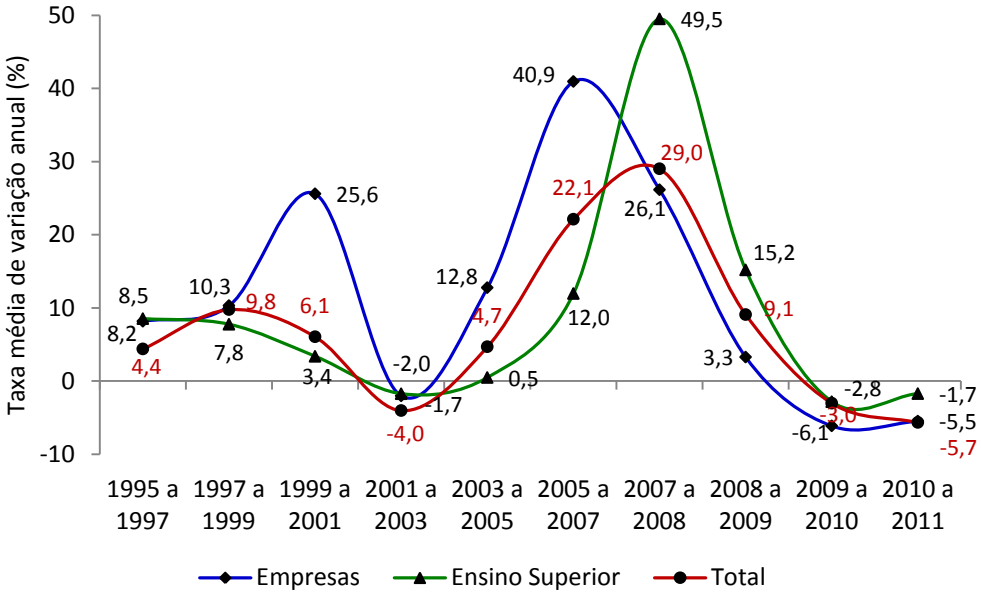


Fontes: GPEARI (2011b), DGEEC (2012a). **Nota**: Valores de 2011 são provisórios.

É ainda relevante realçar que o investimento em I&D empresarial (BERD), em percentagem do PIB, ultrapassou pela primeira vez em 2005 a I&D do ensino superior (HERD), e em 2007 o valor do BERD em percentagem do PIB (0,6%) ultrapassou pela primeira vez a soma do investimento em I&D realizado pelo setor instituições (HERD+GOVERD+PNP=0,57%). Embora simbólicos, são resultados inéditos e que indicam uma tendência que teria bastante significado se representasse uma mudança estrutural efetiva do investimento em I&D em Portugal, nomeadamente na I&D empresarial. No entanto, isso não parece estar a verificar-se a julgar pela evolução dos indicadores após 2009. Em todos os países desenvolvidos, com GERD em percentagem do PIB elevada, a I&D empresarial é a componente mais importante do investimento total em I&D, representando em média 60%-70% do GERD. Em Portugal, o valor do BERD foi superior a 50% do investimento total em I&D apenas nos anos 2007 e 2008, dado que em 2009 voltou a ser inferior a 50%. Isto mostra que a recente alteração estrutural apesar de significativa ainda não é suficiente e não está consolidada.

Figura 2: *Taxa média de variação do investimento em I&D em percentagem do PIB em Portugal, 1995 a 2011*



Fonte: Autor, com base nos dados da Figura 1. **Nota**: Foram utilizados valores não arredondados nos cálculos, exceto em 2010 e 2011.

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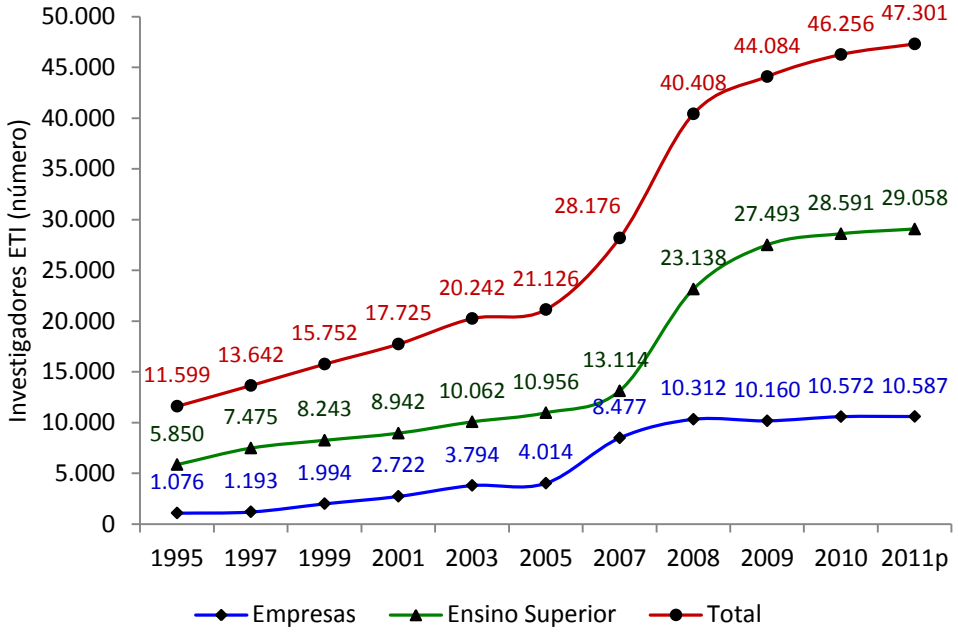
3. Evolução dos investigadores ETI em Portugal

Uma variável muito importante associada ao investimento em I&D é o número de investigadores ETI (equivalente a tempo integral). Na verdade, existe uma correlação positiva muito forte entre o investimento em I&D a preços correntes e o número de investigadores ETI, quer para o setor empresas, quer para o setor ensino superior.[60] A quantidade de investigadores ETI que as empresas e as instituições de ensino superior utilizaram para realizarem a investigação variou proporcionalmente, numa relação quase perfeita, com o montante de investimento em I&D realizado por cada um destes setores. A existência de correlação positiva entre estas variáveis é normal e justificável pelo facto do elemento humano ser uma componente essencial do processo de investigação e, no caso do ensino superior, a despesa em I&D relativa aos docentes-investigadores resultar da valorização duma estimativa de tempo que eles afetam às atividades de investigação.

Figura 3: *Evolução do número de investigadores ETI em Portugal, 1995 a 2011*



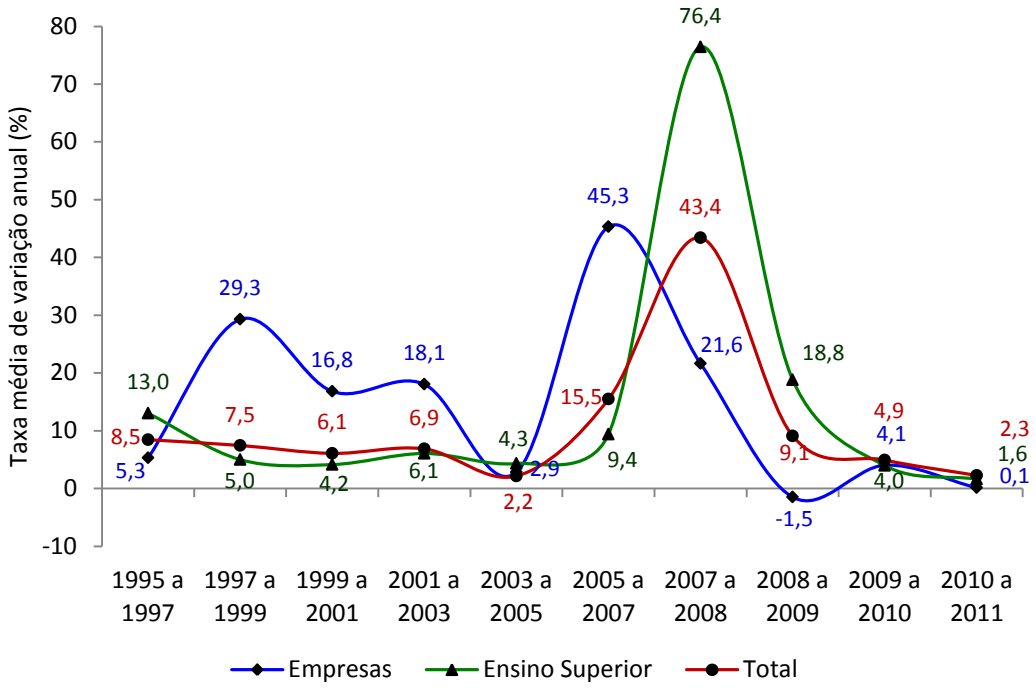
Fontes: GPEARI (2011b), DGEEC (2012a). **Nota**: Valores de 2011 são provisórios.

Conforme é possível verificar nas Figuras 3 e 4, que mostram a evolução do número de investigadores ETI e respetiva taxa de variação anual no período 1995-2011 para os setores de execução "Empresas", "Ensino superior" e I&D total, registou-se uma tendência geral de crescimento do número de investigadores ETI ao longo de todo o período, quer nas empresas, quer nas instituições de ensino superior. Entre 1995 e 2011, o número total de investigadores ETI quase quadruplicou, no ensino superior quase quintuplicou e nas empresas é cerca de 9,75 vezes superior. Há registo apenas de um único ano (2009) em que se verificou um decréscimo do número de investigadores ETI nas empresas, e que nem sequer coincidiu com os períodos 2001-2003 e após 2009 em que o investimento empresarial em I&D em percentagem do PIB diminuiu. Tal como no caso do investimento em I&D em percentagem do PIB (Figura 2), também aqui se destacam as elevadas taxas de crescimento dos investigadores ETI após 2005. Entre 2005 e 2007 registou-se uma taxa de crescimento média anual de 45,3% do número de investigadores ETI nas empresas, que fez com que o número de investigadores ETI mais do que duplicasse naquele período. Nas instituições de ensino superior registou-se uma taxa média de crescimento de 76,4% dos investigadores ETI de 2007

60 A estimativa do coeficiente de correlação entre o investimento em I&D (a preços correntes) e o número de investigadores ETI entre 1995 e 2011 (dados de DGEEC, 2012a) para o setor empresas produziu um r2 = 0,988 e para o setor ensino superior um r2 = 0,975.

para 2008, tendo o número de investigadores ETI aumentado cerca de 173% no período de 2005-2009.

Figura 4: *Taxa média de variação anual do número de investigadores ETI em Portugal, 1995 a 2011*



Fonte: Autor, com base nos dados da Figura 3. **Nota**: Foram utilizados valores não arredondados nos cálculos, exceto em 2010 e 2011.

A evolução destes indicadores, especialmente após 2005, produziu alterações importantes no montante e na estrutura do investimento em I&D em Portugal e aproximou Portugal da média dos países da OCDE e da UE. Não são expectáveis taxas de crescimento semelhantes no futuro próximo, menos ainda no contexto da atual crise económica e financeira cujo fim ainda não se vislumbra, mas a consolidação desta mudança estrutural é fundamental para a afirmação de Portugal como país produtor de conhecimento e inovação. E isso ainda parece estar longe de estar assegurado em face do comportamento irregular dos indicadores no passado recente.

4. Discussão e reflexão

É inegável a evolução positiva recente do investimento em I&D e do número de investigadores ETI em Portugal, bem como a sua relevância para a construção e consolidação de uma economia baseada no conhecimento e na inovação. Há muito tempo que estão diagnosticadas as principais debilidades do investimento em I&D em Portugal, nomeadamente a I&D empresarial, pelo que a alteração do padrão de comportamento e da estrutura daqueles indicadores era necessária e desejável, o que não retira a necessidade de compreender e avaliar até que ponto a evolução daqueles indicadores se deveu à concorrência de circunstâncias específicas favoráveis. A evolução negativa dos indicadores da II&D após o ano de 2009 torna essa dúvida ainda mais pertinente. Para tentar compreender os fatores que explicam o fenómeno e o grau de robustez da mudança que tem dimensões estruturais, este capítulo analisa quatro fatores fundamentais do investimento empresarial em I&D, nomeadamente, a perceção da dinâmica empresarial quanto ao investimento em I&D enquanto *input* importante do processo de inovação, o contexto político recente, nacional e comunitário, quanto ao valor estratégico do investimento em I&D para construir uma economia baseada no conhecimento e na inovação, a evolução dos investigadores ETI e a evolução dos incentivos públicos de estímulo à I&D empresarial em Portugal. A leitura conjunta destes fatores dá-nos um quadro mais nítido do fenómeno em presença.

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4.1 Dinâmica empresarial

O baixo nível de investimento empresarial em I&D em Portugal é um problema estrutural identificado há muito tempo, mas que conheceu uma reação expressiva das empresas em meados da década passada (Figura 1). Muitos e diversos fatores concorrem para explicar o momento e a amplitude dessa reação, não sendo fácil evidenciar desde já quanto dessa reação se deve a uma mudança da dinâmica, dos comportamentos e da mentalidade empresarial, com efeitos estruturais duradouros no investimento em I&D do setor empresas em Portugal. Dentre esses múltiplos fatores podem destacar-se: o contexto político interno e externo favorável ao investimento em I&D e inovação e a crescente generosidade dos incentivos públicos; a discussão pública intensa na sociedade portuguesa ao longo da década passada sobre o papel da inovação na competitividade empresarial e a pressão sobre as empresas para apostarem na inovação e na internacionalização, que até teve o patrocínio da Presidência da República; o aparecimento de novas instituições de apoio empresarial como a COTEC Portugal que deram visibilidade às questões da inovação e do conhecimento científico e tecnológico; a multiplicação de iniciativas de estímulo à criatividade e criação de empresas de base tecnológica como o fenómeno dos concursos de ideias/inovação (Carvalho, 2009), que captou o interesse de entidades muito diversas; o estímulo para a intensificação das relações universidade-empresa e a perceção crescente dos empresários sobre a importância de investir em I&D.

O Quadro 1 contém informação sobre o número de empresas inquiridas e com atividade de I&D no âmbito do Inquérito ao Potencial Científico e Tecnológico Nacional (IPCTN) entre 2001 e 2010.[61] Os dados mostram um crescimento exponencial, superior a 239%, do número total de empresas que declararam ter tido atividades de I&D entre 2001 e 2008, de 621 para 2108 empresas, e ligeira diminuição após 2008. Com exceção de 2005, o número de empresas com atividades de I&D interna cresceu exponencialmente ao longo de todo o período, de 568 para 1916 empresas, a que corresponde um crescimento superior a 237%. O grupo de empresas que subcontratam ou financiam entidades externas para a execução das atividades de I&D registou a taxa de crescimento mais significativa entre 2001 e 2008 e em termos anuais, com exceção de 2005, sendo que em 2008 já representava mais de 10% do total de empresas com atividades de I&D. Os dados incompletos disponíveis apontam para uma descida do número de empresas com I&D contratada e/ou financiada a entidades externas a partir de 2009.

Há dois fatores positivos a assinalar no comportamento das empresas, que revelam a crescente sensibilização empresarial sobre a importância da I&D. Por um lado, o alargamento significativo da base de empresas que investem em I&D, ainda que uma parte delas não tenha uma carteira de projetos de I&D e uma estrutura de I&D consolidada e permanente. É significativo que o número de empresas com I&D interna tenha aumentado mesmo em contexto de crise, o que pode indiciar uma reorientação das empresas para mercados externos e que consideram o investimento em I&D um fator competitivo essencial. Por outro lado, a intensificação das relações das empresas com entidades externas para a realização de atividades de I&D[62] até 2008, nomeadamente com as universidades, corresponde ao paradigma atual de que isso contribui e é necessário para fomentar a inovação e a transferência e divulgação de conhecimento (Comissão Europeia, 2003), especialmente para as PME que geralmente têm menos recursos disponíveis. A descida do número de empresas neste grupo pode indiciar que são PME orientadas para o mercado interno que estão a sentir os efeitos da crise económica em curso.

61 A metodologia de recolha de dados e as fontes utilizadas têm sido alteradas ao longo do tempo e isso tem implicações ao nível da consistência dos dados apresentados. Em 2007, por exemplo, as "alterações resultaram num aumento do número de instituições recenseadas com I&D" devido ao "alargamento e melhoria das fontes administrativas consultadas para a atualização do diretório de empresas (nomeadamente, SIFIDE e Informação Empresarial Simplificada – IES) e instituições a inquirir" (DGEEC, 2012b).

62 O fenómeno da cooperação em I&D entre empresas e entidades externas é ainda mais relevante porque muitas das empresas classificadas como tendo realizado I&D internamente também contrataram e/ou financiaram I&D externamente.

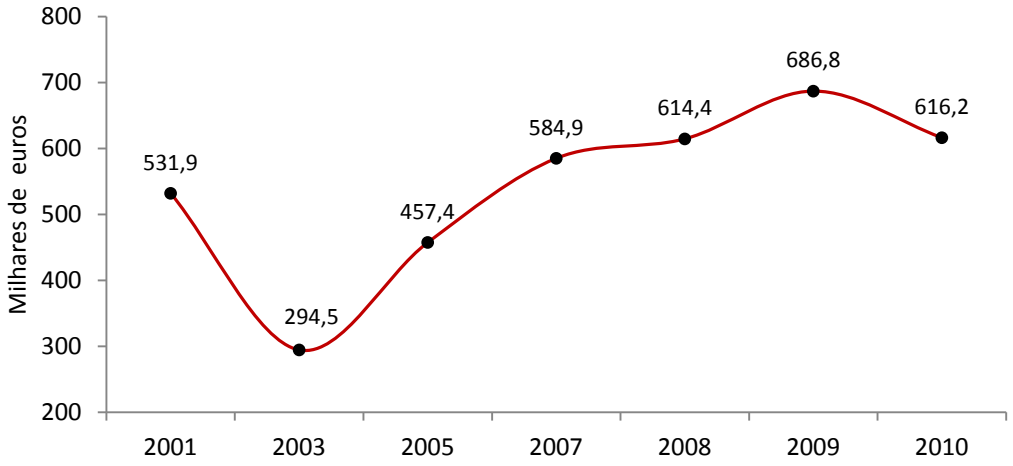
Quadro 1: *IPCTN - número de empresas inquiridas e com atividades de I&D*

	2001	2003	2005	2007	2008	2009	2010
Empresas inquiridas (potenciais executantes de I&D)	4189	6290	7018	9907	10188	?	8718
Respostas recolhidas	2130	4910	5180	7316	8412	?	6680
Empresas com atividades de I&D:							
- Total	621	1148	1010	1728	2108	1909	2055
- Com I&D interna	568	1034	939	1596	1883	1909	1916
- Com I&D contratada/financiada	53	114	71	132	225	?	139

Fontes: OCES (2003, 2006), GPEARI (2007, 2009, 2011c), DGEEC (2012b). **Nota**: "?" - Dados não disponíveis.

Fazendo uma média aritmética simples entre o valor total do investimento empresarial em I&D a preços correntes (DGEEC, 2012a) e o número total de empresas com atividades de I&D (Quadro 1), obtêm-se o valor médio para o investimento em I&D por empresa (em milhares de euros), que está representado na Figura 5. Os dados revelam um decréscimo substancial no investimento empresarial médio em I&D de 2001 a 2003 e um crescimento substancial até 200963, decrescendo novamente em 2010 para valores de 2008. De notar que apenas em 2007 é que o investimento médio em I&D superou o valor de 2001, mas em 2008 já era superior ao dobro do investimento médio em I&D em 2003. Nos anos mais recentes verificou-se um aumento substancial quer do número de empresas com I&D interna, quer do valor médio do investimento realizado por cada uma delas. Estas tendências recentes sugerem um tecido empresarial mais consciente do investimento em I&D e mais disponível para arriscar em projetos de maior dimensão, revelando traços de confiança e maturidade. No entanto, o decréscimo do número de empresas que subcontrata I&D externamente e do valor médio do investimento em I&D a partir de 2010, talvez mesmo a partir de 2009, mostram sinais de debilidade dessas estruturas de I&D.

Figura 5: *Valor médio do investimento em I&D por empresa (milhares de euros)*



Fonte: Cálculos do autor com base nos dados da DGEEC (2012a) e Quadro 1. **Nota**: Média simples entre o valor do BERD a preços correntes e o número total de empresas com atividades de I&D.

Apesar disso, parece igualmente evidente que a reação das empresas está muito associada ao tipo e montante dos incentivos públicos disponíveis, nomeadamente os incentivos fiscais (SIFIDE) que têm vindo a ganhar maior importância no quadro das políticas públicas de estímulo à I&D empresarial (Carvalho, 2012). O Quadro 1 mostra um forte crescimento do número de empresas com atividades de I&D de 2001 para 2003, um decréscimo de 2003 para 2005 e um forte crescimento a partir de 2005. Essa evolução ajusta-se perfeitamente com o aumento substancial da generosidade do SIFIDE

63 O valor de 2009 está sobrestimado porque não foram obtido o valor para o número de empresas com I&D contratada e/ou financiada. Se se considerar um valor médio para 2009 para esta variável resultante da média entre o número de empresas em 2008 (=225) e o de 2010 (=139), o valor médio do investimento em I&D para 2009 seria cerca de 627 mil euros, o valor que parece razoável face ao comportamento dos indicadores das Figuras 1 e 2.

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em 2001, com a substituição do SIFIDE pelo RFI[64] em 2004 e 2005 e reintrodução do SIFIDE em 2006 com novo aumento dos benefícios que o tornaram um dos melhores sistemas de incentivos à I&D da OCDE.

4.2 Contexto político favorável

Nunca antes se tinham conjugado tantos fatores favoráveis à implementação de políticas públicas para fomentar o investimento em I&D em geral e I&D empresarial em particular. A "Estratégia de Lisboa" em 2000 apontou a ambição da UE se tornar na economia baseada no conhecimento mais competitiva do mundo em 2010, que a cimeira de Barcelona em 2002 materializou em objetivos para o GERD (3% do PIB) e BERD (2% do PIB) para a média da UE em 2010 (European Commission, 2003b). Esta mudança na política de S&T e de inovação da UE, que passou a ser orientada em função dos objetivos políticos quantificados e definidos no tempo para o investimento em I&D, tem tido repercussões dentro e fora da UE na forma de conceber e intervir das políticas públicas para estimular o investimento em I&D. As preocupações quantitativas ganharam predominância sobre a racionalidade económica no apoio púbico à I&D empresarial, nomeadamente a racionalidade baseada nas falhas de mercado, que favoreceu a competitividade das nações através da crescente generosidade dos sistemas de incentivos (Carvalho, 2012).

Os planos nacionais de ciência, tecnologia e inovação são cada vez mais orientados em função de objetivos quantificados para o indicador intensidade de I&D (nomeadamente GERD e BERD). No entanto, a ambição e o irrealismo dos objetivos propostos é uma das consequências mais perniciosas destes planos pois, tal como na UE[65], poucos países têm conseguido atingir os objetivos de I&D a que se propuseram. Hoje em dia, quase todos os países da UE, da OCDE e das economias emergentes mais relevantes, incluindo o Brasil, a China, a África do Sul e a Rússia, têm objetivos concretos de I&D a médio e longo prazos definidos nos seus planos nacionais de ciência, tecnologia e inovação. Estamos na era das políticas públicas de I&D orientadas por objetivos (Carvalho, 2012), que é em grande medida consequência da estratégia da UE após a cimeira de Lisboa pela generalização e consolidação dessa política entre os países da UE, pelo impacto que teve sobre a procura de investigadores e recursos de I&D dentro e fora da UE, e pelo apontar de um caminho a outros países.[66]

Houve um crescente encorajamento e apoio aos Estados Membros para estimularem a despesa em I&D, individualmente e em cooperação, nomeadamente com melhores incentivos para as empresas reforçarem o investimento em I&D e incentivos para estimular empresas que tradicionalmente não investem em I&D a fazê-lo, como as PME em geral e as de setores de média-baixa tecnologia em particular. Neste âmbito, os incentivos fiscais à I&D têm-se destacado face aos financiamentos diretos porque permitem apoiar um maior número de empresas, incluindo PME, e ao mesmo tempo deixam às empresas a máxima independência na escolha dos projetos de I&D a investir (European Commission, 2003b), facilitando assim o melhor cumprimento dos objetivos políticos. Uma das consequências desta estratégia foi o crescente aumento da generosidade dos sistemas de incentivos e crescente competitividade fiscal entre países para atrair I&D internacional e investigadores qualificados, e reter os recursos humanos e de I&D existentes (OECD, 2008b; Carvalho, 2012).

É neste contexto que em 2005 Portugal definiu objetivos concretos para o investimento em I&D no âmbito do "Plano Tecnológico", um instrumento de política pública inovador para promover o desenvolvimento e reforçar a competitividade do país tendo por base os eixos do conhecimento, da

64 SIFIDE - Sistema de Incentivos Fiscais à Investigação e Desenvolvimento Empresarial; RSI - Reserva Fiscal para Investimento. O RSI era muito menos interessante que o SIFIDE e não teve aceitação pelas empresas.

65 Apesar de não ter atingido os objetivos de I&D, em 2010 a UE renovou esses objetivos no âmbito da estratégia "Europa 2020" (European Commission, 2010) e em 2011 todos os estados membros definiram objetivos para o investimento em I&D nos seus planos nacionais de reformas.

66 A definição de objetivos de I&D em percentagem do PIB é um assunto que tem vindo a merecer crescente destaque nos últimos relatórios "OECD Science, Technology and Industry Outlook" da OCDE. Ver o relatório OECD (2010b) para informação adicional sobre objetivos definidos e nível de realização obtido para os países da OCDE e outros países emergentes.

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tecnologia e da inovação (Governo de Portugal, 2005). Analisando as Figuras 1 a 4, torna-se evidente que é precisamente a partir de 2005 que se verifica um incremento notável no investimento em I&D e no número de investigadores ETI, o que sugere uma relação forte entre estes factos, embora seja importante não inferir que o incremento verificado nestas variáveis se deveu apenas à alteração nas políticas públicas (conforme se demonstrou no ponto anterior). O Quadro 2 compara alguns objetivos de C&T definidos pelo XVII Governo Constitucional[67] para 2010 com os resultados obtidos nessa data. Verifica-se que o número de investigadores ETI ultrapassou largamente a meta estabelecida, enquanto a despesa pública em I&D e o investimento em I&D empresarial não atingiram as metas previstas, embora a I&D empresarial tenha aumentado significativamente desde 2005 e tenha atingido 0,78% do PIB em 2009.

Quadro 2: *Indicadores de ciência e tecnologia do Plano Tecnológico: metas e realizações*

	Metas 2010	Realizações 2010
- Investigadores ETI em permilagem da população ativa	6,0 ‰	8,2 ‰
- Despesa pública em I&D em % do PIB[68]	1,0 %	0,86 %
- Despesa das empresas em I&D em % do PIB	0,8 %	0,73 %

Fontes: Governo de Portugal (2005), GPEARI (2011b), Figura 1.

O comprometimento político com objetivos bastante ambiciosos (Carvalho, 2006) de aumento do número de investigadores ETI e do investimento em I&D, nomeadamente I&D empresarial (que só indiretamente é estimulada através de mais e melhores incentivos públicos) permite compreender o empenhamento do governo na definição de políticas, instrumentos e incentivos ao longo da legislatura. Isto é, "criando as condições de estímulo necessárias" para incentivar a I&D empresarial, promover o emprego qualificado, aumentar as competências e "vencer o atraso científico e tecnológico" (Governo de Portugal, 2005). Esta aposta do governo, inédita pela sua ambição e determinação, teve ressonância nos setores académico e empresarial. Estes partilharam da premissa que, para alicerçar uma economia baseada no conhecimento e na inovação, era fundamental aumentar o investimento em I&D, em especial I&D empresarial, para aproximar Portugal dos padrões médios da UE e da OCDE. O contexto favorável para o estímulo público ao investimento em I&D sofreu um revés com a crise financeira e económica a partir de 2008.[69] Entretanto, o tema do investimento em I&D perdeu atualidade política mediática e também económica, o Estado está cada mais pressionado a ponderar e a justificar o uso de recursos públicos (por exemplo, o QREN já foi revisto e há redução de investimento em todas as áreas e funções do Estado) e as empresas estão a rever os seus planos de investimento em face da conjuntura económica negativa e da expectativa de redução da procura. As Figuras 1 a 4 já indiciam uma alteração negativa no investimento em I&D que poderá ser justificada por estes fatores, mas é necessário aguardar a evolução futura destes indicadores.

4.3 Investigadores ETI

O notável aumento recente do número de investigadores ETI nas empresas e nas instituições do ensino superior teve como consequência imediata mais visível o facto de Portugal se ter aproximado e até superado os valores médios de investigadores ETI da OCDE e da União Europeia. Este aumento exponencial do número de investigadores ETI não foi, contudo, suficiente para ultrapassar os problemas estruturais de Portugal nesta matéria. A Figura 6 compara a evolução do número total de investigadores ETI por milhar de empregados entre Portugal, a OECD e a UE a 27 estados membros. São perfeitamente visíveis dois períodos distintos na evolução do número de investigadores ETI em

67 XVII Governo Constitucional: 12 de março de 2005 a 26 de outubro de 2009.

68 A "Despesa pública em I&D em % do PIB" é o indicador utilizado no "European Innovation Scoreboard" (European Commission, 2003a) e é igual a [(GERD-BERD)/PIB]*100. Este indicador dá-nos um valor aproximado da despesa pública em I&D porque inclui o investimento em I&D das Instituições Privadas Sem Fins Lucrativos (PNP). Em 2010, a I&D das PNP em Portugal representava cerca de 0,17% do PIB.

69 Contudo, é sintomático que em abril de 2011, quando os indicadores do investimento empresarial em I&D já manifestavam clara tendência de diminuição desde 2009 (Figuras 1 e 2), o governo português tenha estabelecido o objetivo de atingir um BERD entre 1,7% a 2,1% do PIB em 2020, em clara dissonância com a evolução real dos indicadores e o estado da Economia.

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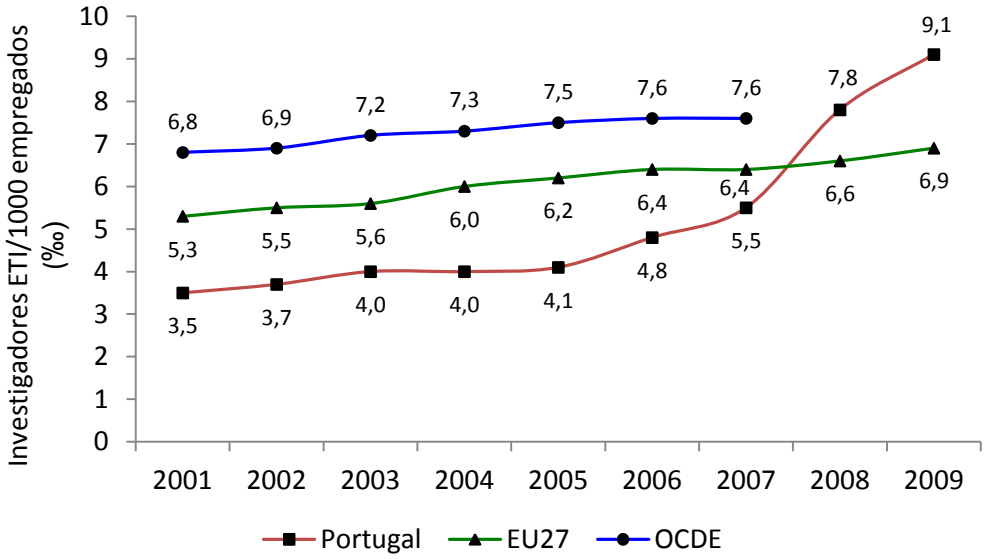
Portugal: uma evolução moderada e com valores claramente abaixo das médias da UE27 e da OCDE antes de 2005; uma evolução rápida a partir de 2005, e sobretudo a partir de 2007, que catapultou Portugal para uma posição acima da média da OCDE e bem acima da média da UE27. De 2001 a 2005, o número de investigadores ETI em Portugal, na OCDE e na UE manifestou uma tendência de crescimento pouco acentuada mas estável, tendência que se continuou a observar na OCDE e na UE após 2005.

A nível setorial também houve progressos assinaláveis, embora diferenciados e com implicações diversas. A evolução do número de investigadores ETI no setor empresarial (Figura 7) manifesta um comportamento semelhante ao verificado para o número total de investigadores ETI (Figura 6). Nas empresas, apesar do número de investigadores ter subido de cerca de 1 para 2,4 ETI por milhar de empregados na indústria de 2005 para 2009 - um crescimento de 140% -, é contudo um valor que fica bastante aquém da média da OCDE (6,4 ETI por milhar de empregados na indústria em 2007) e da média da UE27 (4,1 ETI por milhar de empregados na indústria em 2009). Nas instituições de ensino superior, a percentagem de investigadores ETI no total de investigadores ETI em Portugal registou uma evolução intermitente, baixando de 51,9% em 2005 para 46,5% em 2007 e subindo novamente para 61,2% em 2009. São valores bastantes superiores à média da OCDE (27,5% em 2006) e à média da UE27 (41,6% em 2009) (OECD, 2011). Isto leva-nos a concluir que, apesar do crescimento significativo do número de investigadores, a estrutura dos investigadores ETI em Portugal continua inversa à da OCDE e da UE. Em Portugal há uma maior proporção de investigadores nas instituições de ensino superior e menor nas empresas, o que é condicionador da capacidade de inovação das empresas portuguesas em setores de grande intensidade tecnológica.

Figura 6: Total de investigadores ETI por milhar de empregados em Portugal, OCDE e EU27, 2001 a 2009 (‰)



Fontes: OECD (2008a, 2011)

Figura 7: Investigadores ETI no setor empresarial por milhar de empregados em Portugal, OCDE e EU27, 2001 a 2009 (‰)

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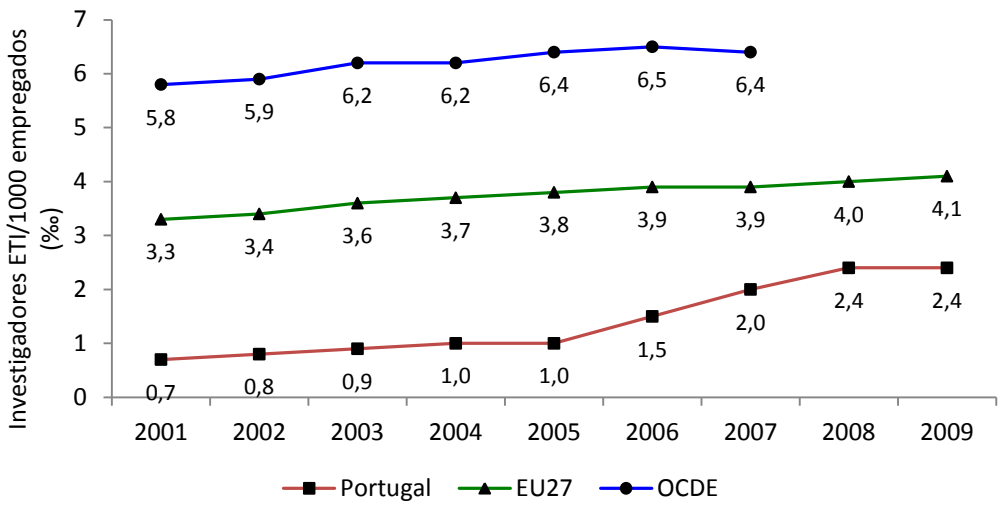

Fontes: OECD (2008a, 2011)

Este comportamento extraordinário do número de investigadores ETI em Portugal levanta algumas questões para investigação posterior mais aprofundada relacionadas com a proveniência e condição dos investigadores que sustentaram aquele aumento tão rápido, sobretudo das empresas. Será importante conhecer as qualificações desses novos investigadores, se já eram trabalhadores das empresas e se ficaram a desempenhar tarefas de investigação em exclusividade. Mas é importante realçar, desde já, senão o paradoxo, pelo menos a aparente inconsistência entre a taxa de investigadores ETI em Portugal, que é bastante superior à da OCDE e à da UE, e o investimento em I&D total (GERD) e empresarial (BERD), em percentagem do PIB, que são bastante inferiores aos média da UE e especialmente aos média da OCDE. Portugal apresenta uma taxa de investigadores ETI significativamente superior a países que investem muito mais em I&D e têm estruturas de investigação mais consolidadas. A predominância de setores de média e baixa tecnologia em Portugal poderá justificar alguma discrepância, mas não é suficiente para justificar o paradoxo.

Alguns aspetos metodológicos relacionados com as fontes de informação tiveram influência relevante nos resultados estatísticos, nomeadamente ao nível dos investigadores ETI nas instituições de ensino superior e do consequente impacto em termos de I&D realizada. De facto, o incremento de cerca de 76,4% no número de investigadores ETI nas instituições de ensino superior em 2008 (Figura 4), que passou de 13114 para 23138 investigadores ETI (Figura 3), é grandemente explicado por uma correção metodológica verificada em 2008. No relatório "Sumários Estatísticos ao Inquérito ao Potencial Científico e Tecnológico Nacional 2008" pode ler-se o seguinte:

"Relativamente ao setor Ensino Superior, prosseguindo o esforço de melhoria da metodologia de recolha da informação do Inquérito já iniciada em 2007, procedeu-se, pela primeira vez, à articulação da informação do IPCTN08 com o sistema estatístico de monitorização do ensino superior, designadamente o registo biográfico de docentes do ensino superior (REBIDES), o que permitiu garantir a quantificação da atividade de I&D de todos os docentes. [F]oram ainda contabilizados os bolseiros de investigação diretamente financiados pela FCT, bem como os investigadores doutorados contratados no âmbito dos programas Ciência 2007 e 2008 (FCT), não reportados pelas unidades de I&D no IPCTN08" (GPEARI, 2011c).

Assim, 17095 docentes do ensino superior, 1753 bolseiros de investigação financiados pela FCT e 86 investigadores doutorados financiados pela FCT não registados foram adicionados à base de dados de investigadores a inquirir. Isto teve como consequência, por um lado, um grande aumento do número de investigadores ETI nas instituições de ensino superior e, por outro, um aumento de cerca de 49,5% na despesa em I&D do ensino superior em 2008 pois são indicadores interdependentes. A dimensão do impacto pode ser avaliada tendo em consideração que, em 2008, a I&D no ensino superior em Portugal registou a taxa de crescimento mais elevada da OCDE (OECD, 2010b).

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Obviamente, o investimento total em I&D em Portugal foi proporcionalmente aumentado em 2008. Daqui decorre uma dúvida legítima quanto à despesa de I&D no ensino superior anterior a 2005 ter sido aparentemente subestimada, ou sobrestimada a partir desta data, tendo em consideração que não houve uma variação significativa do número total de docentes no ensino superior desde 2001 (Quadro 3). Aliás, os maiores decréscimos de docentes no ensino superior registaram-se em 2006 e 2007, e entre 2005 e 2007 registou-se um aumento de 9,8% do número de investigadores ETI no ensino superior (Figura 4).

Quadro 3: Total de docentes no ensino superior em Portugal, 2001 a 2009

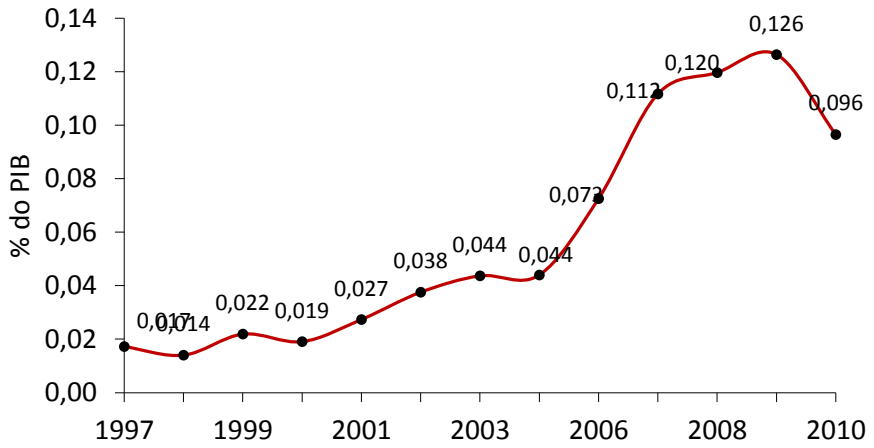
	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total de docentes	35740	36191	36402	36773	37434	36 069	35178	35380	36215
Variação (%)	---	1,3	0,6	1,0	1,8	-3,6	-2,5	0,6	2,4

Fonte: GPEARI (2011a).

4.4 Incentivos públicos

Para se compreender melhor o comportamento do investimento empresarial em I&D em Portugal, é fundamental analisar a evolução do financiamento público à I&D empresarial nos anos mais recentes, pois estas variáveis estão positivamente relacionadas. Decorrente do contexto político favorável, a generalidade dos países da UE e da OCDE e muitos outros países espalhados pelo mundo têm implementado políticas de apoio à I&D empresarial e aumentado substancialmente a generosidade dos incentivos públicos[70]. O mesmo aconteceu em Portugal. As Figuras 8 e 9 mostram a evolução dos incentivos públicos em Portugal entre 1997 e 2010, em percentagem do Produto Interno Bruto (PIB) e em percentagem do BERD (investimento empresarial em I&D).

Figura 8: Financiamento público à I&D empresarial em % do PIB, Portugal, 1997-2010



Fonte: Carvalho (2013). **Notas**: Dados de 2010 são provisórios. 2004 excluído por falta de dados.

Em percentagem do PIB, registou-se uma tendência clara de aumento gradual dos incentivos públicos entre 1997 e 2005, e um crescimento exponencial de 2005 a 2009.[71] Aliás, a evolução dos incentivos públicos ao longo do período em análise segue uma trajetória idêntica à do investimento empresarial em I&D em percentagem do PIB (Figura 1), mas com uma taxa de crescimento ainda mais acentuada no período de 2005 a 2007. Isto é, os incentivos públicos não apenas acompanharam a evolução do investimento empresarial em I&D em percentagem do PIB, em particular o crescimento exponencial a partir de 2005, como ainda o superaram. Houve, portanto, uma vontade explícita das políticas públicas em promover, de forma acelerada, o investimento empresarial em I&D, embora fique a dúvida sobre a qualidade dos projetos de I&D e as motivações das empresas que

70 Os incentivos públicos podem subdividir-se em dois grandes tipos: financiamento direto de projetos de I&D (subsídios, empréstimos, bolsas, e outras subvenções financeiras), e os incentivos fiscais, que reduzem o montante dos impostos a pagar pelas empresas (créditos fiscais, amortizações aceleradas, etc.).

71 Os dados dos anos mais recentes das Figuras 8 e 9 ainda não são definitivos porque os incentivos fiscais, que representam o grosso dos incentivos públicos em Portugal, têm um período de 6 anos para serem reclamados pelas empresas, sendo pois expectável que os valores apresentados nos gráficos nos anos mais recentes venham a ser atualizados futuramente, em particular o ano de 2010.

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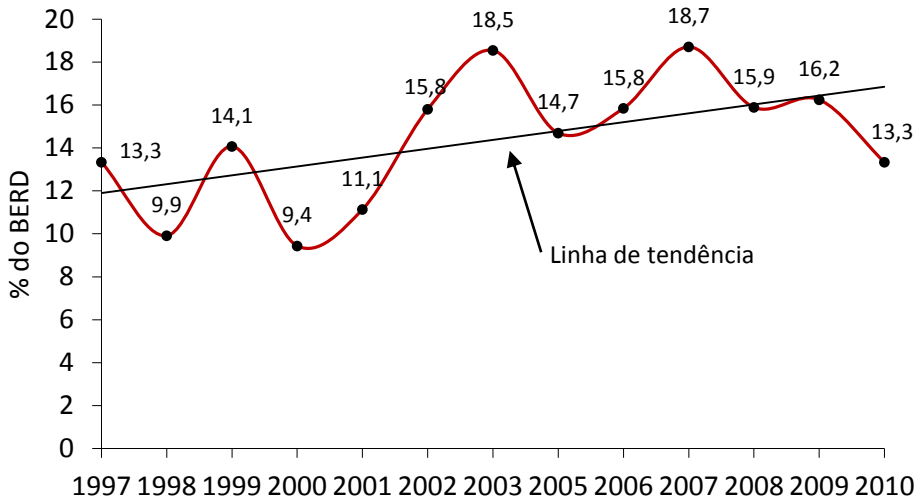
beneficiaram dos incentivos públicos. Será um traço forte de maturidade se as empresas aproveitaram a generosidade dos incentivos públicos para consolidar estruturas internas de I&D e/ou para realizar projetos de I&D necessários ou estratégicos em termos de inovação e competitividade. Por outro lado, predominando os incentivos fiscais, o Estado fica muito limitado para controlar os projetos de I&D que financia, cuja determinação cabe inteiramente às empresas.

Figura 9: Financiamento público à I&D empresarial em % do BERD, Portugal, 1997-2010



Fonte: Carvalho (2013). **Notas**: Dados de 2010 são provisórios. 2004 excluído por falta de dados.

A Figura 9 revela uma evolução intermitente do financiamento público à I&D empresarial em percentagem do BERD, em que se intervalam períodos de aumento com períodos de diminuição do apoio público. No período em análise, o Estado ressarciu as empresas com um mínimo de 9,4% (2003) e um máximo de 18,7% (2007) do total do investimento que estas realizaram anualmente em I&D. Verifica-se, em termos gerais, uma tendência gradual de aumento do financiamento público à I&D empresarial em percentagem do BERD (ver linha de tendência), pois tanto os valores máximos quanto os valores mínimos deste indicador têm vindo a aumentar ao longo do tempo. A maior parte do apoio público reveste-se sob a forma de incentivos fiscais (SIFIDE), que têm vindo a aumentar em substituição dos financiamentos diretos. "O peso dos incentivos fiscais no total de incentivos públicos aumentou de cerca de 39% em 1997 para 75% em 2007, ano em que atingiu o seu valor máximo, baixando para 64%, 59% e 42% nos anos seguintes" (Carvalho, 2013), mas os dados dos anos mais recentes ainda são provisórios. O Estado tem vindo a pagar um preço elevado para obter níveis de investimento empresarial em I&D mais elevados, e para que esse aumento ocorra de forma mais acelerada. Isso acontece em geral quando o Estado pretende estimular o investimento em I&D empresarial quando este é estruturalmente muito baixo, mas o preço tende a aumentar com a definição de objetivos quantificados para o investimento em I&D, não raras vezes demasiado ambiciosos para o tempo definido para a sua execução.

5. Conclusão e implicações

A evolução do investimento empresarial em I&D em Portugal destacou-se pelas elevadas taxas de crescimento que registou a partir de 2005, em contraste com a evolução registada em anos anteriores. A dimensão singular do fenómeno, mesmo no contexto dos países da OCDE, suscita interrogações sobre os fatores que explicam o fenómeno e sobre a dimensão da mudança estrutural que possa implicar no volume de investimento empresarial em I&D em Portugal e na importância relativa das empresas enquanto setor executor de I&D. Este artigo procura uma resposta para estas interrogações a partir do confronto entre os sinais de maturidade já conseguidos e de debilidade estrutural que ainda persistem na I&D empresarial em quatro áreas fundamentais, nomeadamente a

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dinâmica empresarial, o contexto político, os investigadores ETI e os incentivos públicos às atividades de I&D.

O aumento expressivo do investimento empresarial em I&D a partir de 2005, o aumento do número de investigadores ETI, a intensificação das relações entre as empresas e as instituições de investigação, e o aumento da importância relativa das empresas no contexto dos executores de I&D em Portugal são sinais muito positivos que aproximam Portugal dos padrões médios da UE e da OCDE. O aumento significativo do número de empresas com atividades de I&D conjugado com o aumento do investimento empresarial em I&D em percentagem do PIB permitiu, ainda assim, um aumento do investimento médio em I&D em 2007 e 2008 para valores nunca antes atingidos. São sinais positivos, de oportunidade e confiança das empresas, que devem ser enquadrados com o contexto político e social favorável. De facto, a ambição da UE quanto à liderança numa economia baseada no conhecimento e na inovação e a definição de objetivos políticos quantificados para o investimento em I&D, que se generalizou dentro da UE, criaram as condições necessárias para políticas públicas mais generosas, mais esforçadas e mais relaxadas com os fundamentos económicos subjacentes ao apoio público às atividades de I&D. Em Portugal, é evidente o enorme aumento do financiamento público à I&D empresarial em percentagem do PIB a partir de 2005, ano que o governo definiu objetivos quantificados para esta variável, que permitiu acompanhar e até ultrapassar as elevadas taxas de crescimento da I&D empresarial naquele período. Isto confirma a vontade política manifestada em promover o aumento acelerado da I&D empresarial, mesmo que isso implicasse um elevado financiamento público, como se verificou.

Não obstante este bom desempenho, que parece esgotado em face da evolução negativa dos indicadores de I&D a partir de 2009, não é evidente que o setor empresarial tenha finalmente transposto a barreira da maturidade em termos de I&D, ou que tenha ultrapassado algumas das inseguranças da juventude. Por um lado, o comportamento das empresas está muito associado aos incentivos públicos, aumentando o investimento em I&D quando estes existem ou são mais generosos. É certo que é racional aproveitar as oportunidades, e os incentivos públicos visam precisamente estimular o investimento das empresas em I&D, mas este aumento brusco da I&D empresarial e da base de empresas com atividades de I&D pode indiciar que em muitas empresas não existe uma estrutura de I&D consolidada e/ou que de outra forma muitos projetos de I&D não teriam sido realizados (por falta de meios técnicos e financeiros, escassa importância estratégica, dimensão inadequada, etc.). Esta situação de dependência dificilmente permitirá a autonomização e consolidação de estratégias empresariais de I&D na ausência ou redução significativa dos incentivos públicos. O facto do governo português em 2011 ter estabelecido o objetivo de atingir um BERD entre 1,7% a 2,1% do PIB em 2020, em clara dissonância com a evolução real dos indicadores e o estado da Economia, revela que a vontade política está em dissonância com a motivação empresarial.

Por outro lado, embora muito positiva a evolução do número de investigadores ETI para acompanhar o aumento da I&D, é intrigante a mudança súbita de Portugal para uma posição acima das médias da UE e OCDE, e paradoxal quando se relaciona o número de investigadores ETI com o investimento em I&D (GERD e BERD) que, em Portugal, é bastante inferior à média da UE e da OCDE. Portugal tem mais investigadores ETI por unidade de investimento em I&D do que a UE e a OCDE. É necessário aprofundar o conhecimento sobre a situação dos investigadores ETI nas empresas para compreender o extraordinário aumento superior a 150% ocorrido entre 2005 e 2008. Mesmo assim, Portugal apresenta uma estrutura de investigadores ETI com maior proporção de investigadores nas instituições do ensino superior e menor nas empresas, que é inversa à da OCDE.

Daqui emerge a imagem de um setor empresarial com aparente motivação (e necessidade) para investir mais em I&D, que soube aproveitar a crescente generosidade dos incentivos públicos, mas ainda sem confiança (ou meios) suficiente para consolidar a mudança estrutural recente na I&D empresarial em Portugal na ausência de políticas públicas tão generosas.

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CORPORATE R&D STRATEGY AND GROWTH OF US START-UPS: WHY MATTERS THE LICENSE-IN OF EXTERNAL PATENTS?

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Abstract. The present paper intends to estimate the effects of determinants of start-ups growth based on a corporate R&D strategy characterized by the innovative intensity of the firm, using as proxies, the R&D intensity, the start-up's patent portfolio and the business models for patent management, e.g., license-in and license-out, by making use of a panel data approach. We control for the technological intensity through the NACE classification, being the purpose to focus on the high-tech and medium high-tech start-ups. By using a two-step panel data model, static and dynamic estimations are performed among a sample of 818 firms created in 2004 and tracked by the Kauffman Foundation in the subsequent six years. The major results show a significant and positive impact of R&D intensity and the license-in of external patents on the start-ups growth and a negative and significant effect of the squared R&D intensity on the growth path of the firm, revealing a U-inverted relationship to firm's growth, a positive impact on firm growth in an early stage, succeeded by a negative after achieving the optimal level. These conclusions are also ratified when controlling the activity sector, having a major impact on sectors like high-tech manufacturing industries and high-tech knowledge intensive services.

Key words: Firm's growth; Panel data; Patent management; R&D intensity.

JEL Classification codes: L26; O34.

1. Introduction

In high-tech sectors the pace of technological change is commonly high and tends to shorten product's lifecycle. In this connection, and in order to avoid competition, which in this type of sector also tends to be extremely high, firms' success can depend on their IP rights and on the early-mover effect. In innovation intensive industries, patents facilitate active, creative and tradable markets for technology. Also, the protection of knowledge through patents enables innovators to act as licensors and make their assets commercially available to licensees (Joshi & Nerkar, 2010).

Helmers & Rogers (2011) argue that patents, allow inventors to exploit in a successful way, their inventions conferring firms a competitive advantage in terms of an increased performance when comparing to non-patenting firms.

The paper makes an analysis of the theoretical background regarding the determinant factors of firm growth and additionally reviews the literature on corporate R&D strategy focusing on patenting as determinant for firm growth. This paper significantly differs from previous studies on one count. It employs corporate R&D strategy factors (such as R&D intensity, patent portfolio, business models for patent management, e.g. license-in and license-out of patents) that are directly connected with firm growth.

The paper is outlined as follows. Section 2 develops the theoretical underpinnings, drawing from the literature on firm growth, reviewing the main firm growth theories, major factors of firm growth, uncovering the determinants based on R&D investment efforts analyzing the theoretical background on patents acting as determinants for firm growth. Section 3 presents the empirical approach and discusses the results. Section 4 concludes and provides policy implications as well as guidelines for

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entrepreneurs and practitioners in the framework of technological entrepreneurship and firm growth based on corporate R&D strategy factors, especially the one related to business models for patent management.

2. Literature review and research hypotheses

Firm growth is a topic that has been the target of several analyses in the literature from different approaches, due to its importance and relevance for firm survival, generation of employment, increased economic growth and dynamism as well as the industrial concentration of firms, the process of firm selection and competitiveness in the sequence of diverse efficiency levels, and the introduction of innovation and technological change (Suárez, 1999).

According to Delmar (1997) and Ardishvili *et al.* (1998) there are several indicators when measuring firm growth, such as: the financial or stock market value; the number of employees; the total sales and revenues; the productivity; the value of production; and the gross value added.

Kirchhoff & Norton (1992) used three measures denoting their interchangeability in the way that they produce the same set of results when tested in a period of seven years, namely employment, total assets and sales.

Delmar *et al.* (2003) after analysing several measures defend that the use of different indicators has to do with the objectives of the investigation. He also poined out to some limitations of the measures. For instance sales, although easy to access, can be an unsatisfactory indicator since it can be biased by the firm's arbitrary decisions and strategies and in the sequence of vertical integration of the production processes, being also sensitive to currency exchange rates and inflation. Value added, although is capable of explaining the internal activity, is not publicly available and assets can loose explanatory capacity specially if applied to services.

Authors like Penrose (1959) and Kimberley (1976) state that the number of employees can be a good indicator as they are suitable to explain organizational complexity and managerial implications of growth. Nevertheless, Delmar *et al.* (2003) defend that the use of number of employees doesn't reflect the strategic decisions of firms, such as labour productivity, technological change, labour processes and others.

Scherer (1970) pointed to a set of factors that influence size and growth, such as the economies and diseconomies of scale, mergers and acquisitions, government policies, and stochastic determinants of market structure.

Storey (1994) presented a classification based on three main groups of determinant factors for firm growth: the ones related to the entrepreneur; the ones that are concerned to the firm; and the ones associated with the corporate strategy. The first group takes into consideration the individual resources of the entrepreneur, such as motivation, unemployment, education, management experience, number of founders, prior self-employment, family history, social marginality, functional skills, training, age, prior business failures, prior sector experience, prior firm size experience and gender. The second group deals with age, sector, legal form, location, size and ownership. The third one has to do with measures like workforce and management training, external equity, technological sophistication, market positioning and adjustments, planning, new products, management recruitment, state support, customer concentration, competition, information and advice, and exporting.

Accordingly to Storey (1994), firms can be divided in three main groups, the ‘failures’, the ‘trundlers’ and the ‘flyers’. The first ones tend to exit after entering into the market. The second ones survive until the observed period but don't reflect change in size. The last ones are the firms responsible for net job creation and increase in size.

Following Gibrat (1931), Mansfield (1962) and Audretsch *et al.* (2004) the so called Gibrat’s Law, which is also known as the Law of Proportionate Effect, states that the growth rate of a firm is

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independent of its size at the beginning of the examined period, being the probability of a proportionate change in size during a certain period the same for all firms in a specified industry, not denoting influence the size of the firm at the starting period under consideration. Taking the previous into account we hypothesize that:

H_1: The firm's growth has a negative and significant relationship with size.

Several studies focused on the relationship between performance and corporate R&D (using R&D expenditures as a proxy) oriented to innovative activities and products.

For instance Morbey & Reithner (1990) stated that the investment of firms on R&D is positively related to the firm growth and with the generation of knowledge flows needed for product and process innovation. In this sense, R&D activity is supposed to contribute to the success of firms that are dedicated to an innovative strategy.

In the light of the theory of the resource-based view (Barney, 1991; Makadok, 2001) valuable, rare and inimitable resources can act as competitive advantage for firms in order to grow either, under a sustainable basis.

Kumar & Siddharthan (1994) analyzed the positive relationship between the performance of low and medium technology industries and R&D expenditures.

Geroski & Toker (1996) by analyzing a sample of 209 leading UK firms concluded that innovation has a significant positive relationship with sales growth. Roper (1997) makes use of a survey data on 2721 small UK, Irish and German firms in order to verify the positive effect of the introduction of innovative products by firms on sales growth.

Most scholars in studies on growth and innovation used R&D intensity as a proxy for innovation. The 'R&D intensity' refers to a firm's expenditure in new technology development and product innovation, by taking as reference the total sales (Li, 1999).

Freel (2000), by studying 228 small UK manufacturing firms, concluded that innovators are likely to grow more rapidly than non-innovators. Nonetheless, when focusing on the pharmaceutical sector, Bottazzi *et al.* (2001) didn't found any significant effect of a firm's innovative behavior on sales' growth. Del Monte & Papagni (2003) also verified a positive relationship between sales growth and R&D activity, when analyzing a sample of Italian manufacturing firms.

Regarding the studies performed by Ural & Acaravci (2006), R&D for technological innovation has a central position in the definition of the business strategy for firms, especially in the selection of the competition mode.

In accordance with Wiklund *et al.* (2010) and Anderson & Eshima (2011) the resources of a firm are of critical importance to the development of the firm's capacity to be innovative, proactive and assume a risk-taking behavior. In this vein, the possession by a firm of a set of intellectual property IP assets is an important factor that determines the ability to undertake strategies that result in positive outcomes. The authors defend that firms (and especially younger firms with less than 5 years) with more intangible resources are more prone to perform strategically in order to pursue opportunities that in the long-term generate higher sales. Thus:

H_2: The firm's growth has a positive and significant relationship with R&D intensity.

Despite the theoretical background on the positive relationship between firm growth and R&D intensity, several scholars defend that this is not always a linear relationship (Ittner & Larcker, 1998; Canibano *et al.*, 2000; Luft & Shields, 2003). Penrose (1959)'s growth theory also stated that firms aren't able to pursue an unlimited expansion line regarding R&D investments since they are constrained by managerial capacity limitations, being these investments responsible for non-positive

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effects on operating performance. Similarly, Hitt *et al.* (1997) and Bharadwaj *et al.* (1999) found a negative impact of R&D investments on firm's performance.

In addition, R&D investments can denote a positive impact on firm growth in an early stage, although it turns to be negative after achieving the optimal level.

Regarding their study of Portuguese SME's, Serrasqueiro *et al.* (2010) denote that R&D intensity is an important determinant for the survival of firms, presenting a significant non-linearity over growth distribution. In this vein, they defend that Gibrat's Law cannot be rejected in the light of size reductions of the firms analyzed, being rejected when the firm size increases. R&D intensity is then considered by the authors as a restrictive determinant of the firm's growth when considering a reduction in size, acting as a catalyst for growth in the presence of an increased size. Thus:

H_3: R&D intensity of the firm has a U-inverted relationship with its growth.

Cuervo (2005) states that if there is a market for almost everything, the firm's competitive advantage for growing can be based on its accumulated intangible assets (knowledge capital) either in the forms of brands, reputation, knowledge or in the form of decision and problem-solving systems, such as the organizational routines and the incentive systems.

According to Baumol (1990) and Wennekers & Turik (1999) entrepreneurship and the process of new firm entry is a key aspect for economic development, contributing to economic growth through the generation, dissemination and exploitation of innovative ideas, enabling efficiency, productivity, increased competition and providing diversification among firms.

Regarding the Helmers & Rogers (2011)' work, by allowing inventors to profit from their inventions, patents are determinant to confer firms that own this kind of IP asset a competitive advantage conveying an improved performance and subsequent growth when comparing to non-patenting firms. Conversely the patent system makes efforts to motivate the creation of new firms based on inventions, relying on their patent assets to generate a share of the market and achieve additional revenues from their innovativeness. Thus, the patent system works to rectify the appropriability problem, especially when dealing with new and small firms. Start-ups that patent shall, therefore, be more successful than the non-patenting ones. In addition, Rosenbusch *et al.* (2011) also convey that there is a relationship between the SME's growth and an innovation-centric corporate strategy. Thus:

H_4: The firm's growth has a positive and significant relationship with the patent portfolio.

Schneider & Veugelers (2010) call the attention for the importance of young and innovative firms fostering innovation and growth.

The main obstacles for the few studies covering this topic are explained by Helmers & Rogers (2011), due to difficulties in capturing the effects of a patent in a firm's performance. For instance there is not so much data available on the patenting of start-up firms, since small firms report very little on their activities, there is no financial data regarding economic performance, before and after the patent was filled, published or granted, and there is no comparison data with a control group of non-patenting start-ups.

Furthermore, Helmers & Rogers (2011) state that since only a few patents protect really innovative and breakthrough inventions and some of these are associated with small firms, there is a parallel between the patent value distribution and the new firm performance distribution. Subsequently the authors refer the concept of the one in one hundred, from which is expected to value and bring to success one patent in one hundred.

In terms of theoretical background there is a set of authors that have been working on the impact of the patent system on the performance of start-ups and innovation.

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The effects of the geographic extension of patents, specific coverage of the international patent classification and the subsequent number of patent citations over the creation of new firms and subsequent growth were analyzed by Shane (2001), revealing the existence of a stimulus effect.

Shane & Khurana (2003) analyzed the firm creation effect based on a patent licensed from the MIT (Massachusetts Institute of Technology), concluding that there is a sequential effect in the past entrepreneurial experience and the creation and growth of a start-up based on an invention.

Jaffe & Lerner (2001) and Bessen & Meurer (2008) analyzed the possible inefficiencies of the patent system, addressing questions like patenting and minimizing competition, causing entry barriers to new firms, increasing of costs associated with sequential and incremental innovation and patent races.

Other authors analyzed the trade-off between costs and benefits in choosing IP formal mechanisms versus informal mechanisms. For example Anton & Yao (2004) focused on the small and medium value innovations which are object of patenting instead of high value innovations. This is explained by the authors having in mind that if the property rights protection is weak, mainly in the cases of process inventions, the threat of imitation due to disclosure of an invention by patenting can be disadvantageous.

Langinier (2004) focused on patents as a strategic barrier to entry. He concluded that if the demand from the market is high the patent can make the competitor stronger if he respects the novelty requirement, however if the demand is low and the patent holder renews the patent this will work against the firm.

Nerkar & Shane (2007) reviewed the effect of attributes of inventions in their successful commercialization, being some inventions easier and less risky to transfer than others, for instance more applied inventions instead of more basic science based ones.

The authors analyzed the impact of three attributes of technological inventions that influence the strategic performance of the commercialization and transfer process. Firstly, the scope of the patent which if it is broader can allow the appropriation of greater returns if commercialization is successful by covering a wider range of technical areas and also increases the likelihood of new firms being created to commercialize the invention. Secondly, the pioneering nature of the invention by increasing the incentive of owners to invest in the commercialization of the patent is able to provide the first mover effect and learning curve advantages, like the avoidance of imitators and the creation of similar products and processes. Thirdly, the age of the invention increases the possibilities of commercialization, since issues like uncertainty regarding the value of the patent and the inexistence of information on the market and the technology tend to disappear. Nevertheless the age attribute can also be a barrier, by decreasing the number of years of the patent, the returns from its commercialization decline and also by enabling more competitors to develop substitute products. Thus:

H_5: The firm's growth has a positive and significant relationship with firms' license-out activity of internal patents.

Kultti *et al*. (2007) also focused on motives of firms to opt for patents instead of other non-formal IP mechanisms such as secrecy. One such motive can derive from the fact that opting for a patent the firm can avoid the entrance of a possible competitor and be the first innovator in the market, assuring freedom to operate. This is the particular case of high-tech firms.

Hall (2007) has devoted attention on the problematic about the decrease of the average quality of patents. Additionally there are some concerns regarding the role of patents in small firms and start-ups, since the high costs of patenting, the behavior of large firms, the fast growth in overall patenting and the uncertainties over enforceability are not in favor of that type of firms.

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Hudson *et al.* (2007) refer to the comparison between patterns of patenting and generation and performance of start-ups in US which tends to be higher than in Europe.

Mann & Sager (2007) analyzed the patenting behavior of venture-backed software start-ups in the US, denoting a positive impact of patents on firms' performance, namely on the survival rate, growth and income received.

Graham & Sichelman (2008) reviewed the role of patents to start-up firms underlying the possibility of bringing competitive advantages, since these firms will only be able of capitalizing over their knowledge and inventions if the later are protected by patents, excluding other firms from appropriating the outcomes of the assets. Additionally the referred authors confer patents the advantage of firms achieving a more secure protection, especially in inventions where imitation and reverse engineering are relatively easy. They also suggest the possibility of patents to works as a signaling mechanism for small and young firms securing venture investment and financing the transformation process of an intangible asset into a property right. The same authors call the attention for the possibility of start-ups to obtain income via licensing, being an attractive business model for start-ups that are not interested in producing and marketing their inventions. The motives that explain the investment of start-ups in building a patent portfolio are concerned with the possibility of blocking competitors, having bargaining power for cross-licensing agreements and assuring a defense mechanism when being accused of infringement over third parties' patents rights.

Following this line of reasoning, Hsu & Ziedonis (2008) pointed out that in order to obtain external finance, start-ups can affect in a positive way the investors' valuation, by making use of patents as signaling mechanism for investors to preview the firm's potential. Accordingly, Colombo & Grilli (2010) studied the effects of the human capital of founders and their access to venture capital (VC) acting as key drivers of the growth and success of new technology-based firms. They conclude that for non-VC-backed firms the set of skills of founders is positively related to the growth of firms. Furthermore, for VC-backed firms their investors act as scouts conducting performance levels.

In addition, Cucculelli & Ermini (2012), defend that the introduction of new products is positively correlated with growth in multiproduct firms, referring that new product is also associated with the growth of R&D intensive sector' firms and sectors that absorb externally originated patents. Thus:

H_6: The firm's growth has a positive and significant relationship with the firm's license-in activity of external patents.

The appropriability regime and its strength can provide a barrier against imitation from competitors, creating sustainable advantages for the new firm entry and growth, either by limiting competition or by increasing the costs of competitors, or even increasing the value of the firm, providing additional bargaining power (Tuppura *et al.,* 2010). This study is aligned with previous studies on appropriability as a key variable that influences the successful entry and growth strategies for radical innovations (Montaguti *et al.*, 2002). Moreover, the authors stress that the higher the appropriability the higher the option for a penetration strategy, in the sense that this type of strategy requires protection from rapid competitive imitation.

Parker *et al.* (2010) and Kosters (2010) focused their attention on high growth firms, the so called "gazelles", and the role of patents in the growth performance of this type of firms. The concept of "gazelle firms" was firstly studied by Birch (1979). The author defined it as a small group of high-growth firms responsible for the creation of the majority of new net jobs in economy. In contrast the "Elephant firms" correspond to the few large companies in charge of generating a large employment share, being however a few percentage of these jobs new. A third typology corresponds to the "Mice firms", small, characterized by a very slowly growth and a reduced rate of employment growth.

Joshi & Nerkar (2010) state that patents facilitate the markets for technology, since they reduce uncertainty giving the inventor the exclusive right to use for a specific period of time the knowledge

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asset represented by the patent earning entrepreneurial incomes from licensing or exploiting the asset.

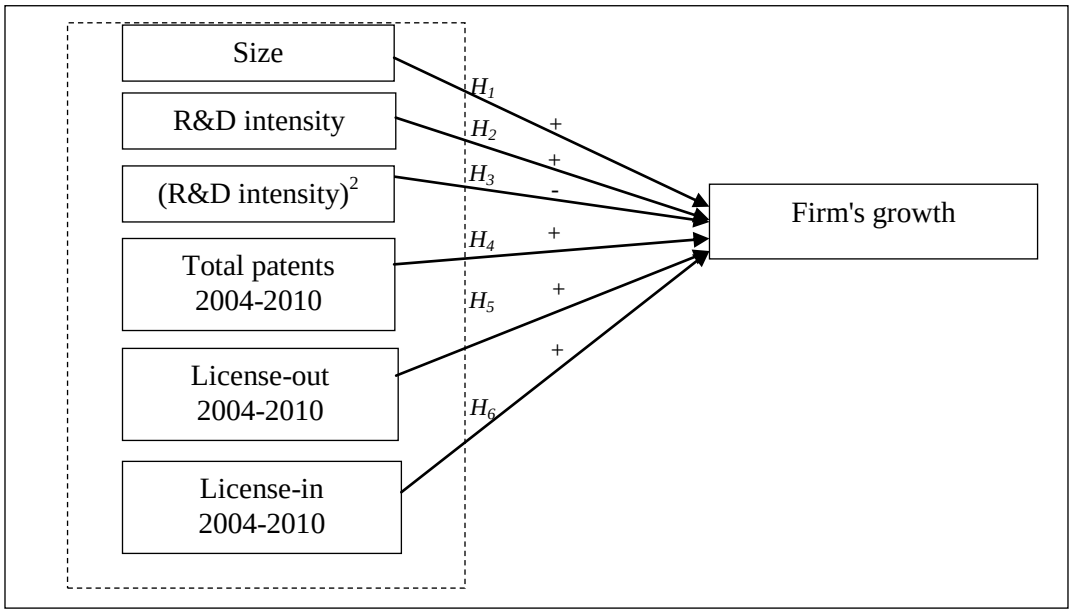
Graham *et al.* (2010) focused on the use and usefulness of patents on start-ups. Firstly they differentiated between start-ups with and without venture capital. They also detected divergences among industries, for some sectors like biotechnology patents are of extreme importance, while for others, software for example, patents are avoidable. The authors concluded that patents provide limited incentives to invent and few advantages for commercializing innovations, because of the high costs around the system, being also difficult to avoid competitors to invent around. Aside of this, they recognize the importance of patents to avoid imitation and securing external sources of funding, by attracting reputation added to the intangible assets and thus supporting the firm in the growth path.

3. Methodology

3.1 The model

Based on the literature review, a conceptual model is proposed, in which are explored the relationships between growth and determinant factors, namely, size and corporate R&D strategy factors (e.g. R&D intensity, patent portfolio and business model for patent management) as displayed in Figure 1.

Fig. 1 Corporate R&D Strategy and Firm's Growth: Conceptual model



3.2. Dataset and model specification

3.2.1 Variables and measurement

The present paper makes use of the Kauffman Firm Survey (KFS)[1], which is a panel study of 4,928 firms founded in 2004 and tracked over their early years of operation until the next six years. This longitudinal panel was created from a random sample of the Dun & Bradstreet (D&B)'s database list of new businesses started in 2004, embracing approximately two hundred fifty-thousand businesses. For achieving the goals of the present paper the KFS dataset was adapted in order to focus on the set of variables under analysis.

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The present paper intends to estimate the effects of corporate R&D strategy factors on firm's growth, by using as proxies, the R&D intensity, the patent portfolio of the firm and the business model for patent management, which is characterized by license-in and license-out activities. We will control for activity, by making use of the NACE classification for high-tech and medium high-tech firms. For this purpose, we will focus on the manufacturing industries and service firms, especially the high-tech and medium high-tech firms.

According to Coad & Rao (2008) it's important to avoid noise when selecting the proxies that are used to quantify 'innovativeness'. To avoid the noise effect, we gather information on both innovative input (R&D efforts) and output (patents), assuring that we obtain useful data on the corporate R&D strategy, since we consider both R&D expenditure and patent data.

The variables included in the conceptual model previously proposed are described in Table 1. The focus of the present paper resides on the assessment of the importance of a selected set of determinant factors related to the corporate R&D strategy on firm's growth, by using a sample of US start-ups. Some of the variables, for instance, R&D intensity and squared R&D intensity, were computed by making use of the variables R&D expenditures and total revenues. Furthermore, the firm's growth is computed through the average annual change of total assets, and the size's variable corresponds to the log of employees' number. We will use as control variables the firm's technological intensity, based on the NACE classification from the OECD[2].

Table 1. Measurements of the variables representing the conceptual model

Variables	Measurement
Firm's growth	Average growth rate of period based on average annual change in firms' total assets.
Size	Log value of total number of employees.
R&D intensity	Mean R&D intensity per year, calculated by R&D expenditures over total revenues.
$(\text{R\&D intensity})^2$	Squared R&D intensity.
Total patents 2004-2010	Patent count.
License-out 2004-2010	A dummy indicating whether the firm licensed out any patent.
License-in 2004-2010	A dummy indicating whether the firm licensed in any patent.
Technological intensity	A control variable indicating the NACE classification of activity - in this case only the firms from NACE 32 and 33 and 72 corresponding to the high-tech sectors (OECD's definition of high-tech sectors for manufacturing firms in the cases of NACE 32 and 33 and knowledge intensive service firms in the case of sector 72). The NACE 31 corresponds to the set of medium high-tech sectors of manufacturing firms.

In this paper the relationships between the firm's growth and the corporate R&D strategy factors, namely, patents owned by a firm, its R&D intensity, business model for patent management and size, were analyzed by using panel data analysis. The panel data has several advantages such as: (i) we can deal with more observations and less multicollinearity, which will increase precision in estimations; (ii) it gives the possibility of controlling for cross-section effects; and (iii) when extended to a dynamic model it gives the possibility of addressing potential endogeneity problems related to the explanatory variables.

The population of the study consists of all firms (818) found on the KFS survey, from the high-tech and medium high-tech sectors, in the period 2004-2010. In this survey we found three high-tech sectors, the 32 (Manufacture of radio, television and communication equipment and apparatus) and the 33 (Manufacture of medical, precision and optical instruments, watches and clocks) for manufacturing firms and the 72 (Computer and related activities) for knowledge intensive service firms and 1 medium high-tech sector, namely the 31 (manufacture of electric machinery and apparatus).

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3.2.2. Selection of the model specification

When considering the use of panel data the same cross-sectional unit is surveyed over a period of time, having as premise the fact that panel data has a space and time dimension. Due to the fact that we are dealing with a panel data of firms, or other units like for instance individuals or states, over time, it's possible to observe heterogeneity in these units. Additionally, by the combination of time-series of cross-section observations, the panel gives more informative data, more variability, less collinearity among variables and increased efficiency. The analysis hereafter presented is based on pooled ordinary least squares (OLS), and both random and fixed effects panel estimations.

Greene (2008) presents the basic regression model as follows:

$$Y_{it} = \beta X_{it} + z_i \alpha + \varepsilon_{it} \qquad (1)$$

where $i = 1,2,...N$, referring to a cross-section unit, $t = 1,2,...T$, relating to time period, Y_{it} corresponds to the dependent variable, being X_{it} the explanatory variables, without the inclusion of a constant term, ε_{it} refers to the disturbance term and β are the unknown coefficients which vary in relation to individuals and time. The individual effect is given by $z_i\alpha$ where z_i contains a constant term and additionally a set of individual or group specific variables.

In the case where z_i is unobserved and correlated with X_{it} the least squares estimator of β is considered biased and not consistent due to an omitted variable. The model is expressed in the following terms:

$$Y_{it} = \beta X_{it} + \alpha_i + \varepsilon_{it} \qquad (2)$$

considering $\alpha_i = z_i\alpha$ contains all the observable effects and specifies an estimable conditional mean. In this sense, this fixed effects perspective assumes α_i as a group-specific constant term in the regression model.

In the case of unobserved individual heterogeneity, although formulated, it can be assumed to be uncorrelated with the included variables, being the model then formulated as follows:

$$Y_{it} = \beta X_{it} + \alpha + u_i + \varepsilon_{it} \qquad (3)$$

being this random effects perspective what specifies that u_i is a group specific random element.

By considering the static panel data models and regarding the determinants of firm's growth for the present study the estimation can be presented through the following models:

Model I: $$Firm's\ growth_{it} = \beta_1 (Total\ \ patents)_{it} + \beta_2 (R\&D\ Intensity)_{it} + \alpha_i + \varepsilon_{it} \qquad (4)$$

Model II: $$Firm's\ growth_{it} = \beta_1 (Total\ \ patents)_{it} + \beta_2 (R\&D\ Intensity)_{it} + \\ + \beta_3 (License-in)_{it} + \beta_4 (License-out)_{it} + \alpha_i + \varepsilon_{it} \qquad (5)$$

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Model III: $$Firm's\ growth_{it} = \beta_1(Total\ \ patents)_{it} + \beta_2(Size)_{it} + \beta_3(R\&D\ Intensity)_{it} +$$

$$+\beta_4(R\&D\ Intensity)^2{}_{it} + \beta_5(License-in)_{it} + \beta_6(License-out)_{it} + \alpha_i + \varepsilon_{it} \qquad (6)$$

4. Results and discussion

The choice of the better model was based on the assumption of the Hausman Test. This test implies the presence of a significant correlation between individual specific effects and the set of explanatory variables.

According to Greene (2008) when performing the Hausman Taylor test, in order to decide between fixed or random effects, and being the null hypothesis that the preferred model is random versus the alternative fixed effects as it tests if the unique errors (u_i) are correlated with the regressors stating the null hypothesis that they are not, we can conclude for choosing the fixed effects model, since the P-value is 0.000 (i.e. statistically significant) which is lower than 0.005.

In Table 4 (Model III) one can see the results of all explanatory variables on firm's growth. The fixed effects model was chosen as the best model, since the Hausman Test result obtained the value of 18.43 for a P-value of 0.0007.

The results from the estimation of the static panel models are presented in tables 2, 3 and 4 below.

Table 2. Static panel models (Model I)

Dependent variable: **Firm growth**	**Random effects**	**Fixed effects**
Independent variables:		
Total patents		
	0.1334946	-0.0275582
	(0.1780455)	(0.2206556)
R&D intensity		
	-6.90e-08	-0.0000357
	(5.33e-06)	(6.60e-06)***
Observations		
Wald	5726	5726
F	0.59	
R^2		14.93
Hausman (χ^2)	0.0001	0.0060
	33.38***	

Notes: Robust standard errors are presented within brackets. The Wald tests are used for testing the null hypothesis of non-common significance of the parameters of the explanatory variables against the alternative hypothesis of common significance of the parameters of the explanatory variables. F tests the null hypothesis of non-common significance of the estimated parameters against the alternative hypothesis of common significance of the estimated parameters.
*significant at 10%
**significant at 5%
***significant at 1%

As illustrated in table 2, the results of the *F* and *Wald* tests show that there are some effects of the explanatory variables on the dependent variable. Although the total number of patents has no significant effect on firm's growth, R&D intensity on its side has a negative and significant (at 1%) effect on the dependent variable. Thus, we fail to reject hypothesis H_2, denoting a negative although significant impact on the dependent variable. By analyzing the results obtained for the two methods, we can state that by not considering the existence of individual effects, the impact of some variables on the dependent variable, in this case the R&D intensity, is under-valuated, in the sense that the coefficient of the variable increases considerably when the fixed effects model is performed.

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The result obtained through the Hausman test, allows us to reject the null hypothesis at 1% significance level. Moreover, it points out that the non-observable individual effects are not correlated with the explanatory variables. Thus we can conclude that the most adequate method to perform the estimation is the fixed effects method.

Next table show the results of the estimation for the model II, adding to model I the patents transactions, either by the license-in of patents or by the license-out of patents.

Table 3. Static panel models (Model II)

Dependent variable: **Firm growth**	**Random effects**	**Fixed effects**
Independent variables:		
Total patents		
	0.0356484	-0.0966291
	(0.1816797)	(0.2222627)
R&D intensity		
	-2.30e-06	-0.0000366***
	(5.41e-06)	(6.68e-06)
License-in		
	12.03784***	9.4966252***
	(2.891837)	(3.573846)
License-out		
	-3.273883	5.647507
	(5.476571)	(6.79571)
Observations		
Wald	5726	5726
F	17.93	
R^2		9.72***
Hausman (χ^2)	0.0022	0.0079
	18.43**	

Notes: Robust standard errors are presented within brackets. The Wald test is used for testing the null hypothesis of non-common significance of the parameters of the explanatory variables against the alternative hypothesis of common significance of the parameters of the explanatory variables. F tests the null hypothesis of non-common significance of the estimated parameters against the alternative hypothesis of common significance of the estimated parameters.
*significant at 10%
**significant at 5%
***significant at 1%

The results of the F and Wald tests also reveal some impact of the explanatory variables on firm's growth. Despite the fact that total number of patents and the license-out variables show no significant effect on firm's growth, license-in denotes a positive and significant impact (at 1%) when considering the random effects model. Running the fixed effects model we can state that besides the positive and significant impact of license-in over firm's growth, R&D intensity also denotes a negative and significant (at 1%) effect on the dependent variable. Thus we fail to reject hypothesis H_2 concerning the existence of a significant effect of R&D intensity on firm's growth, although in a negative way and we also fail to reject hypothesis H_6, stating that there exists a positive and significant impact of patents license-in over the firm's growth.

The Hausman test result show us that by rejecting the null hypothesis at 1% significance level we conclude that the fixed effects method is the most adequate method to perform the estimation.

Table 4 presents the results of the estimation for the model III, where we add to model I and model II the firm size and the squared R&D intensity.

Table 4. Static panel models (Model III)

Dependent variable: **Firm growth**	**Random effects**	**Fixed effects**
Independent variables:		
Total patents		

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	0.0388338	-0.074706
	(0.1817799)	(0.2226921)
R&D intensity		
	5.88e-06	0.0000599***
	(0.0000179)	(0.0000218)
License-in		
	12.08816***	9.561642***
	(2.897496)	(3.576621)
License-out		
	-2.943657	7.771476
	(5.509136)	(6.810741)
Size		
	-0.0409015	0.1083449
	(0.0794618)	(0.1310199)
$(\text{R\&D intensity})^2$		
	-9.69e-12	-1.28e-10***
	(2.20e-11)	(2.70e-11)
Observations		
Wald	5726	5726
	17.93***	9.72***
F		18.43***
R^2	0.0026	0.0050
Hausman (χ^2)	18.43**	

Notes: Robust standard errors are presented within brackets. The Wald test is used for testing the null hypothesis of non-common significance of the parameters of the explanatory variables against the alternative hypothesis of common significance of the parameters of the explanatory variables. F tests the null hypothesis of non-common significance of the estimated parameters against the alternative hypothesis of common significance of the estimated parameters.
*significant at 10%
**significant at 5%
***significant at 1%

The results obtained for the F and Wald tests denote significant impact of the set of explanatory variables on the dependent variable. When using the random effects method, the results of the estimations point to a positive and significant impact (at 1%) of license-in on the firm's growth, although we verify the inexistence of significant effects concerning other explanatory variables. When contrasting the results obtained through the two methods, we can defend that when we don't consider the existence of individual effects, the impact of some variables on the dependent variable is under-valuated. In this sense the coefficients of some variables increase considerably when we run the fixed effects model. The total patents, license-out and size denote no significant impact on firm's growth.

Nevertheless the license-in of patents and the R&D intensity show a positive and significant effect (at 1%) over the firm's growth. Furthermore, the squared R&D intensity denotes a significant effect (at 1% level) on the firm's growth although in a negative way. In this way we fail to reject hypothesis H_2 and H_6 concerning the existence of a strong effect of R&D intensity and license-in of patents over the firm's growth, and also fail to reject hypothesis H_6, which argues there exists a significant impact of the squared R&D intensity on the firm's growth, since we find empirical evidence about the existence of an U-inverted shaped curve, concerning the relationship between growth and R&D intensity.

The Hausman test result show us that by rejecting the null hypothesis at 1% significance we conclude that the fixed effects method is the most adequate method to perform the estimation.

In the present paper, firms are displayed in two groups by NACE classification corresponding to the firms belonging to the high-tech sector namely, NACE 32 (manufacturing firms of radio, television and communication equipment and apparatus), NACE 33 (manufacturing firms of medical, precision and optical instruments, watches and clocks) and NACE 72 (knowledge intensive service firms in the

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field of computer and related activities) and firms belonging to the medium high-tech sector namely, the NACE 31 (Manufacture of electric machinery and apparatus).

In this sense the previous model was expanded with group-specific effects for the NACE classification, for providing tests for the sub-groups of firms.

Coefficients of the explanatory variables related to each of the four groups were obtained from the model III which can be defined as follows.

$$Firm's\ growth_{it} = \sum_{b=1} \alpha_b Group_b + \sum_{b=1} \sum_{c=1} \beta_{bc} \left(Explanatory\ Variables_{cit} \right) + \varepsilon_{it} \qquad (7)$$

In table 5 the effects of the set of explanatory variables on each of the four groups of medium high-tech firms and high-tech firms, are presented.

Table 5. Effects of explanatory variables on firm's growth by NACE classification: Static panel model (Model III)

Dependent variable: **Firm's growth**		**Fixed effects**		
Independent variables:	**Medium high- tech firms**	**High-tech firms**		
	NACE 31	**NACE 32**	**NACE 33**	**NACE 72**
Total patents	0.5398951	-0.61375	0.0648638	0-1833405
	(1.271934)	(0.5928311)	(0.2056365)	(3.36721)
R&D intensity	-6.93e-06	0.0002051**	1.05e-06	8.94e-06
	(0.000075)	(0.0000892)	(0.0000159)	(0.0016266)
License-in	1.478734	39.86206***	-0.5130497	2.156899
	(3.979211)	(12.85977)	(2.805205)	(17.49601)
License-out	0.1690885	8.769738	6.598083	-0.2948615
	(6.324638)	(22.52544)	(5.677249)	(52.99631)
Size	0.094622	0.9374975	0.0426836	-0.1628666
	(0.105214)	(0.6968148)	(0.1079569)	(0.2535601)
$(\text{R\&D intensity})^2$	1.23e-11	-4.35e-10***	-1.02e-11	4.45e-10
	(1.32e-10)	(1.05e-10)	(1.99e-11)	(2.69e-08)
Observations	357	1057	3626	686
F	0.22	10.06	0.47	0.07
R^2	0.0043	0.0629	0.0009	0.0007

Notes: Robust standard errors are presented within brackets. Wald tests the null hypothesis of non-common significance of the parameters of the explanatory variables against the alternative hypothesis of common significance of the parameters of the explanatory variables. F tests the null hypothesis of non-common significance of the estimated parameters against the alternative hypothesis of common significance of the estimated parameters.
*significant at 10%
**significant at 5%
***significant at 1%

Regarding the effects of the set of explanatory variables on firm's growth by firm sector and considering that in our sample of high-tech and medium high-tech sectors we have founded 4 sectors, namely the 31 (manufacture of electric machinery and apparatus) corresponding to the medium high- tech sector of the sample, the 32 (manufacture of radio, television and communication equipment and apparatus), the 33 (manufacture of medical, precision and optical instruments, watches and clocks) and the 72 (computer and related activities) corresponding to the high-tech sector of the sample, we can conclude that for the sectors 31, 33 and 72 the explanatory variables show no impact on the explained variable. On the contrary, and confirming the results obtained

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through the F test, which denote impact of the set of explanatory variables on the dependent variable, for the sector of manufacture of radio, television and communication equipment and apparatus, which is an high-tech manufacturing sector, the license-in of patents denote a positive and significant effect (at 1% level) on firm's growth.

Additionally, the R&D intensity shows a positive and significant impact on the firm's growth (at 5% level) and the squared R&D intensity denotes a negative and significant impact on the firm's growth (at 1% level).

We therefore support previous considerations by failing to reject hypothesis H_2, H_3 and H_6, being a positive effect for H_2 and H_6 and a negative effect for H_3.

With the intention of verifying if the firm's growth is adjusted by the effect of the set of explanatory variables under analysis and in order to contrast the results obtained through the static panel estimation we will present the results of the dynamic panel coefficients.

By considering the determinants of firm's growth, previously defined, the estimation can be presented in accordance with:

Model I:

$$Firm's\ growth_{it} = \gamma Firm's\ growth_{it-1} + \beta_0 + \beta_1 (Total\ \ patents)_{it} + \\ + \beta_2 (R\&D\ Intensity)_{it} + \alpha_i + \varepsilon_{it} \qquad (8)$$

Model II:

$$Firm's\ growth_{it} = \gamma Firm's\ growth_{it-1} + \beta_0 + \beta_1 (Total\ \ patents)_{it} + \beta_2 (R\&D\ Intensity)_{it} + \\ + \beta_3 (License-in)_{it} + \beta_4 (License-out)_{it} + \alpha_i + \varepsilon_{it} \qquad (9)$$

Model III:

$$Firm's\ growth_{it} = \gamma Firm's\ growth_{it-1} + \beta_0 + \beta_1 (Total\ \ patents)_{it} + \beta_2 (R\&D\ Intensity)_{it} + \\ + \beta_3 (R\&D\ Intensity)^2{}_{it} + \beta_4 (License-in)_{it} + \beta_5 (License-out)_{it} + \beta_6 (Size)_{it} + \alpha_i + \varepsilon_{it} \qquad (10)$$

Next, we present the results of the dynamic estimator GMM (Generalized Method of Moments) for the three models under consideration. Results are presented in table 6 below.

Table 6. Dynamic model GMM for explanatory variables on firm's growth

Dependent variable: **Firm growth**			
Independent variables:	**Model I**	**Model II**	**Model III**
Firm growth$_{it-1}$	-0.0057396 (0.017956)	-0.0084947 (0.0179368)	-0.0076616 (0.0179156)
Total number of patents	-0.016035 (0.459021)	-0.0294823 (0.4605002)	-0.204654 (0.4608675)
R&D intensity	-0.0000367*** (0.0000101)	-0.0000388*** (0.0000102)	0.0000659*** (0.0000326)
License-in		16.7088*** (6.242826)	16.50125*** (6.237478)
License-out		4.270857 (10.48882)	5.610881 (10.50437)
Size			0.2768552 (0.2404457)

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(R&D intensity)^2			-1.38e-10*** (3.99e-11)
Instruments	GMM	GMM	GMM
Observations	4090	4090	4090
Wald	13.43***	21.70***	14.35**

Notes: Robust standard errors are presented within brackets. Wald tests the null hypothesis of non-common significance of the parameters of the explanatory variables against the alternative hypothesis of common significance of the parameters of the explanatory variables.
*significant at 10%
**significant at 5%
***significant at 1%

Taking into account the results obtained through the *F* test, for the first two models, at a 1% significance level, and for the third model, at a 5% significance level, we can conclude that the explanatory variables are determinant to firm's growth.

The parameter that measures the impact of last period firm's growth on the present period firm's growth is not statistically significant in none of the three models.

Moreover, when applying the dynamic model we can confirm that there are no significant changes to the results achieved through the static panel estimations, being this effect similar to the application of the three models under consideration.

Regarding the model I the variable R&D intensity has a negative and significant effect on the firm's growth. Therefore we fail to reject hypothesis H_2.

In what concerns the model II the introduction of additional variables like license-in and license-out doesn't change the overall statistical significance of the estimation when compared with the static model, as the explanatory variable R&D intensity maintains its negative and significant effect and the license-in of patents still denotes a positive and significant effect on the firm's growth. We also fail to reject hypothesis H_2 and H_6.

When we add firm's size and the squared R&D intensity to the model III the positive and significant effect of the independent variable R&D intensity on the dependent variable is ratified, as it happens with negative and significant effect of the squared R&D intensity. In this model we also find a positive and significant effect of the license-in of patents in explaining firm's growth. We still fail to reject hypothesis H_2, H_3 and H_6.

To go a little bit deeper in explaining the effects of the set of independent variables on explaining firm's growth we expanded the model III, since it is the most complete, with the group-specific effects for the NACE classification, having tested it for the sub-groups of firms. In table 7 the coefficients of the explanatory variables related to each of the four groups are displayed.

Table 7. Effects of explanatory variables on firm growth by NACE classification: Dynamic panel model (Model III)

Dependent variable: **Firm growth**				
Independent variables:	**Medium high- tech firms**	**High-tech firms**		
	NACE 31	**NACE 32**	**NACE 33**	**NACE 72**
Firm Growth$_{it-1}$	-0.0921838 (0.0848246)	-0.0173099 (0.0407389)	-0.0005099 (0.0204013)	-0.2163854*** (0.0457784)
Total patents	0.3846035 (2.807704)	-1.135208 (1.094274)	0.0226633 (0.465482)	6.084914 (48.31873)
R&D intensity	-0.0000259 (0.0001184)	0.0002936*** (0.0001344)	0.0000145 (0.000022)	-0.0004694 (0.0018125)
License-in	2.524079	67.40523***	0.1277929	2.730327

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License-out	(7.463831)	(23.08888)	(4.457442)	(31.77782)
Size	-7.350663 (18.71642)	-2.533191 (36.10568)	6.785308 (7.653061)	-
$(\text{R\&D intensity})^2$	0.2836974 (0-.1919845)	3.022028*** (1.314656)	0.170622 (0.1815026)	-0.1955736 (0.4066395)
Observations Wald	4.61e-11 (2.08e-10)	-6.21e-10*** (1.62e-10)	-1.36e-11 (2.70e-11)	7.69e-09 (2.95e-08)
	255 3.37	755 19.31***	2590 1.31	490 22.61***

Notes: Robust standard errors are presented within brackets. The Wald test is used for testing the null hypothesis of non-common significance of the parameters of the explanatory variables against the alternative hypothesis of common significance of the parameters of the explanatory variables. F tests the null hypothesis of non-common significance of the estimated parameters against the alternative hypothesis of common significance of the estimated parameters.
*significant at 10%
**significant at 5%
***significant at 1%

Regarding the effects of the set of explanatory variables on firm growth by firm sector and considering the sectors 31, 32, 33 and 72, we can conclude that for the sectors 31 (medium high-tech firms) and 33 (high-tech firms) the explanatory variables show no significant effect on the dependent variable. This result is similar to the one that was obtained through the estimation of the static model. This finding is ratified through the Wald test results, which denote a significant impact of the set of explanatory variables on the explained variable, for the sector of manufacture of radio, television and communication equipment and apparatus (NACE 32, corresponding to high-tech firms) the license-in of patents denotes a positive and significant effect (at 1% level) on firm's growth, as well as the R&D intensity that shows a positive and significant impact on the firm's growth (at 5% level for the static model and 1% for the dynamic model) and the squared R&D intensity that denotes a negative and significant impact on the firm's growth (at 1% level).

The only effect that is different from the static model is the one that is relative to the impact of size on firm's growth, which in the case of the dynamic model is positive and significant. Furthermore, for the sector of computer and related activities (NACE 72 which corresponds to an high-tech knowledge intensive service firms' sector), when performing the dynamic model the lagged variable of firm's growth shows a negative and significant impact (at 1% level) on the explained variable, denoting that the firm's growth on the present moment is impacted negatively by the firm's growth on the previous moment for the computer and related activities firms.

5. Concluding remarks

This study uses the concept of firm's growth in seeking to uncover the effects of a set of explanatory variables on its dynamics. Firm's growth, as a topic of research that has been target of several studies, was hereby analyzed under a different lens, e.g., by assessing the effects of corporate R&D strategy factors (such as R&D intensity, patent portfolio and business model for patent management) on start-ups growth.

The dimension and richness of the US start-ups dataset used allows us to achieve an unusual observation of the evolution over time of 4 different NACE sectors, namely the high-tech and medium high-tech sectors in a sample of 818 firms extracted from the KFS survey that contains 4928 firms, in a 6 year period.

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While previous studies also focused on the role played by innovation proxies, such as the R&D intensity, or the patent portfolios on firm's growth, the present paper went a little bit further obtaining in innovative way information about corporate R&D strategies based on business models for patent management, the license-in and license-out of patents in firms, and its impact on start-ups growth. In addition, the present study contributes to existent literature by gathering more information on the effects of innovation proxies on firm's growth expanding the analysis to understand this effect on high-tech and medium high-tech sectors, where the pace of technological change is usually high and tends to shorten life cycle products, and where firms tend to rely on their IP rights and on the effect early-mover (Tuppura *et al*., 2010).

Our results indicate that the set of explanatory variables representing the corporate R&D strategy determines the start-ups growth. Comparing the results of the three models in static and dynamic panels, we confirm that there are no major or significant changes in the results achieved.

Overall, R&D intensity appears to play a high and positive impact on start-ups growth, in both static and dynamic estimations. The same effect is detected on the positive and significant impact of the license-in of patents on start-ups growth.

When we add the squared R&D intensity we verified the existence of a U-inverted relationship between start-ups growth and R&D intensity.

Our results confirm that only for the sector of manufacture of radio, television and communication equipment and apparatus (NACE 32, which corresponds to a high-tech manufacturing sector) the activity of license-in of external patents has a positive and significant effect on firm's growth and the R&D intensity denotes a negative and significant impact on start-ups growth. In addition for the dynamic estimation the effect of firm's size on start-ups growth reveals to be positive and significant.

Furthermore, the empirical evidence now obtained reveal that for the sector of computer and related activities (NACE 72, which corresponds to an high-tech knowledge intensive service sector), the lagged variable of firm's growth undertakes a negative and significant impact on firm's growth, detecting a negative correlation of the firm's growth at the present moment with the firm's growth at a previous moment.

In general, our study reveals the mechanisms for patent transaction that can influence the firm's growth, especially when considering small and young start-ups, with an average size of 2.2 employees, created in 2004 and traced for the next 6 years. In this framework, the patent portfolio doesn't affect the start-ups growth, neither the firm size denotes a major impact on their performance, excluding the later effect on start-ups belonging to the sector 32 which relates to a high-tech manufacturing sector. The license-in of patents reveals to be significant and positive for the growth path of the firm and also its R&D intensity with particular focus on the high-tech manufacturing sector.

Future avenues for research into the role played by the patent portfolios, innovative business models for patent management (e.g. coopetitive licensing) and R&D intensity should include the examination of different sectors, especially the innovative service firms in order to assess the possibility of shedding more light to the variations of growth, R&D and intangibles across industries and business activities.

Consequently, different firms should use different strategies and business models for improving performance and subsequently leveraging growth. For instance, for small young firms the technology transfer activities and the open innovation schemes related to the management of patents, especially by licensing external IP rights, can be of extreme importance to foster growth patterns.

Of particular interest is the analysis of the relationship between growth and R&D intensity, which is characterized by a U-inverted relationship, being positive and significant at an initial stage but revealing to be negative later on, when dealing with this type of start-up firms, especially high-tech and medium high-tech firms.

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In terms of implications for policy makers and entrepreneurs, a problematic for future debate is: the spillover effect of open innovation and coopetition strategies, in helping young firms to consolidate their growth path. Although having a patent portfolio at an initial phase doesn't impact on the start-up's growth, it is an important factor for strengthening the corporate R&D strategy. This point is also ratified by the positive and significant effect of license-in of external patents which proved to be determinant to the start-ups growth.

End notes:

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Sectors are designated as high-tech or low-tech following the standard OECD sector classification based on NACE Rev.2 at 3-digit level to compile aggregates related to high/medium technology and low-technology (http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an3.pdf, accessed in: 2012/03/05).

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THE CLUSTERING OF CORK FIRMS IN SANTA MARIA DA FEIRA: WHY HISTORY MATTERS

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Abstract. This papers studies the reasons why most of the Portuguese cork manufacturing firms are concentrated in *Santa Maria da Feira*, a small county in the North of the country, whereas the bulk of the cork is produced in the South (*Alentejo* and *Ribatejo).* It starts with a brief introductory discussion of the advantages and limitations of clusters and industrial districts along the recent theoretical findings of evolutionary economic geography. Next, a comparative analysis of the economic performance in the last decade, of firms localized in *Santa Maria da Feira* and other regions is made, from which a strong conclusion emerges that points to an absence of clear advantages of clustered firms. Then, an exercise is made of searching the fundamental roots of the Feira's cluster in historical and socio-political reasons that are shown to be indispensable to understand and substantiate the business localization decisions of most of the cork Portuguese entrepreneurs.

Keywords: Cork industry; clusters; Portugal

1. Introduction

The cork industry is an important economic activity in Portugal, a country which is by far the largest world producer and exporter of manufactured cork products, responsible for 62 percent of the 804,7 million Euros in value exported worldwide. Corks for wine bottles are the leading product, representing about 70% of total exports (563 million Euros, of which 352 million are exports of natural corks). Cork products contribute to more than 2% of total Portuguese exports and around 30% of exports of forest products. The main export destinations are the wine-producing countries, notably France, Italy and the U.S.A. (APCOR 2011).

The nearly 600 companies belonging to this sector employ more than 8.000 workers and produce about 40 million corks per day, of which 35 million are produced in *Santa Maria da Feira*, a small county in the North of the country, belonging to the district of *Aveiro*. The main purpose of this paper is to study the reasons why most of the Portuguese cork manufacturing firms are concentrated in this northern district, whereas the bulk of the raw material (natural cork) is produced in the southern regions of *Alentejo* and *Ribatejo.*

It starts with a brief analysis of the advantages and limitations of clusters and industrial districts, along the recent theoretical findings of evolutionary economic geography, as well as the older perspectives of Porter and Becattini, largely based in Marshall (section 2).

In section 3, a quantitative assessment is made of the relative economic performance of firms clustered in *Santa Maria da Feira* and firms dispersed in other regions of the country, using the most recent data available from Portuguese national statistics institute (INE) about this industry: production, employees, hours worked, labour productivity and international trade. This exercise covers the period 2004-2010, and it seems to uncover an absence of clear advantages of clustered firms.

With this result in mind, the main part of the paper (section 4) is dedicated to a careful effort of searching and describing the fundamental roots of the Feira cork cluster in historical and socio-political reasons that are shown to be indispensable to understand and substantiate the business localization decisions of most of the cork Portuguese entrepreneurs.

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Finally, section 5 ends the paper with the main concluding remarks and suggestions of future lines of investigation, for a better understanding and improving of the functioning of this important sector for the Portuguese re-industrializing effort in course, essential to overcome the serious macroeconomic and financial crises of this country.

2. The importance of Clusters and industrial districts

In the 1990s, the approach of Alfred Marshall to external economies in his book Principles of Economics (1890) was renewed by Michael Porter (Porter 1990, 1998) with the introduction of the "cluster" concept. In the definition of this new concept we can find many features of the Italian Industrial Districts (Becattini, 1990) or the geographical agglomerations of Marshall. Clusters can be understood as geographical concentrations of interconnected companies, specialized suppliers, service providers and institutions, competing and cooperating in a same space, at a national or a regional level (for a detailed analysis of this concept see Martin and Sunley, 2003). The clustered companies are connected to other companies and institutions also inside the cluster, through exchange relations and mutual interdependencies.

Clusters are important for economic development since the companies inside the cluster experience a stronger growth, resulting from competitive advantages determined by the interaction of the four points of the "competitive diamond" (Porter 1991): factor (input) conditions; context for strategy and rivalry; demand conditions and related and supporting industries; all of them influenced by other factors (for instance, chance or Government policy). The geographical agglomeration of firms increase the potentialities of the diamond, reinforced by the local economic and social history that strength the links between companies and institutions locally set.

The research agenda about clusters has been marked by the analysis of its functioning and not so much on its origin, development or even decline. The importance of a more profound analysis of these aspects of the cluster may shed some light to understand the factors that underpinned the emergence of a cluster.

The evolutionary economic geography developed a new approach of the clusters, considering its "life cycle" (Boschma and Frenken 2006; Martin and Sunley 2011), studying the evolution of the cluster since its origin, during its development and maturity or even decline. In this context, the historical approach is very useful since the past (or historical) choices in terms of productive specialization, technologies, labour skills, network of suppliers, etc., can create a path and past dependency and ultimately lead to "lock-in" situations. According to Martin and Sunley (2006), the possible sources of regional path dependence are: natural resource based; sunk cost (facilities, machinery, etc.); local external economies of industrial specialization; regional technological lock-in; economies of agglomeration; local institutions and socio-cultural features; regional dependencies in relation to other region or political decisions in other regions. The regional dependence explains the path dependence: the same factors responsible for the development of one or few firms may cause de creation of other firms in the same local. Moreover, some random and historical "accidents" or events may divert the cluster from the "first path dependency", conducting it to a self-reinforcing mechanism that could be either positive or negative.

But the results are still not predictable. The cluster presents endogenous and exogenous factors that shape the local productive system and it can learn during its evolutionary process, pressed by the competition or by exogenous (international or national) factors. As Belussi and Sedita (2009: 508) state, the cluster is an evolving complex system and it exhibits some learning capacity.

Considering the approach of the "life cycle", initially the cluster experiences a rapid expansion and accumulation of capital resources in terms of expertise, knowledge and support institutions. In a second phase it tends to stabilize in terms of structure and shape. The degree of interconnection is high and this can make the cluster less resilient. However, the cluster may become mature,

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depending on its flexibility and type of external shocks to which it will be exposed. Facing a competitive shock, the cluster may disappear or diminish in size.

However, the transition to a phase of disappearance is not so linear. Resilience can be understood as the adaptation capability of a system. In the case of the cluster, two trends are in conflict: on the one hand, clusters increase their internal interconnections; on the other hand, the growing interconnections reduce the adaptive capacity of the system with respect to external shocks. This means that there is a trade-off between resilience and interconnections: the more interconnected are the parts of the system more rigid it will be in structural and functional terms. The "adaptive life cycle model" seeks to reconcile these two tendencies, albeit with unpredictable results in terms of success and survival.

Martin and Sunley (2006) consider six options regarding the evolution of a mature cluster: 1) emergence of a new cluster that leverages the resources and capabilities inherent to the former; 2) constant mutation cluster and in this case, it fits and is constantly evolving, for both new sectors as for new activities (high degree of resilience); 3) stabilization cluster for a long period, for example, by taking advantage of market niches, but always with the threat of disappearance (modest degree of resilience); 4) reorientation of the cluster, corresponding to the emergence of a new cluster; 5) emerging cluster failure for not achieving the critical mass to exploit external economies; 6) disappearance of the cluster, according to classic life cycle theory.

Also according to Martin and Sunley (2006), the triggering factors could permit the end of the lock-in situation, i.e., the rigidity and inflexibility of the cluster when confronted to external challenges. Likewise, Belussi and Sedita (2009) highlight the qualitative aspects of the cluster in the several phases of its life cycle. The existence of some local endowments (input conditions, for instance, qualified or specialized workers; natural resources, etc.), institutions and anchor firms, are some of the endogenous factors explaining the genesis of the cluster. In the development and maturity phases, several other endogenous factors can be important, like: technological innovation; universities, research centers, business networks; aggressive strategies like diversification of products and markets. Among the exogenous factors, the growth of demand, the internationalization and globalization processes – for instance, when a local company becomes a multinational company - are determinant, representing simultaneously a challenge and a menace to the cluster. These factors put the cluster in contact with outside customers, suppliers, institutions, competitors that may transform the cluster in an open and global system.

Menzel and Fornahl (2009) conclude that the cluster can be also distinguished by a quantitative dimension, considering the number of firms and employees. In the origin, the number of firms is small but is growing, mostly small firms. In the development phase the number of employees growths significantly, comparing to the national situation. In the mature phase the cluster is able to sustain the level of employment. The declining phase is marked by the diminishing of the number of firms and employees.

Considering and explaining the factors that are in the origin of path dependency of the cluster and its hypothetical lock-in, certainly represents a considerable contribution for possible solutions to put an end to the "lock-in" situation.

Adopting an historical approach we intend to identify the factors that are in the genesis of the Cluster of Feira and if during its life cycle it has developed a "delocking" mechanism. Starting the empirical analysis with the picture of the cluster in the last decade, of firms localized in *Santa Maria da Feira* and other regions, certainly disclose the significance of empirical analysis based in the historical knowledge of the cluster of Feira.

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3. The economic performance of Feira's firms and other firms compared

According to the theory about clusters and industrial districts briefly described above, it would be expectable that firms belonging to a strong and resistant cluster show economic and financial advantages over the firms of the same sector localized in other regions of the country.

It is an interesting exercise to compare the performance of these two groups of firms and see if the above expectation is confirmed. In order to do so, a diversified number of indicators are used, based on data from the Portuguese official statistics institution (INE) and the period covered is 2004-2010. It is a difficult phase for the Portuguese economy as a whole, and for manufacturing sectors in particular, marked by two serious recessions in 2003 and 2009.

Of course, the cork sector in Portugal could avoid these global difficulties, as can be seen in Table 1 that shows its main indicators in the beginning and end years of the period, namely, the absolute and relative numbers, as well as the rate of change, of firms, employees, production, value added and investment, in the area of Santa Maria da Feira (around 80 per cent of the sector's firms) and in other regions of Portugal (mostly Setúbal and Algarve).

Table 1. Main indicators of the Cork Industry in Portugal, 2004 - 2010

Year	**Firms**							
	S. M. Feira			**Other regions**			**Portugal**	
	Number	% of Tot.	R. Ch. (%)	Number	% of Tot.	R. Ch. (%)	Number	R. Ch. (%)
2004	1.062	79,9	-	267	20,1	-	1.329	-
2010	779	80,2	-26,6	192	19,8	-28,1	971	-26,9
Year	**Employees**							
	S. M. Feira			**Other regions**			**Portugal**	
	Number	% of Tot.	R. Ch. (%)	Number	% of Tot.	R. Ch. (%)	Number	R. Ch. (%)
2004	9.304	72,7	-	3.493	27,3	-	12.797	-
2010	6.169	67,5	-33,7	2.973	32,5	-14,9	9.142	-28,6
Year	**Production**							
	S. M. Feira			**Other regions**			**Portugal**	
	Million €	% of Tot.	R. Ch. (%)	Million €	% of Tot.	R. Ch. (%)	Million €	R. Ch. (%)
2004	1.163,8	75,8	-	330,5	24,2	-	1.494,4	-
2010	762,5	84,9	-34,5	353,2	15,1	6,9	1.115,7	-25,3
Year	**Value Added**							
	S. M. Feira			**Other regions**			**Portugal**	
	Million €	% of Tot.	R. Ch. (%)	Million €	% of Tot.	R. Ch. (%)	Million €	R. Ch. (%)
2004	265,4	83,8	-	51,4	16,2	-	316,8	-
2010	234,9	83,6	-11,5	45,9	16,4	-10,7	280,8	-11,4
Year	**Investment (Gross Fixed Capital)**							
	S. M. Feira			**Other regions**			**Portugal**	
	Million €	% of Tot.	R. Ch. (%)	Million €	% of Tot.	R. Ch. (%)	Million €	R. Ch. (%)
2004	25,6	66,3	-	13,0	33,7	-	38,7	-
2010	9,0	37,6	-64,9	14,9	62,4	14,6	23,9	-38,1

Source: INE and authors' calculations

As we can see, the main trend between 2004 and 2010 is the significant decay of the Portuguese cork sector, almost 30% in firms and employees, 25% in production, 11,4% in value added and an astonishing value of 38% in investment.

However, some regional nuances are worth mention, namely that although diminishing less in the number of firms, the employment decay in Santa Maria da Feira was more than double relative to other regions, such that, in 2010, to 80% of the firms corresponds only 67,5% of employment. And contrary to the expectations from the evolutionary economic geography analysis about the advantages of clusters and industrial districts, the production of Feira's firms diminished 34,5% in this period, comparing to a surprising growth of 7% in the production outside this region. This situation is parallel to what has happened to a crucial variable to the competitiveness and sustained growth of any industry, investment in gross fixed capital. In this case, we saw a worrying decay of 64% in the

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Feira and an appreciable growth of 15% in other firms. Considering this best performance of the firms out of Feira, it is however somehow puzzling the huge and stable weight of value added generated in Feira's firms, more than 83%.

So, in order to better assess the relative performance of clustered (in Santa Maria da Feira) and no clustered firms (dispersed in other regions of Portugal), it is necessary to look at other indicators, namely the evolution of productivity and exports in the period under analysis.

The best indicator of labour productivity is the value added generated by hour worked, but, as the series of INE do not include hours of work in the cork industry by region, we will use value added by worker (Table 2).

Table 2. Productivity in the Cork industry, 2004-2010

	S.M. Feira		Other Regions		Portugal	
Year	Prod	R.Ch. (%)	Prod	R.Ch. (%)	Prod	R.Ch. (%)
2004	28.521,6	n.a.	14.717,9	n.a.	24.753,9	n.a.
2005	30.378,2	6,51	13.889,3	-5,63	25.856,4	4,45
2006	29.844,9	-1,76	17.346,2	24,89	26.539,1	2,64
2007	31.174,8	4,46	23.462,3	35,26	29.159,8	9,87
2008	26.049,1	-16,44	19.607,8	-16,43	24.878,5	-14,68
2009	26.241,4	0,74	11.925,1	-39,18	21.640,2	-13,02
2010	38.070,0	45,08	15.441,3	29,49	30.711,1	41,92
2004-2010	-	4,93	-	0,80	-	3,66

Source: INE and authors' calculations

Labour productivity tends to be a strong pro-cyclical indicator, with large short run variability. In fact, looking at the sector in Portugal, some years show a large increase, namely 2010 and others a significant decrease, for instance 2008 and 2009. But it is also interesting to observe the large regional differences in this indicator. The firms outside the region of Maria da Feira had a good increment of productivity in 2006 and 2007, but the recession of 2009 affected them tremendously, with a fall of almost 40%. Although the annual average rate of growth in this period is clearly grater in Feira's firms, this is mainly because they had been particularly resilient to this serious macroeconomic crises and its aftermath.

Another important indicator of the strength, competitiveness and sustainability of an industry is the evolution of its exports. Fortunately, INE published detailed export data by region, covering already the year of 2011, both in quantity (Kg of cork - Table 3) as in value terms (millions of € - Table 4).

Table 3. Exports of the Cork industry, quantities - 2004-2011

	S.M. Feira		Other Regions		Portugal	
Year	Kg	R.Ch. (%)	Kg	R.Ch. (%)	Kg	R.Ch. (%)
2004	134.921.579	n.a.	26.668.466	n.a.	161.590.045	n.a.
2005	120.450.643	-10,73	29.003.388	8,76	149.454.031	-7,51
2006	135.447.353	12,45	37.895.356	30,66	173.342.709	15,98
2007	133.896.916	-1,14	37.148.532	-1,97	171.045.448	-1,33
2008	131.713.506	-1,63	27.322.045	-26,45	159.035.551	-7,02
2009	118.661.613	-9,91	23.769.672	-13,00	142.431.285	-10,44
2010	131.013.062	10,41	23.620.193	-0,63	154.633.255	8,57
2011	134.678.911	2,80	30.144.848	27,62	164.823.759	6,59
2004-2011	-	-0,03	-	1,77	-	0,28

Source: INE and authors' calculations

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The exports of manufactured products of cork in quantity have shown a remarkable constancy between 2004 and 2011, although with some large changes in between. However, the firms outside the region of Santa Maria da Feira behaved better, with a slight increase in this period of almost 2%.

Table 4. Exports of the Cork industry, values - 2004-2011

	S.M. Feira		Other Regions		Portugal	
Year	€	R.Ch. (%)	€	R.Ch. (%)	€	R.Ch. (%)
2004	759.244.039	n.a.	99.138.104	n.a.	858.382.143	n.a.
2005	604.712.785	-20,35	95.074.739	-4,10	699.787.524	-18,48
2006	687.816.755	13,74	106.500.329	12,02	794.317.084	13,51
2007	707.779.078	2,90	110.511.072	3,77	818.290.150	3,02
2008	682.061.140	-3,63	90.404.401	-18,19	772.465.541	-5,60
2009	573.787.169	-15,87	73.549.222	-18,64	647.336.391	-16,20
2010	636.290.505	10,89	77.709.977	5,66	714.000.482	10,30
2011	677.184.734	6,43	94.365.659	21,43	771.550.393	8,06
2004-2011	-	-1,62	-	-0,70	-	-1,51

Source: INE and authors' calculations

The trends in the values exported are similar, but now with a slight decrease in all the regions, once more with a worst performance of Feira's firms. It is important to note that these are nominal values, and so the performance is much worrying in terms of real decay. It was indeed a difficult period for the Portuguese cork firms, and all things seen and pondered it appears that clustering the manufacturing activity in one region does not bring clear economic advantages, so the roots of the Feira cork cluster must be found in other (non-economic) domains.

4. The historical roots of the Feira Cluster in the production of cork

The Iberian Peninsula reveals soil and climate conditions that give to Portugal and Spain an absolute competitive advantage in the production of cork. The western Mediterranean Basin presents optimal natural conditions for hosting cork oak and in particular, the Southwest of Iberian Peninsula emerges as the most important region in terms of the area occupied by this forest tree for almost two centuries (Aronson, Pereira and Pausas 2009: 13), being Portugal the world leader in the area of the specie and in the production of cork (APCOR 2011).

The Portuguese cork sector presents two historical features: first, since the beginning the cork business is an export business; second, the cork industry has always presented a high geographical concentration.

The export vocation of the sector signifies that globalization and its rhythms always affected the cork business, representing an external factor always challenging the survival of the firms, accustomed to play the game of internationalization. Furthermore, cork is a natural renewable resource used in stoppers and external demand is essentially limited to the countries that produce wine.

The manufacturing of cork – at least until the invention of the agglomerated cork in the nineteenth century – was a labour-intensive process, making easier to later industrialised countries to develop the cork industry. Being a low-tech sector, dependent from a natural renewable resource, the firms in the cork industry were subordinated to two constraints in terms of their localization: proximity to natural raw material and cheap labour. Nevertheless, the motivations underpinning the strategic options of location of cork firms were also constrained by the type of cork industry production (Zapata 1996): cork planks, cork stoppers or agglomerated cork.

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In the nineteenth century, Portugal exported cork planks, a semi-manufactured product and the first firms were settled in the South of the country, closer to the raw material, being much more expensive the transportation of raw cork comparatively to the labour costs (Mendes 2009).

The developing of the stoppers industry and the agglomerates industry, plus the growing of cork exports (Mendes 2009), laid other constrains, namely, the proximity to maritime ports and to a more specialised labour force, changing the geography of "new" cork companies. During the process, the Centre of Portugal has become a growth pole of the cork industry for a long time, especially Setúbal, attracting international firms, like Mundet (1905), that became one of the largest cork companies in the world (Carrasco *et al.* 2010). The proximity to the Lisbon harbour and industrial labour force, gave to Setúbal the localization advantage for firms that produced manufactured cork (stoppers and agglomerates). Nevertheless, the presence of industries that produced agglomerate cork put Setúbal in a more vulnerable position in terms of international competition and, in the future, more vulnerable to the technological innovation that would arise, the plastics.

However, according to the *Boletim do Trabalho Industrial* (DGT 1917), in 1917 the stoppers industry in Aveiro district had 43 establishments (41 in Feira) and 880 workers (368 in Feira), being already one of the most representative district in that industry. This means that the origin of the cluster can be put in the beginning of the twentieth century.

But up to the 1930s, the leadership in terms of manufactured cork exports belonged to Spain, position ensured by the Catalonia cork industry. Still, the cork business was still dominated by developed countries like England, Germany and United States, which having not raw material, had high specialized labour, technology, capital and international trade power.

The Spanish Civil War (1936-1939) set a turning point in the Iberian cork business that pave the way to the Portuguese domination of the cork trade. Together, the Great Depression, the Civil War and the undertaken of Franco's Regime, settle the downturn of Spanish cork presence in worldwide trade (Branco e Parejo 2008). The opportunity wasn't frozen neither by the Portuguese government nor by the Portuguese entrepreneurs, but for the time being without any relevant change in the productive and trade specialization: the semi-manufactured cork still was the most relevant cork export until the 1950s.

During the 1960s, a second important exogenous factor benefited again the Portuguese cork business, giving the final push to what would become the cork cluster in Santa Maria da Feira: the synthetic materials that substitute natural cork. Three main consequences resulted from that technologic innovation. First, the more developed countries abandoned the cork industry that came to be concentrated in the Iberian Peninsula. Second, these two countries became specialized in the production of cork stoppers, changing the outlet of cork products, now totally dominated by the wine producers. Thirdly, and resulting from the two previous, the "Iberization" of the cork business took place, that is, production, industry and trade, have become concentrated in the Iberian Peninsula (Zapata 2002; Zapata et al. 2009).

In the context of the "Iberization" of cork business, Portugal and Spain had the advantaged in terms of abundant raw material. But this time, the roles of Portugal and Spain in the cork business were reversed: Portugal displaced Spain from her hegemonic position and became the worldwide leader of cork business, this time with a new specialization: manufactured cork (Parejo 2010).

During this period the geographical pattern of this industry changed and the North of Portugal, namely Santa Maria da Feira, has become the "capital of cork stoppers". Several authors have classified Santa Maria da Feira as an Industrial District or a Cluster and we can point the 1960s as the period when the cluster developed (Mira 1994; Ruivo 1992, 1995, 1996, Branco e Parejo 2011). The *Boletim da Junta Nacional da Cortiça* (1970), one of the most important publications about the cork sector, confirms the ascension of Aveiro, classifying this district as the most important in terms of manufactured cork.

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Following Porter (1991) and the determinants of competitiveness presented in his "diamond model", we can find in the origin and development of the Santa Maria da Feira Cluster two main key factors, locally and historically determined: the presence of craft workshops with skilled and cheap workers and the presence of an anchor firm. The combination of these two factors would never produce such results if it wasn't for the presence of one random exogenous factor: the Spanish Civil War that weakened the most important Portuguese competitor in the cork business, Spain.

According to Belussi and Sedita (2009) the factor condition and the anchor firm (or firms) are always linked to the previous industrial history of a cluster. In the case of Feira, the two exogenous factors were transformed into an opportunity to the cork industry located there, boosted by an institutional framework that favoured some of the most important endogenous factors of Feira.

The endowment of natural resources available was not an endogenous triggering factor for the cluster emergence since most of the cork production is concentrated in the South of Portugal, being Alentejo the leader. However, Feira already had an industrial tradition based on craft workshops producing stoppers. According to Mendes (2009) since the end of the nineteenth century the firms located in Feira were small family businesses. This feature was reinforced by the public (Estado Novo) industrial policy or, at least, not contradicted by one of the most significant measures of industrial policy, the *Condicionamento Industrial* that gave licences for a growing number of craft workshops in Aveiro district (Branco e Parejo 2011).

Another important endogenous factor, again connected with institutional aspects, was the low wages paid in the North, Aveiro included. The cork workers in Santa Maria da Feira were the worst paid in the country, a situation reinforced by several laws that regulated the wages of cork manpower (Branco e Parejo 2011) and setting another competitive advantage for Portugal, besides the raw material. Sampaio (1982) shows that cheap labour is a relevant factor in terms of competitiveness and the lower costs made all the difference in competing with other Portuguese regions, namely Setúbal, since the instauration of the democratic process in Portugal was marked by the rising trend in wages.

Finally, we can add the presence of a successfully anchor firm. Since its origin, the Cluster of Feira is an open local/global system although without any multinational company, a different feature from the clustering of firms in Setúbal. But Feira had a local anchor firm – *Amorim&Irmãos*[72] – whose history is confounded with the cluster history. Acting as an anchor firm and by taking a putting-out strategy, *Amorim&Irmãos* stimulated the spin-offs and new firms stars-ups (Branco e Parejo 2011).

The *Amorim&Irmãos* had financially encouraged its workers to open small workshops and developed with them intensive ties. The relation with small stopper producers allowed the company to respond to fluctuations in the world demand of cork products without increasing the scale of production. Also in a Michael Porter's study about the cork cluster (Monitor Company 1994: 74, 135), he stated that the success of the cluster was explained by the small firms access to certain phases of production process that were provided by the larger company, *Corticeira Amorim*.

Finally, the vertical integration and the diversification of markets and products strategies implemented by this company explain the success of *Grupo Amorim* (Branco and Parejo 2011) and the quasi monopoly position acquired by the group in the cork business: 26% of market share in the world wide of cork; 65% of market share in the cork stoppers and 55% of market share in the composite agglomerate and 80% of expanded agglomerate (Amorim 2011).

The internationalization strategies of Amorim & Irmãos, Lda gave to Portugal a favourable position in the cork trade in 1986, when Portugal and Spain accessed to the European Union (EU). During the 1980s two tendencies were reinforced: the *Europeanization* of demand – the important role of countries belonging to the EU that are wine producers, namely France and Italy - and the growing

72 The first firm of the Grupo Amorim was founded in 1922, the Amorim & Irmãos, Lda., being the origin of Corticeira Amorim, founded in 1963.

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importance of trade between Portugal and Spain – this last country exports for Portugal mainly semi-manufactured cork (Zapata et al. 2009).

These final features may pose a threat to the success of Feira cluster because they open doors to a lock-in situation, not only in terms of mono-specialization in stoppers but also in terms of trade partners, giving to these a growing power of negotiation that could flat the export prices. Furthermore, the big firm strategies to face this threat could conduce to the demand of new suppliers outside the cluster in order to react to the lower prices pressure, since the wages are getting higher in Santa Maria da Feira Cluster.

5. Concluding remarks

This paper studied the relative performance of clustered and non clustered firms in the Portuguese cork industry, and the historical and socio-political roots of the Feira's cork cluster, also known in the literature as the Aveiro's cork industrial district.

The Portuguese cork industry provides an interesting case study on several levels. First of all, it must be stressed that Portugal is the world leading country in this economic activity, in terms of production, value added and employment, as well as international trade (representing more than 60% of all world cork exports).

Moreover, there is a considerable geographic concentration of production in the municipality of Santa Maria da Feira, in what could be considered an industrial district, suitable for analysing and testing the Marshallian agglomeration economies and the competitive advantages of a cluster, as evidenced by Becattini and Porter, among many others.

However, from the analysis of several mesoeconomic indicators quantified in this paper, at the regional level, the main conclusion is that there is no empirical evidence that unequivocally supports the economic advantages from the geographic concentration of the production of cork.

In fact, the economic performance of clustered firms in Santa Maria da Feira is not significantly better than the performance of the correlative cork manufacturing firms dispersed in other regions of the country, and this applies both to relative labour productivity as well as export growth.

This important result suggests that the effective concentration of the manufacturing cork activities in Portugal, since at least five or six decades ago, must be searched and found on other dimensions, not only or predominantly economic, but of historical, political and socio-institutional nature.

As it is carefully explained in the main section of this paper, the cork cluster of Santa Maria da Feira is a mature one, whose formation has its roots in the beginning of the twentieth century and its development in the second half of this century, associated with the installation in this geographical area of a key anchor firm, *Corticeira Amorim*. It is a mono-cluster exploring a sector in which Portugal has absolute advantages based in the availability of its main raw material (natural cork) and the comparatively lower wages of an abundant and skilled labour force.
The relations between the companies forming this cluster are also based on historical, cultural and social traditions of this region of Portugal that are not so strong in other regions, namely Alentejo and Algarve. This last advantage, which can subsume into a comprehensive conception of the notion of social capital, that is, for obvious reasons, very difficult to assess quantitatively, is certainly one that has justified the continuation and strengthening of this cluster in the past, and can continue to provide its resilience in the future.
Two main research questions need to be further addressed in the future. The first is to make a comparative analysis of the economic performance of clustered and non clustered firms along a much larger time horizon, connecting it with the different phases of the cork industry, and the Feira cluster, life cycle. The second, is to develop a qualitative analysis of the knowledge and research networks, social capital, skill improvements, technological innovations, etc., that can be crucial to sustain the relative strength and world dominance of the cluster, and to avoid the eventual, and

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always possible, lock-in and decay. The economic and social importance of this industry as well as its environmental and biodiversity sustainability role, deserve well this research effort.

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FUNDOS ESTRUTURAIS EUROPEUS, CARACTERÍSTICAS REGIONAIS E CRESCIMENTO

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Resumo. O aprofundamento da coesão económica, social e territorial é um objectivo central da UE. Contudo, as disparidades existentes ao nível das regiões europeias são consideráveis, e há dúvidas se eventualmente se poderão dissipar. Alguma literatura recente tem analisado a eficiência dos Fundos Europeus para a promoção do crescimento e a redução das disparidades regionais entre os Membros. Neste artigo contribuímos para a literatura, examinando as condições sob as quais a ajuda financeira europeia poderá afectar o crescimento regional de forma eficiente. Para tal, exploram-se as interacções implícitas entre as transferências e o rendimento e outras características regionais, como a inovação ou o capital humano. O estudo é aplicado a um painel de 138 regiões europeias no período 1995-2009. As conclusões sugerem uma eficiência maior dos Fundos em regiões mais pobres. Uma ideia adicional é a de que a utilização dos Fundos para intensificar o capital humano é aparentemente a melhor alternativa quando o objectivo é a promoção do crescimento regional e a redução das assimetrias regionais.

Palavras-chave: Dados em painel, Fundos Estruturais, Crescimento económico regional

EUROPEAN STRUCTURAL FUNDS, REGIONAL CHARACTERISTICS AND GROWTH

Abstract. Strengthening economic, social and territorial cohesion is a central objective of the EU. However, disparities among European regions are considerable, and there are doubts if they are likely to reduce. In recent years there has been an increasing literature examining the effectiveness of the EU funds for promoting growth and reducing the disparities between Members. In this article we contribute to the literature by examining under which conditions EU financial aid may be affecting regional growth. Doing so, it explores the implicit interactions between transfers and income and other regional characteristics, such as innovation or human capital. The study is applied to a panel of 138 European regions covering the period 1995-2009. The conclusions suggest a higher efficiency of the funds in poorer regions. Moreover, the use of funds to strengthening human capital is apparently the best alternative when the aim is to promote regional growth and reduce regional disparities.

Keywords: Panel data, Regional economic growth, Structural Funds

1. INTRODUCTION

In a recent reflection about the Annual Growth Survey of the European Union, the Council of the European Union (2013) emphasised the need to ensure that actions at the EU level fully support economic growth, job creation and reduction of regional disparities. It is stressed that the focus of the EU budget should lie in throughout measures enabling smart, sustainable and inclusive growth, according to the Europe 2020 growth strategy.

Strengthening economic, social and territorial cohesion by reducing disparities between its regions is a central objective of the EU laid down in its Treaty. In spite of this, the first mention to a formal regional policy occurred in the Single European Act (1986). Since then the EU has completed three programming periods (1989-93, 1994-99, 2000-06) and is currently closing the fourth (2007-13). For the latter, funding for regional and cohesion policy represented 35.7 per cent of EU budget, which reveals the central role of the regional policy in the EU agenda. For the next programming period (2014-20), Structural Funds will increase the focus upon innovation and smart growth specialisation, in line with the increasing importance of education and of the innovative activity for growth. Given

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the current constraints on national public funding, this orientation of Funds appears as crucial to fill the gaps on national investments.

An intense debate, lasting for decades, questions the effectiveness of Structural Funds for achieving the EU goals of economic growth, disparities reduction and social and economic cohesion. Indeed, it is not clear whether the promotion of regional competitiveness is compatible with the goal of reducing regional asymmetries. On the one hand, financial aid, instead of reducing disparities, leads to centripetal forces that favour the centre in detriment of peripheral areas (Llussá and Lopes, 2011). On the other hand, many regions that have been major net beneficiaries of financial aid have not grown beyond the threshold of assistance, raising doubts about the efficiency of the regional policy. Additionally, the presence of substitution effects may divert factors from more productive projects to those financed by Structural Funds (Kyriacou and Roca-Sagalés, 2012).

The 2004 enlargement of the EU came to challenge even further the EU regional policy, given the higher heterogeneity it encompasses. On the one hand, the Cohesion countries highly dependent on EU financial assistance and, on the other, the new member states asking for transfers to tackle structural difficulties, dispute limited financial resources. The constraints upon the available resources, the sizeable needs and the different challenges regions face in the context of increasing globalisation, may hamper the functioning of the regional policy.

Since the first support programming period, the European Commission has emphasised that European policy assistance to regions should be subject to regular and rigorous evaluation. When doing so, it is well-established in the literature that one should not expect absolute convergence between regions. Indeed, the economic understanding of these matters has evolved also quite substantially as a result of valuable contributions (see, for instance, Barro and Sala-i-Martin, 2004).

The neoclassical approach to convergence is derived from the Solow's growth (1956) model with diminishing marginal returns to capital and exogenous technical progress. The idea was that poorer economies would tend to grow faster than richer ones in earlier stages of economic development and then in the long-run they would grow at similar growth rates, due to the law of diminishing returns to capital.

Given the unsatisfactory results provided by absolute convergence, a new concept of convergence emerged: conditional convergence, developed under the framework of endogenous growth theory. According to this approach, convergence is assumed to be conditioned by some structural factors with increasing returns to scale properties, coming mostly from human and physical capital accumulation, technological progress and innovation. Therefore, economies converge to different steady-states determined by idiosyncratic characteristics (Barro and Sala-i-Martin, 2004).

From the early 1990s onwards there has been an upsurge in the empirical literature regarding growth and convergence, both at the national and regional levels. However, given the diversity of methodological approaches, time spans and sets of explanatory variables, the conclusions are far from being unanimous, even regarding the specific case of the European Union. [73]

The focus upon European regional economic growth gained increased relevance after the enlargement to the central and eastern European countries. The inclusion of these economies, along with the increasing budget constraints, has brought to the spotlight the discussion about the reduction of regional disparities and the ability of the EU policies in general, and of the regional assistance in specific, to effectively promote and guarantee social and economic cohesion among its members. Within this context, this study contributes to the literature by analysing the impact of Structural Funds on growth for the 1995-2009 period. The dataset includes also the new EU members from the 2004 enlargement (Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia), where data is available. We examine the (indirect) channels through which Structural Funds possibly affect growth, by analysing the links with income, human capital and

[73] See for instance Henrekson *et al.* (1997), defending the existence of growth effects from EU integration and Vanhoudt (1999), claiming the existence of only trade effects.

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innovation. Only a few studies on this subject have included interaction terms, although in a different perspective. Regarding the most recent, Llussá and Lopes (2011) interacted income with each of the Objective dummies (to examine how eligibility contributes to growth) and they verified that being covered by one of EU regional policy contributes to regional convergence, though with a relatively weak effect. Rodriguez-Pose and Novak (2011) combined regional per capita Funds either with national per capita GDP or with relative regional per capita GDP, to determine Structural Funds effectiveness depending on national and relative wealth, respectively. Contrary to the outcomes for 1994-99, for 2000-06 the authors conclude that the returns of Funds tend to be greater the wealthier the country and also the better the region's relative position within a country.

Finally, we also try to understand if the sign of the impact of the Funds is always the same, regardless of the amount received by a region (both in per capita terms and as a percentage of GDP) or, instead, if there is a given threshold from which the returns are reversed. This addresses the discussion about the effectiveness of financial transfers and conditions under which more Funds are reflected into more growth.

The outline of the study is the following: in Section 1 we reflect upon the role of Structural Funds, human capital and innovation on regional growth and discuss central results from the literature. In Section 2 we present the growth model and the variables used. Section 3 discusses the main outcomes and the last section concludes.

2. THE ROLE OF STRUCTURAL FUNDS, HUMAN CAPITAL AND INNOVATION ON REGIONAL GROWTH

The role of Structural Funds is at the centre of the discussion on the effectiveness of the EU regional policy to attain the desired goals of growth, competitiveness, disparities reduction and economic, social and (more recently) territorial cohesion. The bulk of literature on this matter has been developed under the framework of the neoclassical growth model (e.g. Cappelen et al., 2003; Esposti and Bussoletti, 2008; Rodriguez-Pose and Novak, 2011). The results differ significantly in several aspects: the indicator used for Structural Funds, the time period and the sample analysed, and the estimation method applied. Moreover, poor quality data on Structural Funds also contributes to major differences in the outcomes. While some studies point to the existence of positive effects of Funds on growth (Cappelen et al., 2003; Ramajo et al., 2008; Becker et al., 2010), others find inconclusive impacts (Rodriguez-Pose and Fratesi, 2004; Mohl and Hagen, 2010) or even negative ones (Dall'erba and Le Gallo, 2008).[74] Moreover, Llussá and Lopes (2011) find that financial assistance from the EU contributed to increase convergence only at the national level. Rodriguez-Pose and Novak (2011) find the existence of learning processes between the second and third programming periods that resulted in a more effective allocation and monitoring of expenditures on Structural Funds, thus impacting positively on regional growth.

Bearing in mind the discussion presented and the variety of conclusions, we explore the effect of the structural funds. A positive effect would go along those arguments defending the relevance of structural aid to help deprived regions and reduce regional disparities. Otherwise, a negative effect would question whether EU regional policy has been oriented in the right direction and whether it has been efficiently allocated. In addition in this article we explore the way in which EU transfers work, i.e, if there is a direct link or, otherwise, a channel transmission is present, and if the effect depends on other contextual variables. Moreover, we check for the existence of a limit upon which financial transfers no long exert the desired positive impact on growth.

Indeed, regions differ along several endogenous characteristics that matter for growth, and these may interact with the effects of the EU funding upon growth. On this regard, the models of endogenous growth confer a special role to human capital. The latter is a measure of the ability and skills of the labour force, and it is evaluated by the level of formal education or by job accumulated

74 For a comparison of the major results on the literature about the impact of Structural Funds on economic growth, see Mohl and Hagen (2010).

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experience, with potential to contribute to increase the productivity of physical capital (Lucas, 1988). A better-educated and well-trained workforce is expected to exert a positive effect on growth.[75] However, the empirical results have sometimes shown a different pattern, with the impact of human capital on growth being negative and/or statistically insignificant, especially in panel data studies. Islam (1995) and others argue that this happens due to poor quality data and inadequate proxies to capture qualitative rather than quantitative aspects of human capital.

According to another line of research, it is the accumulation of technological change the key factor for growth (Romer, 1986; Di Liberto, 2005). On the one hand, technology is non-rival, which implies the existence of knowledge spillovers, increasing returns and externalities.[76] On the other hand, non-excludability depends both on the kind of knowledge produced and on the mechanisms protecting property rights, like the patents. The patents system as an incentive to protect the R&D sector is thus determinant for growth (Grossman and Helpman, 1991 b).

Human capital and innovation are reflected into faster economic growth only if economies show the "social capability" to benefit from higher education skills and more protection to R&D (Abramovitz, 1986; Crescenzi and Rodriguez-Pose, 2012). [77] Bearing this in mind, Alexiadis et al. (2010) reinforce the need for the European policy to focus on R&D activities in order to promote regional growth in an enlarged area. This corroborates the target of investing 3 per cent of GDP in R&D under the European 2020 growth strategy.

Hence, from the previous considerations, we expect both human capital and innovation to play a positive role. Furthermore we explore how (and if) the regional conditions on these matters condition the effect of the EU assistance upon regional growth.

3. DESCRIPTION OF THE MODEL AND THE DATA USED

In order to address our research issue, we consider an augmented version of the neoclassical growth model to panel data, to avoid omitted variable bias. The growth equation to be estimated is the following:

$$gy_{i,t} = b\ln\left(y_{i,t-2}\right) + c_1\ln(gpop_{i,t-2}) + c_2\left[\ln(s_{i,t-2}) - \ln(s_{i,t-3})\right] + c_3\ln(hc_{i,t-2}) + \\ + c_4\ln(pat_{i,t-2}) + c_5\ln(sf_{i,t-2}) + v_{i,t}, \quad with \quad v_{i,t} = \alpha_i + \lambda_t + u_{i,t} \qquad \textbf{(1)}$$

where α_i refers to country-specific effects, λ_t reveals time-specific effects common to all units and $u_{i,t}$ is the idiosyncratic error term. The subscript *i* refers to regions[78] and *t* is the time index, ranging from 1995 to 2009.

Although the time period is relatively small, it is still adequate for growth regressions and inferences can be made for a medium-term horizon.

The dependent variable is the annual growth rate of real *per capita* income ($gy_{i,t}$). [79] The set of explanatory variables includes: $\ln(y_{i,t-2})$, real *per capita* income; $\ln(gpop_{i,t-2})$, annual population growth rate; $\ln(s_{i,t-2}) - \ln(s_{i,t-3})$, growth of the investment share; $\ln(hc_{i,t-2})$, human capital measured by the ratio of students in tertiary education over 20-24 year-olds; $\ln(pat_{i,t-2})$, innovation proxied by the number of patents per million inhabitants;[80] and $\ln(sf_{i,t-2})$, (interpolated)

75 See, for instance, Ciccone and Papaioannou (2006).
76 See Grossman and Helpman (1991 a).
77 As an example of a study on the impact of innovation on regional growth, see Fagerberg *et al.* (1997). For the joint impact of human capital and innovative performance, see Rodriguez-Pose and Crescenzi (2006).
78 For a detailed description of the 138 regions included, see the Appendix I.
79 For the description and explanation on the computation of the variables, see the Appendix II. ln stands for natural logarithms.
80 We alternatively used the share of R&D expenditures on GDP, but the results were generally more fragile and this variable never displayed statistical significance.

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Structural Funds.[81] All the explanatory variables are lagged twice, to avoid endogeneity and reverse causality.[82]

4. EMPIRICAL RESULTS

We estimate the model by FE[83] using Rogers standard errors, which are heteroscedasticity and autocorrelation consistent.[84] The limitation of this approach is that it does not take into account the possible existence of cross-sectional correlations, *i.e*, it assumes that residuals are correlated within but not between groups of individuals.

Conversely, Driscoll and Kraay's approach deals with an error structure that is assumed to be heteroscedastic, autocorrelated up to some lag and possibly correlated between groups. However, with this correction standard errors are robust to general forms of spatial and temporal dependence only when T→∞ (Baltagi, 2005). Moreover, only strong cross-sectional correlation constitutes a serious problem in terms of estimation and inference (Pesaran, 2012). Still, as robustness check we also use Driscoll and Kraay's standard errors following Hoechle (2007). [85]

Table 1 displays the results of the estimation of the growth equation with *per capita* Structural Funds as the proxy for financial assistance. Both FE with robust standard errors and FE with standard errors from Driscoll and Kraay's correction are presented for comparison purposes. The difference between them is in the standard errors and thus statistical significance of the variables may change. All the estimations include time dummies.

Table 1. FE with robust and Driscoll-Kraay's standard errors. 138 European regions, 1995-2009. (Structural Funds *per capita*)

	No interaction term		Interaction with income		Interaction with patents		Interaction with h.capital		Quadratic term	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	Robust FE	Driscoll-Kraay	Robust FE	Driscoll-Kraay	Robust FE	Driscoll-Kraay	Robust FE	Driscoll-Kraay	Robust FE	Driscoll-Kraay
$\ln(y_{i,t-2})$	-0.2288***	-0.2288***	-0.2390***	-0.2390***	-0.2611***	-0.2611***	-0.2312***	-0.2312***	-0.2449***	-0.2449***
	(-5.043)	(-3.342)	(-4.998)	(-3.615)	(-5.351)	(-4.072)	(-5.085)	(-3.380)	(-5.485)	(-3.594)
$\ln(s_{i,t-2})-\ln(s_{i,t-5})$	0.0227*	0.0227*	0.0199	0.0199*	0.0194	0.0194*	0.0227*	0.0227*	0.0168	0.0168
	(1.677)	(1.872)	(1.453)	(1.812)	(1.447)	(1.802)	(1.685)	(1.861)	(1.223)	(1.465)
$\ln(gpop_{i,t-2})$	-0.0161	-0.0161	-0.0034	-0.0034	-0.0042	-0.0042	-0.0148	-0.0148	-0.0090	-0.0090
	(-0.601)	(-0.659)	(-0.131)	(-0.125)	(-0.147)	(-0.149)	(-0.518)	(-0.580)	(-0.347)	(-0.368)
$\ln(sfpc_{i,t-2})$	0.0026	0.0026	0.0715**	0.0715	0.0106***	0.0106	0.0228*	0.0228***	0.0346***	0.0346***
	(1.608)	(0.347)	(2.555)	(1.370)	(4.177)	(1.178)	(1.690)	(5.348)	(5.277)	(3.443)
$\ln(hc_{i,t-2})$	0.1013***	0.1013***	0.1006***	0.1006***	0.0984***	0.0984***	0.1178***	0.1178***	0.1023***	0.1023***
	(4.503)	(3.216)	(4.545)	(3.053)	(4.355)	(3.040)	(5.406)	(3.785)	(5.860)	(3.384)
$\ln(pat_{i,t-2})$	0.0062	0.0062	0.0043	0.0043	0.0186***	0.0186**	0.0062	0.0062	0.0073	0.0073
	(1.196)	(1.005)	(0.847)	(0.835)	(3.038)	(2.226)	(1.185)	(1.008)	(1.452)	(1.259)
$\ln(y_{i,t-2})*\ln(sfpc_{i,t-2})$			-0.0074**	-0.0074						
			(-2.518)	(-1.507)						
$\ln(pat_{i,t-2})*\ln(sfpc_{i,t-2})$					-0.0043***	-0.0043**				
					(-4.282)	(-2.592)				
$\ln(hc_{i,t-2})*\ln(sfpc_{i,t-2})$							-0.0053	-0.0053***		
							(-1.555)	(-2.836)		
$[\ln(sfpc_{i,t-2})]^2$									-0.0055***	-0.0055***
									(-5.353)	(-2.982)
Constant	1.6947***	1.6947**	1.8574***	1.8574***	2.0433***	2.0433***	1.6608***	1.6608**	1.8363***	1.8363**
	(4.150)	(2.395)	(4.229)	(2.748)	(4.631)	(3.080)	(4.175)	(2.337)	(4.332)	(2.563)
Time dummies	Yes		Yes		Yes		Yes		Yes	
Number of regions	138		138		138		138		138	
Observations	1037		1037		1037		1037		1037	
Avg. Obs. per Group	7.514		7.514		7.514		7.514		7.514	
R^2 overall	0.163		0.149		0.152		0.162		0.163	
R^2 within	0.516		0.522		0.528		0.519		0.539	
R^2 between	0.242		0.244		0.245		0.241		0.243	
p-value F test	0.000		0.000		0.000		0.000		0.000	
p-value F test time dummies	0.000		0.000		0.000		0.000		0.000	

Notes: Coefficient significant at the 10 per cent (*), 5 per cent (**) or 1 per cent level (***)

81 We use per capita real Structural Funds, $\ln(sfpc_{i,t-2})$, and alternatively, Structural Funds as a percentage of GDP, $\ln(sfshare_{i,t-2})$. Since some values are null, to avoid losing observations we add 1 to the Funds before computing the logarithm.

82 Rodridguez-Pose and Fratesi (2004) also use two-year lagged income to avoid endogeneity.

83 The regressions were run using Stata 12.

84 It is often more adequate to use FE than RE with aggregated data, in terms of policy analysis (Wooldridge, 2009).

85 We are not able to perform Pesaran's CD test on residuals cross-sectional dependence after the FE regression (De Hoyos and Sarafidis, 2006) for not having enough common observations in the panel. We thus opted for comparing outcomes from both methods.

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Common to all the estimations presented is the evidence of conditional convergence, given the negative and significant sign of the convergence coefficient. The evolution of physical capital is almost always significant with the expected positive sign.[86] Moreover, annual population growth displays a negative coefficient and the impact over income growth is insignificant, a common finding in the literature.

Human capital is positively and significantly influencing growth, as expected. This is the only variable that maintains its significance in all the estimations ran and it exerts the highest impact on growth. The patents ratio is rarely significant, but removing it from the estimations does not improve overall results and by keeping it we avoid the omitted variable bias.

Finally, Structural Funds also show a positive impact on growth, although not always significant.

When considered alone, financial assistance is not significantly affecting growth ((1) and (2)). In columns (3) and (4) we add an interaction term between income and transfers, to assert whether the effectiveness of Structural Funds depends on the development level of the region. With the correction for spatial dependence (column (4)) both the Funds and the interaction term are not significant. Hence, we base our interpretation in the results from column (3). The impact of Structural Funds on growth is given by:

$$\frac{\partial gy_t}{\partial ln(sfpc_{t-2})} > 0 \Leftrightarrow\ 0.0715 - 0.0074\, ln(y_{t-2}) > 0\ \Leftrightarrow$$
$$\Leftrightarrow ln(y_{t-2}) < 9.6622\ \Leftrightarrow\ y_{t-2} < 15711.7193$$

Thus, the Funds have a positive impact on growth for regions with per capita incomes lower than the limit here identified. This outcome goes in line with the findings of Ramajo *et al.* (2008) and Mohl and Hagen (2010), supporting the idea that EU regional policy explicitly oriented for the less developed areas is most effective in promoting growth.

In columns (5) and (6) we test the interaction effect between innovation and Structural Funds. When no cross-sectional dependence is accounted for (column (5)) all the elements of interest are significant. In that case, Structural Funds influence growth according to:

$$\frac{\partial gy_t}{\partial ln(sfpc_{t-2})} > 0 \Leftrightarrow\ 0.0106 - 0.0043\, ln(pat_{t-2}) > 0\ \Leftrightarrow$$
$$\Leftrightarrow ln(pat_{t-2}) < 2.4651\ \Leftrightarrow\ pat_{t-2} < 11.7649$$

Thus, we conclude that Funds exert a positive impact on growth on regions showing lower levels of innovation. Given that innovation and income levels are generally positively correlated, this outcome demonstrates once more that the returns to EU financial assistance are higher in less favoured areas.

In columns (7) and (8) the Structural Funds were interacted with human capital. Only with the Driscoll and Kraay's correction the multiplicative effect is significant (column (8)). The impact of the Funds is, in that case, given by:

$$\frac{\partial gy_t}{\partial ln(sfpc_{t-2})} > 0 \Leftrightarrow\ 0.0228 - 0.0053\, ln(hc_{t-2}) > 0\ \Leftrightarrow$$
$$\Leftrightarrow ln(hc_{t-2}) < 4.3019\ \Leftrightarrow\ hc_{t-2} < 73.8390$$

Structural Funds exert a positive and significant effect on growth whenever the share of people with tertiary education is lower than the indicated limit. Human capital is positively correlated with the

86 The alternative use of the lagged investment share resulted on a negative (and generally non-significant) impact.

level of income, showing (again) that the impact of the Funds is positive in regions with low per capita incomes.

Finally, in columns (9) and (10) we are able to understand that the Funds affect growth positively, although at a diminishing marginal rate. In fact, the value of the Funds that maximises the impact over growth is approximately 23.23 and from that point on, each additional Euro received per inhabitant will influence growth negatively, thus evidencing the existence of an inverted U-relationship between the variables.

All in all, considering the variables that maintain their significance in each pair of estimations, we are able to summarise that: (i) human capital is the only variable robustly explaining growth across regressions; (ii) *per capita* Funds are not significant, meaning that at the most their impact depend on other conditionings; (iii) the effect of the Funds upon growth is more noticeable for less favoured regions; and (iv) the Funds affect growth positively at a decreasing marginal rate, changing sign beyond a certain threshold.

In **Table 2** we use as the Structural Funds *proxy* the share of Funds on GDP.

Table 2. FE with robust and Driscoll-Kraay's standard errors. 138 European regions, 1995-2009. (Structural Funds as a percentage of GDP)

	No interaction term		Interaction with income		Interaction with patents		Interaction with h.capital		Quadratic term	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	Robust FE	Driscoll-Kraay	Robust FE	Driscoll-Kraay	Robust FE	Driscoll-Kraay	Robust FE	Driscoll-Kraay	Robust FE	Driscoll-Kraay
$\ln(y_{i,t-2})$	-0.1940***	-0.1940***	-0.1996***	-0.1996***	-0.2116***	-0.2116***	-0.2033***	-0.2033***	-0.2375***	-0.2375***
	(-4.538)	(-2.876)	(-4.512)	(-2.882)	(-4.730)	(-3.292)	(-4.833)	(-3.032)	(-5.456)	(-3.653)
$\ln(s_{i,t-2})-\ln(s_{i,t-5})$	0.0241*	0.0241*	0.0234*	0.0234*	0.0233*	0.0233*	0.0221*	0.0221*	0.0187	0.0187
	(1.788)	(1.783)	(1.751)	(1.822)	(1.731)	(1.888)	(1.659)	(1.659)	(1.448)	(1.627)
$\ln(gpop_{i,t-2})$	-0.0194	-0.0194	-0.0161	-0.0161	-0.0086	-0.0086	-0.0254	-0.0254	-0.0268	-0.0268
	(-0.757)	(-0.779)	(-0.648)	(-0.490)	(-0.333)	(-0.324)	(-0.889)	(-0.935)	(-0.943)	(-0.996)
$\ln(sfshare_{i,t-2})$	-0.0251***	-0.0251	0.0768	0.0768	0.0070	0.0070	0.1431**	0.1431***	0.0897***	0.0897**
	(-3.486)	(-0.723)	(0.608)	(0.162)	(0.588)	(0.142)	(2.038)	(4.621)	(3.800)	(1.983)
$\ln(hc_{i,t-2})$	0.1079***	0.1079***	0.1088***	0.1088***	0.1055***	0.1055***	0.1232***	0.1232***	0.1244***	0.1244***
	(5.232)	(3.460)	(5.260)	(3.463)	(5.056)	(3.285)	(6.050)	(4.148)	(6.780)	(3.980)
$\ln(pat_{i,t-2})$	0.0087	0.0087*	0.0083	0.0083**	0.0148**	0.0148**	0.0090*	0.0090*	0.0096*	0.0096**
	(1.627)	(1.756)	(1.538)	(2.434)	(2.562)	(2.184)	(1.667)	(1.851)	(1.944)	(2.239)
$\ln(y_{i,t-2})*\ln(sfshare_{i,t-2})$			-0.0108	-0.0108						
			(-0.819)	(-0.231)						
$\ln(pat_{i,t-2})*\ln(sfshare_{i,t-2})$					-0.0165***	-0.0165*				
					(-2.853)	(-1.748)				
$\ln(hc_{i,t-2})*\ln(sfshare_{i,t-2})$							-0.0431**	-0.0431***		
							(-2.488)	(-13.150)		
$[\ln(sfshare_{i,t-2})]^2$									-0.0940***	-0.0940***
									(-4.663)	(-3.622)
Constant	1.3298***	1.3298*	1.3933***	1.3933*	1.5260***	1.5260**	1.3432***	1.3432*	1.6561***	1.6561**
	(3.416)	(1.867)	(3.463)	(1.876)	(3.723)	(2.255)	(3.674)	(1.877)	(4.190)	(2.433)
Time dummies	Yes		Yes		Yes		Yes		Yes	
Number of regions	138		138		138		138		138	
Observations	1037		1037		1037		1037		1037	
Avg. Obs. per Group	7.514		7.514		7.514		7.514		7.514	
R^2 overall	0.182		0.177		0.178		0.178		0.162	
R^2 within	0.520		0.521		0.526		0.525		0.543	
R^2 between	0.231		0.233		0.232		0.224		0.230	
p-value F test	0.000		0.000		0.000		0.000		0.000	
p-value F test time dummies	0.000		0.000		0.000		0.000		0.000	

Notes: Coefficient significant at the 10 per cent (*), 5 per cent (**) or 1 per cent level (***)

Once more, there is evidence of conditional convergence and the population growth does not have a significant impact. In addition, the human capital proxy is always statistically significant, displaying the expected positive sign. Physical capital and innovation are also positive, but there are some cases of statistical insignificance - though less than in the previous table.

Regarding our variable of interest, the Funds are rarely significant. In fact, in columns (1) and (2), the impact is even negative, but only significant in the first case. The inclusion of an interactive term between Funds and income level (columns (3) and (4)) does not improve the results.

When the patents are interacted with the Funds, in columns (5) and (6), the direct impact of Funds is not statistically significant. Thus, we are not in the presence of a direct but only of an indirect effect on the part of EU transfers. The Funds positively influence growth as long as the patents ratio is lower than 1. Since poorer regions innovate less, this shows that disadvantaged regions assist to a positive impact of financial aid on growth.

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By interacting human capital with Structural Funds (columns (7) and (8)), we conclude that Funds positively and significantly affect growth if the share of people with tertiary education is lower than 27.7 per cent. Like previously, the impact of Funds on growth is thus positive in poorer regions with lower human capital endowment.

From the two last columns ((9) and (10)), we get to the conclusion that the Funds influence growth positively but at a decreasing rate. For shares higher than 1.6 per cent of GDP, the positive effect of Structural Funds is reversed. To the best of our knowledge, no threshold had been established at the regional level so far. This outcome is equal to the threshold found by Kyriacou and Roca-Sagalés (2012) at the national level. Additionally, this result focuses the importance of the ceiling (of 4 per cent) that was established in the Lisbon Treaty, for the country's total transfers.

Reflecting on the common elements from **Table 2**, we conclude that: (i) the effect of the Funds share on GDP is not related to the region's income level; (ii) the Funds display a positive role on growth in poorer less-innovative regions; (iii) the Funds share is successfully combined with human capital and plays a positive role if human capital is lower than a certain level, showing that in less developed areas with low levels of education the returns from Funds are probably higher; and (iv) for regional transfer intensities above 1.6 per cent, the effect of Structural Funds on growth is potentially reversed.

Combining the information from the tables, there is clear evidence of conditional convergence and human capital is always significant for growth, displaying the expected positive sign. The annual population growth is not significant and the evolution of the investment share reasonably and positively influences growth, being more proper when the share of Funds is used. The innovation proxy is not always significant, but it also displays the expected positive sign. As for the Structural Funds proxy, the conclusions differ, depending on the indicator used.

5. CONCLUSION

It is clear that funding needs to be large enough to make a difference which implies it should not be spread too widely across policy areas. But because regions differ in terms of the problems they face and their specific needs, which are hard to identify centrally, there is a case for allowing them to choose a limited number of areas on which to concentrate funds. There is an extensive research on the impact of Structural Funds to reduce EU regional asymmetries and to promote sustained growth. However, the outcomes vary widely and it is hard to establish comparisons.

We find evidence of conditional convergence. Moreover, human capital is always significant and it positively affects growth. Both the population growth rate and innovation display mixed results, depending on the estimation method and the combination of explanatory variables. The evolution of investment is positive but not always significant.

Regarding our variable of interest - Structural Funds -, the results differ depending on the *proxy* used and the estimation method.

For *per capita* Funds, we observe that they do not act significantly when considered isolated. Thus, by adding interaction terms we find the mechanisms through which this variable exerts impact on growth. This way, the impact of the EU transfers depends on the level of income, innovation or human capital. Comparing the results for each pair of regressions, the conclusions differ depending on the estimation method considered. Apparently, the Funds have a positive impact on growth in lower-income, less innovative regions with low human capital. This result raises questions about the effectiveness of the Funds, originally designed to assist deprived regions to flourish and thus reduce regional asymmetries. On the one hand the finding support the idea that EU regional policy should explicitly be oriented for the less developed areas, if the aim is to be most effective in promoting growth. On the other hand, less developed regions may not have the right incentives to go beyond the threshold of assistance. In addition, the Funds affect growth positively at a decreasing marginal rate; above a certain limit the sign of the impact is reversed, thus calling the attention for the

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plausible limits regarding financial assistance destined to promoting growth and reducing regional asymmetries.

When the share of Funds on GDP is considered, the transfers are reasonably combined with innovation and human capital. For the former, Funds impact indirectly on growth, showing a positive impact in less innovative areas. For the latter, the impact of Funds is only positive if the share of people with tertiary education is lower than 27.7 per cent. Thus, apparently the Funds are more effective and display higher returns in regions with low indicators regarding human capital. This result support the focus upon less developed regions, but this approach creates a moral hazard problem, due to the lack of incentives to improve human capital skills because it will mean losing Funds. Human capital is always significantly and positively affecting growth and this fact should act as an incentive for policy makers to incentive improvements in this field. In addition, for regional transfer intensities above 1.6 per cent, the effect of Structural Funds on growth becomes negative, thus highlighting the need for the existence of reasonable limits of assistance, beyond which it loses effectiveness.

Summing up, the debate about the importance of Structural Funds is not conciliatory and our results show once more that the discussion on this matter is not plain. The outcomes found point in general to a positive impact of Funds over growth especially in less developed regions, and up to a certain level of assistance. At the same time, our results raise questions about the effectiveness of Structural Funds, since that they may originate behaviours from policy makers contrary to those originally intended.

Considering the direct impact of human capital upon growth, financial aid destined to improve human capital qualifications is probably the best way to promote growth in the long run, rather than allocating it mainly to physical infrastructures. This goes in line with the EU's Agenda 2020 focus on smart, sustainable and inclusive growth, by improving school early leavers' figures, investing in R&D and young employment, reducing the population affected by poverty and promoting energy efficiency.

We are aware that some of the effects of Structural Funds may take time to be visible, but our main goal was to ascertain the links through which Funds might be affecting growth, to assist in the decision of which policy to favour. This is even more important given the changes that are currently being discussed regarding the next programming period (2014-20).

Appendix I. Construction of the dataset

The choice on the level of regional disaggregation (NUTS) [87] for each country depended on the availability of data for Structural Funds.

For the years 1995-98, data on Structural Funds payments was collected from the European Commission's annual Reports (European Commission, 1996; 1997; 1998; 1999). For 1999, we computed the payments as the residual difference between commitments and payments in the 1994-98 period.[88]

From 2000 onwards, we relied on data sent on 12th December 2012 by the European Commission – DG Regional and Urban Policy, following a formal request. The estimated payments for 2000-06 refer to the programmes ERDF (European Regional Development Fund), ESF (European Social Fund), EAGGF (European Agricultural Guidance and Guarantee Fund), FIFG (Financial Instrument for Fisheries Guidance) and Cohesion Fund. For 2007-13, payments concern funds received under ERDF, ESF and the Cohesion Fund. The information is disaggregated at the NUTS2 level. For some countries, data on the Reports is available only for NUTS1 and thus we had to reconcile these different

87 NUTS, a territorial classification from the European Commission, means "Nomenclature des Unités Territoriales Statistiques".
88 We could not successfully download the European Commission's 11th Annual Report on the Structural Funds 1999 (published in 2000), from: http://ec.europa.eu/regional_policy/sources/docoffic/official/repor_en.htm.

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databases. Moreover, since only data from the Reports was disaggregated by Objective we had to rely on aggregated figures, to guarantee consistency.

For those countries that joined the EU more recently, there is no information on Structural Funds for previous years, so we considered them to be null. We used linear interpolation to avoid gaps in the series (Ionia Nisia – GR22 – and Östra Sverige – SE1 - were dropped at this stage).

For Bulgaria there was no information and Romania had data only from 2007 on. Therefore, they were eliminated. For Italy, Austria and Hungary, *per capita* GDP was not available until 2007 and thus they were discarded.

For Voreio Aigaio (GR41), Ciudad Autónoma de Ceuta (ES63) and Ciudad Autónoma de Melilla (ES64), there is no information on human capital and innovation and thus they were also dropped.

The 138 NUTS1 and NUTS2 regions considered are the following - according to European Commission's (2007) codes:

Belgium (3 NUTS 1): Région de Bruxelles-Capitale (BE1), Vlaams Gewest (BE2), Région Wallonne (BE3)

Czech Republic (8 NUTS 2): Praha (CZ01), Strední Cechy (CZ02), Jihozápad (CZ03), Severozápad (CZ04), Severovýchod (CZ05), Jihovýchod (CZ06), Strední Morava (CZ07), Moravskoslezsko (CZ08)

Denmark (1 NUTS 1):* Denmark (DK)

Germany (16 NUTS 1): Baden-Württemberg (DE1), Bayern (DE2), Berlin (DE3), Brandenburg (DE4), Bremen (DE5), Hamburg (DE6), Hessen (DE7), Mecklenburg-Vorpommern (DE8), Niedersachsen (DE9), Nordrhein-Westfalen (DEA), Rheinland-Pfalz (DEB), Saarland (DEC), Sachsen (DED), Sachsen-Anhalt (DEE), Schleswig-Holstein (DEF), Thüringen (DEG)

Estonia (1 NUTS 2): # Estonia (EE)

Greece (11 NUTS 2): Anatoliki Makedonia, Thraki (GR11), Kentriki Makedonia (GR12), Dytiki Makedonia (GR13), Thessalia (GR14), Ipeiros (GR21), Dytiki Ellada (GR23), Sterea Ellada (GR24), Peloponnisos (GR25), Attiki (GR30), Notio Aigaio (GR42), Kriti (GR43)

Spain (17 NUTS 2): Galicia (ES11), Principado de Asturias (ES12), Cantabria (ES13), País Vasco (ES21), Comunidad Foral de Navarra (ES22), La Rioja (ES23), Aragón (ES24), Comunidad de Madrid (ES30), Castilla y León (ES41), Castilla-La Mancha (ES42), Extremadura (ES43), Cataluña (ES51), Comunidad Valenciana (ES52), Illes Balears (ES53), Andalucia (ES61), Región de Murcia (ES62), Canarias (ES70)

France (26 NUTS 2): Île de France (FR10), Champagne-Ardenne (FR21), Picardie (FR 22), Haute-Normandie (FR 23), Centre (FR 24), Basse-Normandie (FR 25), Bourgogne (FR 26), Nord-Pas-de-Calais (FR 30), Lorraine (FR 41), Alsace (FR 42), ranche-Comté (FR 43), Pays-de-la-Loire (FR 51), Bretagne (FR 52), Poitou-Charentes (FR 53), Aquitaine (FR 61), Midi-Pyrénées (FR 62), Limousin (FR 63), Rhône-Alpes(FR 71), Auvergne (FR 72), Languedoc-Roussillon (FR 81), Provence-Alpes-Côte d'Azur (FR 82), Corse (FR 83), Guadeloupe (FR91), Martinique (FR92), Guyane (FR93), Réunion (FR94)

Ireland (1 NUTS 1):* Ireland (IE)

Cyprus (1 NUTS 2): # Cyprus (CY)

Latvia (1 NUTS 2): # Latvia (LV)

Lithuania (1 NUTS 2): # Lithuania (LT)

Luxembourg (1 NUTS 2): # Luxembourg (LU)

Malta (1 NUTS 2): # Malta (MT)

Netherlands (4 NUTS 1): Noord-Nederland (NL1), Oost-Nederland (NL2), West-Nederland (NL3), Zuid-Nederland (NL4)

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Poland (16 NUTS 2): Lódzkie (PL11), Mazowieckie (PL12), Malopolskie (PL21), Slaskie (PL22), Lubelskie (PL31), Podkarpackie (PL32), Swietokrzyskie (PL33), Podlaskie (PL34), Wielkopolskie (PL41), Zachodniopomorskie (PL42), Lubuskie (PL43), Dolnoslaskie (PL51), Opolskie (PL52), Kujawsko-Pomorskie (PL61), Warminsko-Mazurskie (PL62), Pomorskie (PL63)

Portugal (7 NUTS 2): Norte (PT11), Algarve (PT15), Centro (PT16), Lisboa (PT17), Alentejo (PT18), Região Autónoma dos Açores (PT20), Região Autónoma da Madeira (PT30)

Slovenia (2 NUTS 2): Vzhodna Slovenija (SI01), Zahodna Slovenija (SI02)

Slovakia (4 NUTS 2): Bratislavský kraj (SK01), Západné Slovensko (SK02), Stredné Slovensko (SK03), Východné Slovensko (SK04)

Finland (2 NUTS 1): Manner-Suomi (FI1), Åland (FI2)

Sweden (2 NUTS 1): Södra Sverige (SE2), Norra Sverige (SE3)

United Kingdom (12 NUTS 1): North East (UKC), North West (UKD), Yorkshire and the Humber (UKE), East Midlands (UKF), West Midlands (UKG), East of England (UKH), London (UKI), South East (UKJ), South West (UKK), Wales (UKL), Scotland (UKM), Northern Ireland (UKN).

* The NUTS0 classification coincides with the NUTS1. We classify these regions as NUTS1.

The territorial categories NUTS0, NUTS1 and NUTS2 are identical. We regard them as NUTS2.

Appendix II. DefinitionS of the variables and data sources

$y_{i,t}$ – Real p*er capita* Gross Domestic Product (GDP) (Euros per inhabitant)

Computed by the authors using data on: (i) GDP at current market prices (Million euro (from 1.1.1999)/Million ECU (up to 31.12.1998)), (ii) Price deflator GDP at market prices (national currency; annual percentage change) and (iii) Annual average population (1 000).

Data Sources: (i) Eurostat, Regional Economic Statistics (data extracted on 6th November 2012); (ii) European Commission (2011) - Knowing the base year (2005=100), we computed the annual national GDP deflator and used it to divide the regional current GDP. Given that regional price indexes are not available, we converted nominal into real figures using national GDP deflator assuming that for each region of a given country, the price index is the same; (iii) Eurostat, Regional Demographic Statistics (data extracted on 20th November 2012).

$gy_{i,t}$ – Annual growth rate of real *per capita* GDP (annual logarithmic difference of real *per capita* GDP)

$gpop_{i,t}$ – Annual growth rate of population

Computed by the authors using data on "Annual average population (1 000)". To the annual logarithmic difference of population we added 5 per cent, to account for the rate of (human and physical) capital depreciation and the rate of technological progress.

Data Source: Eurostat, Regional Demographic Statistics (data extracted on 20th November 2012).

$s_{i,t}$ – Investment share (per cent)

Computed by the authors using data on: (i) Gross fixed capital formation (Million euro (from 1.1.1999)/Million ECU (up to 31.12.1998)) and (ii) GDP at current market prices (Million euro (from 1.1.1999)/Million ECU (up to 31.12.1998)).

Data Source: (i) and (ii) Eurostat, Regional Economic Statistics

$hc_{i,t}$ – Human capital (per cent)

Students in tertiary education as a percentage of the population aged 20-24 years

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Data Source: Eurostat, Regional Education Statistics (data extracted on 6th November 2012)

$pat_{i,t}$ –Patent applications to the European Patents Office (EPO) by priority year - Total (per million of inhabitants)

Computed by the authors using data on: (i) Number of patent applications to the EPO by priority year and (ii) Annual average population (1 000).

Data Sources: (i) Eurostat, Regional Science and Technology Statistics (data extracted on 16th January 2013) and (ii) Eurostat, Regional Demographic Statistics.

$sfpc_{i,t}$ –Interpolated real *per capita* Structural Funds terms (Euros per inhabitant)

Computed by the authors using data on: (i) payments for 1995- 1998; (ii) calculation of payments for 1999 as the difference between commitments and payments in 1994-1998; (iii) payments for 2000-2009; (iv) Price deflator GDP at market prices (national currency; annual percentage change) and (v) Annual average population (1 000).

Data Sources: (i) European Commission (1996; 1997; 1998; 1999); (ii) European Commission (1999); (iii) European Commission – DG Regional and Urban Policy; (iv) European Commission (2011) and (v) Eurostat, Regional Demographic Statistics.

$sfshare_{i,t}$ –Interpolated Structural Funds share over GDP (per cent)

Computed by the authors using data on: (i) payments for 1995- 1998; (ii) calculation of payments for 1999 as the difference between commitments and payments in 1994-1998; (iii) payments for 2000-2009; (iv) GDP at current market prices (Million euro (from 1.1.1999)/Million ECU (up to 31.12.1998))

Data Sources: (i) European Commission (1996; 1997; 1998; 1999); (ii) European Commission (1999); (iii) European Commission – DG Regional and Urban Policy; (iv) Eurostat, Regional Economic Statistics.

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ARE SMALL FIRMS MORE DEPENDENT ON THE LOCAL ENVIRONMENT THAN LARGER FIRMS? EVIDENCE FROM PORTUGUESE MANUFACTURING FIRMS

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Abstract. This paper analyses the impact on firm-level total factor productivity (TFP) of both agglomeration economies and regional knowledge, measured by local sector specialization and diversity, and of regional knowledge, using an unbalanced panel of Portuguese manufacturing firms covering the period 1996–2004. Additionally, we study if smaller firms are more dependent of local environment than larger ones. We use TFP at firm level, which was estimated after controlling for endogenous input choices and self selection using the Arellano and Bond (1991) difference GMM estimator. We found that both localization and urbanization economies have a significant and positive effect on firms' TFP, with the latter playing the most important role. Sectoral specialization economies are important for small and medium firms, but not for large firms. However, larger firms profit more from regional knowledge than smaller ones.

Keywords: agglomeration economies, regional knowledge, small firms, total factor productivity.

Resumo. Analisa-se o efeito das economias de aglomeração e do conhecimento regional na produtividade total dos factores (TFP) ao nível da empresa, medidas pela especialização e diversificação sectorial e pelo conhecimento regional, utilizando um painel não balanceado de empresas da indústria transformadora, no período 1996-2004. Analisa-se ainda se são as pequenas empresas as mais dependentes do ambiente local. Utilizamos a TFP ao nível das empresas, estimada depois de se controlar a endogeneidade associada às escolhas de inputs e à auto selecção com o estimador GMM de equações em primeiras diferenças de Arellano e Bond (1991). Conclui-se que as economias de localização e urbanização têm um efeito positivo e significante na TFP, sendo as de urbanização mais importantes. Conclui-se também que as economias de especialização sectorial são importantes para as pequenas e médias empresas, mas não para as grandes empresas, sendo estas as que mais beneficiam do conhecimento regional

Palavras-chave: economias de aglomeração, conhecimento regional, pequenas empresas, produtividade total dos factores

1. Introduction

The study of spatial agglomeration of both production activities and knowledge is important to understand their contribution for local and national economic growth. Notwithstanding the tendency to reducing transaction costs, there has been observed an increasing propensity for firms to agglomerate their activities in certain regions with economic impacts on employment levels, wages, knowledge, productivity and economic growth.

The theories of the location of economic activity are microeconomic in his essence, which means that the empirical studies should use firm level data. However, the unavailability of large microeconomic datasets has favoured empirical investigations at the aggregate rather than micro-level. Moreover, given that productivity growth at firm level is generally not available, most of earlier studies use proxies, namely employment growth or wage growth, under the assumption that there is a national labour market and that labour is homogeneous, which is hardly verified.

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In this paper, we perform a micro-level analysis of TFP to shed further light on the extent to which the local environment has an effect on firms' performance. The main purpose of our paper is thus to estimate the impact of agglomerations economies and regional knowledge base, on firms' TFP. Additionally, we study if smaller firms are more dependent of local environment than larger ones. To conduct the analysis, we will use an unbalanced panel of Portuguese manufacturing firms covering the period 1996–2004.

This paper makes two main contributions to the economic literature. Even though agglomeration economies and regional knowledge base encompass a large number of studies, to our awareness, there has been no research that assesses the role of these two productivity sources together. Furthermore, there is scarce evidence on the effect of local environment on firms' TFP, specially, across firms' size.

The paper proceeds as follows. Following a brief review of the background literature in the next section, Section 3 presents the modelling and the dataset. Section 4 evaluates the effects of agglomeration economies and regional knowledgebase on firm growth across firms' size. Section 5 offers some brief concluding remarks.

2. Theory and selected empirical findings

The location of economic activity within the models of the new economic geography is endogenously determined through the interaction between two forces: the 'centripetal' forces that attract economic agents to the same location and the 'centrifugal' forces that push them apart (Krugman, 1998). Externalities, a key concept developed by Marshall, are the most important centripetal force, as they are central to explain why production activities tend to agglomerate in certain regions.[89] The rationale is that, in the process of choosing its spatial location, a firm looks for the proximity of other firms due to the benefits they can get. Glaeser *et al*. (1992) identifies three sources of externalities:

i) Marshall-Arrow-Romer (MAR)—after the three pioneering contributions of Marshall (1890/1961), Arrow (1962) and Romer (1986)—or localization externalities, which are related to intra-industry economies arising from the regional concentration of firms in the same industry (i.e. sectoral specialization). Firms have advantages in being located near others belonging to the same industry because the geographical concentration of an industry can increase the variety of intermediate goods available (at lower prices) as well as the dimension of final good demand, can attract a large labour force with the skills demanded by that industry and can spread a great specialized knowledge level (namely via informal channels).

ii) Jacobs or urbanization externalities, which are connected to inter-industry economies arising from the variety of regional economic activity (Jacobs 1969). A sectoral diversity in a given region can stimulate a more diverse client base protecting firms from volatile demand, can create a vast spectrum of locally available inputs easing their switching in case of scarcity or a rise in prices and can disseminate a more assorted knowledge base increasing the possibility of discovering new products or production processes.

iii) Porter or competition externalities, which are related with competition intensity within a region. Competition stimulates both production and adoption of innovations and, consequently, improves firms' performance (Porter, 1990). Porter externalities are similar to MAR externalities, but unlike earlier, it is local competition and not local monopoly that stimulate a faster search and adoption of innovations.

As it is possible to see, the theories which underlie externalities, whether MAR-type, Jacobs type or Porter type, are microeconomic in essence, which means, that empirical studies should use firm level data. However, as generally data on productivity is generally not available, it is used as a proxy for

89 Krugman (1998) identify as the main centrifugal forces the immobile factors (e.g. certain land and natural resources), the high land rents and the external diseconomies (such as congestion).

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productivity employment or wages data under the assumption that there is a national labour market and that labour is homogeneous and that productivity growth will result in proportional employment gains through shifts in labour demand, which is hardly verified (see, for example, Glaeser et al. (1992); Henderson et al. (1995); Combes (2000)).

Using a cross-section of US cities, Glaeser et al. (1992) find that MAR externalities have a negative impact on urban employment growth, while Jacobs and Porter economies positively affect it. Glaeser et al. (1992) approach has been replicated by other authors (see, for example, Cingano and Schivardi (2004), for a brief survey). However, the findings from these researches are to some extent puzzling. Moreover, while taking local employment growth as the dependent variable, using 1991 Italian census data, Cingano and Schivardi (2004) show that the specialization effect is negative and variety has a significant and positive impact on employment growth, in line with Glaeser et al.'s results, using firm-level based TFP indicators, they find that specialization effect is reversed and becomes positive, and neither sectoral variety nor the degree of local competition have any effect. Cingano and Schivardi (2004) question the conclusions of previous empirical works arguing that they suffer from serious "identification problems" when interpreted as evidence of dynamic externalities, since the chain of causality from agglomeration economies to employment growth could be reversed—the use of employment or wages growth at firm level as dependent variable is based on the (unlikely) assumption that productivity growth will result in proportional employment gains through shifts in labour demand (see, for example, Glaeser et al. (1992); Henderson et al. (1995); Combes (2000)).

Therefore, since externalities imply a change in output not fully accounted for by a change in inputs, TFP would be a better measure of performance. Martin et al. (2011) show that French plants from 1996 to 2004benefit in terms of TFP growth from localization, but not from urbanization economies. They do not find any consistent pattern for local competition. An explanation can be that competition incentives firms to invest in R&D, but if the succession of innovations is rapid, the returns from R&D are low, which will reduce the R&D investment and, as a consequence, the innovations. In the case of the USA plants, over the period 1972–1992, Henderson (2003) find that localization economies only have strong positive effects on TFP in high-tech not in mechanical industries. He also finds little evidence of urbanization economies.

Another interesting strand of economic geography research, favoured by the flourishing endogenous growth theories, has pointed out that localized knowledge and technology spillovers matter for innovative activity, which is consequently shaped by space and concentrated in certain areas (Scott (1988); Feldman (1994); Acs (2002); Johansson and Lööf (2008); Bronzini and Piselli (2009)). In particular, it is argued that proximity to the knowledge base can encourage the circulation of ideas and the transmission of knowledge, thanks to face-to-face contacts and social interaction, which in turn facilitates innovation (Storper and Venables (2004); see Audretsch and Feldman (2004) for a review of theoretical and empirical studies). The knowledge-transfer environment in which a firm is embedded can also play a key role in explaining productivity differential between firms located in different geographic areas (Amesse and Cohendet (2001))—for example, *knowledge intensive business services* (KIBS) are crucial to disseminate knowledge across the region and to support firms' innovative activity (Muller and Zenker (2001)).

Looking at the firm size, in general small firms could be expected to be more dependent on the local environment than larger firms (Henderson (2003); Andersson and Lööf (2009)). Indeed, they are less able than large firms to internalise innovative inputs and providing complementary activities that may facilitate innovation (Feldman, 1994).

On the whole, despite the fact that the literature on agglomeration economies and regional knowledge base encompass a large body of studies, to our awareness, there has been no empirical research that assesses the role of these two productivity sources together. In fact, if both factors affect productivity and interact with each other and if one these factors is omitted, estimations of elasticity can be biased. Moreover, there is scarce evidence on effect of local environment across firms' size. We will try to fill this gap by assessing the role of both agglomeration economies and regional knowledgebase effects in enhancing the TFP by firm size.

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3. Empirical strategy

3.1 The data

To conduct our empirical analysis, we use an unbalanced panel of Portuguese manufacturing firms covering the period 1996-2004. The raw data is drawn from the combination of two statistical data sources, both run by the Portuguese Statistical Office (INE): *Inquérito às Empresas Harmonizado* (IEH), an annual business survey with detailed information on inputs and output, required to determine productivity at firm level; and *Ficheiro de Unidades Estatísticas* (FUE) which contains a variety of firm characteristics (activity, number of employees, age and location) of all Portuguese firms, critical to compute spatial agglomeration variables. The longitudinal dimension of the panel was constructed using firm's unique identification code.

The unit of production considered is the firm. Each firm is assigned to a given region (at NUT3 level; NUT3 definition of 2002) through a spatial identification code. Thus, the first drawback of the data is that multi-plant firms may affect our results if their different plants are located in different regions. We note, however, that the different plants of corporations are often registered as distinct legal entities, thus the multi-plant phenomena impact on results may be small.

The IEH survey comprises all firms operating in Portugal with more than 100 employees and a representative random sample of firms with less than 100 employees.[90] For the purpose of this paper the following cleaning procedures were made: firstly, due to the lack of quality of information reported, firms with less than 20 employees were eliminated from the estimation sample;[91] secondly, both firms located in the island regions (i.e. Madeira and Azores) and, given the number of observations, those operating in manufacture of tobacco products (CAE 16) and manufacture of coke, refined petroleum products and nuclear fuel (CAE 23)were also excluded; finally, observations that were reported with either missing or unreasonable values (negative values and outliers) were dropped. For each industry, we define as an outlier a firm for which the log difference between an input and the output is in the top or bottom one percentile of the respective distribution. As a result of all these procedures, we have an unbalanced panel of 8,074 firms, over the period 1996-2004, resulting in 32,003 (year-firm) observations.

3.2. Empirical model and variables

The main purpose of our analysis is thus to shed further light on the extent to which the local environment has an impact on productivity. In the past few years the study of this issue has greatly shifted from aggregated regional level towards the understanding of the operation of micro units (Stephan (2011); Ottaviano (2011)). Accordingly, the general model that we use for our empirical analysis is a firm-level Cobb-Douglas production function—we assume that each firm is located in a given region and operates in a given industry:

$$Y_{it} = A_{it} K_{it}^{\alpha_j} L_{it}^{\beta_j} M_{it}^{\theta_j}, \qquad (1)$$

where Y_{it} is the real gross output of the *i*th firm and year *t* (located in region *r*and operating in industry *j*), and K_{it}, L_{it} and M_{it} are capital, labour and material (intermediate) inputs, respectively; A_{it} is the total factor productivity (TFP). We allow for the coefficients α_j, β_j and θ_j to vary across industries. Given the regulation of the Portuguese labour market, we cannot assume perfect competition hypothesis, so neither constant returns to scale. The advantage is that, we disentangle TFP changes from production-scale effects, otherwise attributed to TFP.

90 The sample is representative of the Portuguese sector disaggregation (at 3-digit level), both in terms of employment size and sales.

91 We note that firms with less than 20 employees represent about 71% of Portuguese manufacturing firms, but only 16% of total employment (average over the period; source: OECD database).

The *gross output* is given by the sum of total revenues from sales, services rendered and production subsidies. It is deflated by the producer price index at the 3-digit level. The *labour* input is a 12-month employment average. *Materials* include the cost of materials and services purchased and were deflated by the GDP deflator. *Capital stock* is measured as the book value of total net assets (excluding financial investments and cash stock).

We assume that TFP of firm *i*is driven not only by firm's knowledge, but also by both agglomeration economies and regional knowledgebase:

$$A_{it} = (R_{it})^{\gamma}(S_{it}^{jr})^{\varphi}(Z_{it}^{jr})^{\phi}, \qquad (2)$$

where R_{it} is the firm's knowledge stock in year *t*, S_{it}^{jr} is a vector of covariates that reflects the potential for spatial agglomeration economies of industry *j* in region *r*, and Z_{it}^{jr} is a vector of covariates that proxies regional knowledgebase.

We assume as a proxy for firm's stock of knowledge the inverse of firm's size times its age:

$$FKNOW_{it} = \frac{1}{L_{it} \cdot Age_{it}}. \quad (3)$$

The rationale is that older and larger firms often command more resources and have higher managerial experience (Jovanovic (1982)). The firm's knowledge returns are assumed non-linear and decreasing. The index (3) ranges between close to zero (high level of knowledge), when firm is very large and old, and one (low level of knowledge), if it had only one employee and one year old—in our case, since we have imposed a censoring level of 20 employees, the maximum value is 0.05.

As discussed in Section 2, three kinds of advantages of the proximity for economic agents (agglomeration economies) can be distinguished: localization, urbanization and competition economies. The localization (or sectoral specialization) economies are measured, for each firm, as the share of other employees working in the same industry (at the two-digit level) within a region (Combes (2000)):[92]

$$LOC_{it}^{jr} = \frac{L_t^{jr} - L_{it}}{L_t^{r} - L_{it}}, \qquad (4)$$

with $L_t^{jr} = \sum_{i \in J^{jr}} L_{it}$ and $L_t^{r} = \sum_{i \in I^{r}} L_{it}$, where J^{jr} and I^{r} are the set of firms belonging to industry *j* in region *r* and whole region *r*, respectively, in year *t*.

The urbanization (or sectoral diversity) economies are proxied by the inverse of the Herfindahl-Hirschman index of industry concentration based on the employment share of the different industries (at the two-digit level), except the respective industry *j*, in a region (Henderson et al. (1995); Combes (2000)):

$$URB_t^{jr} = \frac{1}{HR_t^{jr}}, \qquad (5)$$

with $HR_t^{jr} = \sum_{g \neq j \wedge g \in G^r} \left[L_t^{gr} / \left(L_t^{r} - L_t^{jr} \right) \right]^2$, where G^r is the set of industries in region *r*. The measure of industrial diversity (5) ranges between 1 (minimum value), when all other manufacturing employment in the region is concentrated in a single industry, and $J^r - 1$ (maximum value) if it is uniformly distributed across all (other) industries. As pointed out by Combes (2000), the value of this indicator is not directly linked with the previous one of industrial specialization. In fact, if the regional employment is highly concentrated in a given industry and the several remaining industries have

92 Since we subtract ith firm's employment, LOC are firm specific.

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approximately the same size, the value of both indexes (concentration and diversity)for this industry are high.

To measure the degree of competition inside each industry at local level (competition externalities), we use the inverse of the Herfindahl-Hirschman index of regional employment concentration:

$$COMP_t^{jr} = \frac{1}{HJ_t^{jr}}, \qquad (6)$$

with $HJ_t^{jr} = \sum_{i \in J^{jr}} \left(L_{it} / L_t^{jr} \right)^2$. The higher is the employment share of firm *i*, therefore lesser uniform distribution of employment across firms, the lower is $COMP_t^{jr}$. The index also tends to increase with the number of firms.

Taking into account the theories of innovation and technological diffusion outlined in Section 2, we consider two kind of factors through which regional innovative environment might impact on firm's productivity: knowledge transfer and knowledge base. Some economic agents such as those that operating in KIBS play a crucial role in disseminating knowledge through the region and supporting firms' innovative activity. We represent the capacity of transfer knowledge as the number of employees working in KIBS sector in the region.[93] In order to capture the effect of knowledge base, we distinguish two sources: regional R&D employment (*RD*) and the number of higher degree establishments in a region (*UNIV*)—the role of universities in innovation has been highlighted by various studies, such as Fritsch and Slavtchev (2007) and Cassia et al. (2009).

3.3. Estimation

We adopt the so-called two-step approach. We firstly estimate the factor elasticity parameters of following (log) Cobb-Douglas production function for each two-digit industry,

$$y_{it} = a + \alpha^j k_{it} + \beta^j l_{it} + \theta^j m_{it} + u_{it} \qquad (7)$$

where lower-case letters denotes the log upper-case variables of equation (1), to compute firm-level (log) total factor productivity:

$$\hat{a}_{it} = y_{it} - \hat{\alpha}^j k_{it} - \hat{\beta}^j l_{it} - \hat{\theta}^j m_{it}. \qquad (8)$$

In the estimation of equation (1), we control for macroeconomic shocks by including year dummy variables. Additionally, we assume $u_{it} = \eta_{it} + \varepsilon_{it}$, with η_{it} denoting a firm-specific unobserved component and ε_{it} a residual term uncorrelated with input choices. Ordinary least-squares (OLS) estimation of equation (7) produces inconsistent estimates due to the likely presence of simultaneity and selection bias: the simultaneity bias arises because input demands are also determined by firm's knowledge of its productivity level, which makes η_{it} correlated with the observed inputs; the selection bias is generated by endogenous exit, as smaller firms, with lower capital intensity, are more likely to exit. Assuming that η_{it} is time invariant, equation (7) can be estimated using the least square dummy variable approach or the within transformation.[94] Consistency of the fixed effect model requires, however, strictly exogeneity of the included regressors, a non-realistic assumption (Grilliches and Mairesse, 1998). To overcome this problem, we estimate the equation (7) using the generalized method of moments (GMM) methodology for 20 separate industries (at 2-digit level). In particular, we employ the Arellano and Bond (1991) one-step difference GMM (GMM-DIF) estimator, which transforms the panel data model in first differences to remove the individual effects and then

93 According to European Monitoring Centre on Change, KIBS comprises the following CAE-rev2.1 divisions: (CAE 72) computer and related activities, (CAE 73) research and experimental development and (CAE 74) other business activities.

94 The random effects model is rejected in favour of the presence of fixed effects by both Hausman and robust Hausman tests at the 1% significance level (see Wooldrige (2002)).

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uses lagged levels of the dependent variable and the predetermined variables as instruments for the endogenous differences.[95]

We then estimate (in the log form) the model (2):

$$a_{it} = \gamma_0 + \gamma_1 fknow_{it} + \varphi_1 loc_{it}^{jr} + \varphi_2 urb_t^{jr} + \varphi_3 comp_t^{jr} + \phi_1 kibs_t^r + \phi_2 univ_t^r + \phi_3 rd_t^r + \upsilon_{it}, \qquad (9)$$

where the residual term is given by $\upsilon_{it} = \text{?}_i + \text{?}_{it}$. We cannot disentangle firm and regional fixed effects with this formulation, but that does not affect the estimation. Since all covariates are expressed in logarithms, the estimated coefficients can be interpreted as elasticity parameters.

Regarding equation (9), we note that it is subject to two main sources of endogeneity: unobserved heterogeneity and simultaneity bias. In fact, some region characteristics (e.g. public infrastructures, local climate, natural resources, etc.) that are not taken into account in this econometric model can affect the propensity to agglomerate, while at the same time agglomeration influences these region characteristics—in other words, υ_{it} is correlated with the independent variables. Additionally, self-selection of the more productive firms also creates a simultaneity problem. Higher productivity in larger markets (or denser areas) may not be due to agglomeration economies (learning effect); it might instead be due to the fact that high-productivity firms are more likely to be attracted to these advantageous markets (selection effect).[96] In other words, because more productive firms are likely located in larger/denser regions, average firm productivity in these regions should be higher even if there are negligible agglomeration economies, which means that OLS estimates might be biased (Baldwin and Okubo (2006); Melitz and Ottaviano (2008); Andersson and Lööf (2009); Saito and Gopinath (2009)). To deal with the endogeneity problem, we estimate the model using again the GMM-DIF procedure. Industry and region dummies were also included in the estimation.

As discussed in Section 2, it can be expected that the role of local environment can be different across firms of different sizes. In order to investigate this, we will split the sample into three size classes: firms with 20–100, 100–250 and 251 or more employees (small, medium and largefirms, respectively). The thresholds are those used by the OECD, except for large firms—in Portugal, there are only a few firms with more than 500 employees, the OECD threshold.

3.4. Summary statistics

Tables 1 and 2 report the summary statistics and the correlations matrix, respectively, of the main variables used in our estimations. Most variables exhibit strong variability, as shown by the large values of standard deviations respective to their mean (Table 1). Even if between variations account for a large part of this heterogeneity, within standard-deviation has a non-negligible role on its explanation. The mean manufacturing firm in the estimation sample has 122 employees and produce 9,812 thousand euros.

The correlation matrix reveals that, as expected, there is a statistically significant (at 5%) and negative correlation between *TFP* and *FKNOW*—recall that lower values of variable mean higher level of knowledge—and a statistically significant and positive correlation between *TFP* and both spatial agglomeration and regional knowledge covariates, except in the case of *URB* (Table 2). The correlation between the regional knowledge covariates (i.e. *KIBS*, *RD* and *UNIV*) is rather high, which should cause multicollinearity problems in the regressions. Given that, the two explanatory variables that measures the knowledge input available in the region, *RD* and *UNIV*, are replaced by their product (i.e. *RKNOW* = *RD*× *UNIV*).

Figure 1*a*displays the distribution of sample firms across the 28 NUTS3 regions. The map shows a high concentration of firms in the North, mainly in the regions of Grande Porto and Ave, but also in

95 Regressions were performed using the Stata, xtabond2 procedure (Roodman, 2009). The results presented in the paper are robust to fixed-effects, Olley and Pakes (1996), Levinsohn and Petrin (2003) and GMM-System methods. These results are available from the authors upon request.

96 In the Portuguese case, larger markets and denser areas are highly correlated.

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the region of Grande Lisboa. Figure 1*b* has been coloured to highlight the spatial distribution of the weighted average of the TFP level. As can be seen, the regions of Ave, Cova da Beira, Dão-Lafões, Minho-Lima and Pinhal Litoral show the highest values of TFP.

Table 1. Descriptive statistics, 1996-2004

Variable		Obs	Mean	Std. Dev.			Min	Max
			overall	overall	between	within	overall	overall
a) Firm specific								
Y	Output (10^3€)	32,003	9,812	39,822	29,437	8,382	118	2,076,602
K	Capital (10^3€)	32,003	9,927	35,903	29,689	10,685	28	2,019,021
L	Labour	32,003	122	236	185	47	20	7,455
M	Material (10^3€)	32,003	6,934	32,795	23,938	6,002	11	1,699,340
TFP	Total factor productivity	32,003	40.9	29.6	29.2	6.8224	7.0	702.8
FKNOW	Firm's knowledge	31,960	0.0015	0.0023	0.0030	0.0009	0.0000	0.0476
b) Regional level								
LOC	Localization economies	32,003	0.1428	0.1406	0.1427	0.0213	0.0000	0.8047
URB	Urbanization economies	32,003	7.0256	3.0239	3.0009	0.6114	1.2258	13.3175
COMP	Competition economies	32,003	37.4	46.3	52.0	8.7	1.0	272.5
KIBS	Business services employment	32,003	17,239	35,589	32,548	9,774	24	143,322
RD	R&D employment	32,003	2,166	3381	3163	688	0	11,991
UNIV	Higher degree establishments	32,003	25.3	32.7	31.4	5.2	0	97

Table 2. Correlation across covariates (pooled yearly values), 1996-2004

	Y	K	L	M	TFP	FKNOW	LOC	URB	COMP	KIBS	RD
K	0.834*	1									
L	0.629*	0.566*	1								
M	0.930*	0.791*	0.580*	1							
TFP	0.047*	0.063*	0.088*	0.030*	1						
FKNOW	-0.106*	-0.120*	-0.200*	-0.091*	-0.062*	1					
LOC	-0.041*	-0.036*	0.021*	-0.040*	0.063*	-0.017*	1				
URB	0.084*	0.091*	0.051*	0.075*	-0.008	-0.054*	-0.349*	1			
COMP	-0.054*	-0.059*	-0.004	-0.052*	0.289*	0.000	0.489*	-0.269*	1		
KIBS	0.077*	0.084*	0.048*	0.063*	0.042*	-0.055*	-0.190*	0.534*	-0.049*	1	
RD	0.078*	0.087*	0.052*	0.063*	0.045*	-0.060*	-0.221*	0.617*	-0.045*	0.981*	1
UNIV	0.071*	0.081*	0.049*	0.059*	0.042*	-0.059*	-0.267*	0.710*	-0.061*	0.881*	0.932*

Note: * denotes statistical significance at the .05 level.

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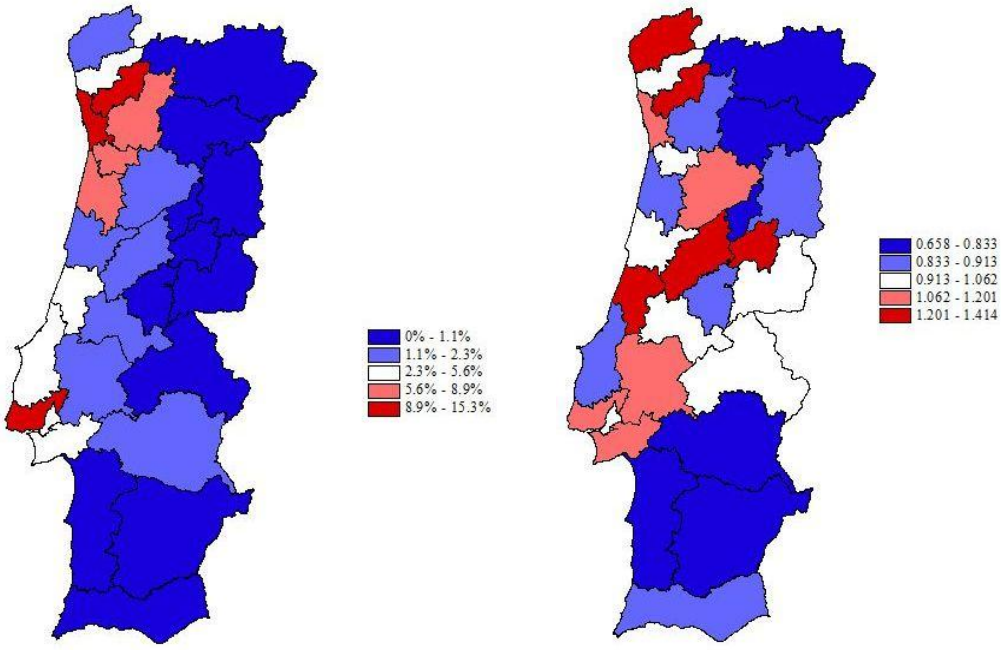

(a) Number of firms (% of total) (b) Total Factor Productivity (quintiles)

Figure 1. Number of firms and TFP by NUT3 regions

4. How large are the local environment effects across size classes?

The key results of GMM-DIF estimation of model (9) are presented in Table 3—the factor elasticity estimates for each industry, used in the second-step to compute firm-level TFP, are in Appendix Table A1. Column (1) of Table 3 summarizes the main coefficient estimates for the overall sample, while columns (2)-(4) show the results by size classes. The validity of GMM-DIF estimates depends on the absence of second-order serial autocorrelation and on the choice of the appropriate set of instruments. This is indeed the case, since, as expected, the Arellano-Bond AR(1) test shows a negative first-order serial correlation, while the AR(2) test indicates that residuals are seemingly free from second-order serial correlation. Moreover, the null hypothesis of the Hansen test that the overall instruments are valid is not rejected in all four regressions. We note that the Hansen and Sargan tests for over-identifying restrictions show opposite results; however, the Sargan test should be interpreted with care, since the model allows for heteroskedasticity rendering the test baseless.

Table 3. Results of GMM-DIF regression

Firm size Variable	Overall (1)	Small (2)	Medium (3)	Large (4)
FKNOW	-0.0690**	0.0017	-0.2943***	-0.0991***
	(0.0271)	(0.0470)	(0.0474)	(0.0352)
LOC	0.0068***	0.0065*	0.0087**	0.0006
	(0.0025)	(0.0038)	(0.0042)	(0.0036)
URB	0.0751***	0.0773***	0.0083	0.0744**
	(0.0191)	(0.0248)	(0.0341)	(0.0361)
COMP	0.0023	0.0026	0.0092	0.0008
	(0.0066)	(0.0091)	(0.0096)	(0.0131)
KIBS	0.0078**	0.0127**	-0.0034	0.0184***
	(0.0033)	(0.0050)	(0.0055)	(0.0064)
RKNOW	0.0241***	0.0195***	0.0141**	0.0318***
	(0.0041)	(0.0054)	(0.0061)	(0.0111)
No. of observations	11,015	5,368	3,958	2,107
No. of firms	2,922	1,827	1,046	478
No. of instruments	49	42	31	44

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AR (1)	-6.33	-2.52	-6.53	-6.02
Prob>*z*	0.000	0.012	0.000	0.000
AR (2)	1.95	1.64	0.07	0.73
Prob>*z*	0.051	0.101	0.948	0.468
Sargan test	274.89	81.26	0.48	115.97
Prob>χ^2	0.000	0.000	0.785	0.000
Hansen test	4.93	0.00	0.86	7.02
Prob>χ^2	0.177	1.000	0.651	0.319

Notes: The table summarizes the key coefficient estimates for four different regressions of model (9). GMM-DIF denotes the Arellano-Bond one-step difference GMM estimator. All regressions include industry and region dummies. Variables are in logarithmic form (except in the case of the dummy variables). Robust standard errors are given in parentheses. ***, **, and * denote statistical significance at the .01, .05, and .10 levels, respectively.

4.1. Overall sample analysis

Looking at the estimated parameters in column (1) of Table 3, firm's stock of knowledge (*FKNOW*) has a statistically significant (at 5%) and virtual impact on firm's productivity—an increase in knowledge implies that the corresponding index reduces, then increasing the productivity—, but it is far to explain all productivity gains. Localization (*LOC*) and urbanization (*URB*) economies also positively impact (at the 1% significance level) on the firm's productivity, while no effects of the degree of local competition (*COMP*) is found at conventional significance levels. In particular, increasing by 1% the share of other employees working in the same industry-region, *ceteris paribus*, increases the TFP of a firm by 0.0068%. In the case of the employment share of the other industries in the region, the corresponding increment in the TFP is 0.0751%. These results seem to point out a superiority of sectoral diversity (urbanization) economies.

For its part, regional knowledge also seems to play a key role on firms' TFP gains. In fact, both the number of employees working in KIBS sector-region and regional knowledge base have a positive impact (significance at 5% and 1%, respectively) on the productivity—increasing *KIBS* (*RKNOW*) by 1%, all else equal, increases the TFP by 0.0078 (0.0241)%.

4.2. Differences across firms' size

We now refine our analysis splitting the sample into three size classes—small, medium and large firms, respectively, columns (2), (3) and (4) of Table 3—, in order to investigate if there is a difference in the role of the local environment across firms' size. Surprisingly, while firm's internal knowledge has a significant (at 1%) expected effect on the productivity level of medium and large firms, it does not seem to impact on the productivity of small firms. A possible explanation for this unexpected finding can be that sample partition created a homogeneous group of (small) firms which have not yet accumulated enough internal knowledge to impact on productivity.

Looking at the estimated parameters of agglomeration economies, our first finding is that the effect on productivity level of small and medium firms is higher when the employment in neighbouring firms of the same industry is also higher (relative to total regional employment), while at the same time large firms do not benefit from this sectoral specialization. A second finding is that there is a significant and positive relationship between sectoral diversity and productivity for small and large firms. Finally, the impact of regional knowledge (KIBS and RKNOW) seems to be higher for large firms than small ones.

5. CONCLUSION

This study focuses on the extent to which the local environment has an impact on productivityacross firms' size, using an unbalanced panel of Portuguese manufacturing firms covering the period 1996–2004. We assume that both agglomeration economies and regional knowledge have a positive

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impact on firms' TFP. Additionally, smaller firms are more dependent of local environment than larger firms.

Our econometric estimates confirm the conjecture that the agglomeration economies and regional knowledge base seem to be important to explain productivity gains at firm-level, then at regional and national level too. In particular, we found that both localization and urbanization economies have a significant and positive effect on firms' TFP, with the latter playing the most important role. Sectoral specialization economies are important for small and medium firms, but not for large firms. However, larger firms profit more from regional knowledge than smaller ones. One explanation for this unexpected finding can be that small firms have not accumulated enough knowledge to absorb external (regional) knowledge ('absorptive capacity of firms', after Cohen and Levinthal (1989)).

Overall, this paper contributes to a better understanding of the economic mechanisms and, consequently, may contribute to the implementation of the adequate regional policies to enhance economic growth. Our findings imply that fostering productivity could require different instruments across firms' size. Regional specialization seems to be a worthwhile policy to promote productivity gains of small firms. To help small firms to benefit from regional knowledge base, policy makers could promote the creation of internal knowledge inside of these firms type.

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Appendix

Table A1. Production function elasticities by industry

Industry	?	?	?
Food products and beverages	0.0306* (0.0174)	0.0534* (0.0285)	0.7591*** (0.0311)
Textiles	0.0261 (0.0243)	0.1556*** (0.0348)	0.7123*** (0.0221)
Wearing apparel	0.1460*** (0.0213)	0.4205*** (0.0870)	0.4571*** (0.0225)
Leather and leather products	0.0794*** (0.0268)	0.2023*** (0.0554)	0.7135*** (0.0321)
Wood and wood products	0.0108 (0.0212)	0.1004*** (0.0388)	0.7204*** (0.0234)
Pulp, paper and paper products	0.0993*** (0.0350)	0.1396* (0.0720)	0.6758*** (0.0460)
Publishing and printing	0.0580*** (0.0195)	0.1433*** (0.0484)	0.6560*** (0.0280)
Chemical and chemical products	0.0303 (0.0213)	0.1240*** (0.0289)	0.7700*** (0.0250)
Rubber products	0.0031 (0.0567)	0.1074 (0.0973)	0.6360*** (0.0636)
Plastics products	0.0012 (0.0250)	0.1033* (0.0555)	0.7104*** (0.0365)
Other non-metallic mineral products	0.0266 (0.0223)	0.1155***(0.0341)	0.7361*** (0.0254)
Basic metals	0.0226 (0.0288)	0.2701***(0.0625)	0.7309*** (0.0289)
Fabricated metal products	0.0909** (0.0361)	0.2156***(0.0360)	0.6265*** (0.0378)

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Machinery and equipment	0.0783*** (0.0290)	0.3004***(0.0534)	0.6315*** (0.0236)
Electrical and optical equipment	0.0679** (0.0307)	0.1037***(0.0401)	0.7417*** (0.0280)
Motor vehicles, trailers and semi-trailers	0.0251 (0.0267)	0.1472*** (0.0420)	0.7363*** (0.0310)
Other transport equipment	0.0674 (0.0849)	0.2195* (0.1191)	0.5904*** (0.0786)
Furniture, manufacturing n.e.c. and recycling	0.1240*** (0.0377)	0.0751** (0.0351)	0.6976*** (0.0293)

Notes: Arellano and Bond (1992) one-step difference GMM estimates of Equation (9). , and denote capital, labour and material elasticities, respectively. All regressions include year dummies. Robust standard errors are given in parentheses. ***, **, and * denote statistical significance at the .01, .05, and .10 levels, respectively.

Table A2. Results of OLS and FE

Variable	Pooled OLS				FE			
	Overall (1)	Small (2)	Medium (3)	Large (4)	Overall (5)	Small (6)	Medium (7)	Large (8)
FKNOW	-0.0190***	-0.0061***	0.0055	-0.0088***	-0.0507***	-0.0456***	-0.0810***	-0.0538***
	(0.0015)	(0.0020)	(0.0033)	(0.0032)	(0.0069)	(0.0118)	(0.0142)	(0.0172)
LOC	0.0009	0.0012	0.0000	0.0023	0.0019	0.0055*	0.0062	-0.0033
	(0.0012)	(0.0017)	(0.0021)	(0.0023)	(0.0023)	(0.0032)	(0.0048)	(0.0045)
URB	0.0049	0.0027	0.0175	0.0292	0.0590***	0.0454**	0.0669**	0.0570*
	(0.0079)	(0.0128)	(0.0125)	(0.0229)	(0.0158)	(0.0229)	(0.0317)	(0.0342)
COMP	0.0036	0.0067**	0.0055	-0.0145***	0.0003	-0.0127	0.0075	-0.0086
	(0.0022)	(0.0031)	(0.0037)	(0.0054)	(0.0063)	(0.0079)	(0.0102)	(0.0136)
KIBS	0.0098***	0.0106***	0.0084**	0.0160**	0.0105***	0.0070	0.0058	0.0194***
	(0.0028)	(0.0041)	(0.0041)	(0.0069)	(0.0030)	(0.0049)	(0.0047)	(0.0063)
RKNOW	0.0148***	0.0096*	0.0259***	0.0288***	0.0249***	0.0142**	0.0295***	0.0410***
	(0.0036)	(0.0050)	(0.0057)	(0.0101)	(0.0038)	(0.0057)	(0.0067)	(0.0112)
No. of observations	14,882	7,803	4,972	2,107	14,882	7,803	4,972	2,107
R-squared	0.9500	0.9433	0.9556	0.9624	0.8473	0.6722	0.4799	0.3076

Notes: The table summarizes the key coefficients estimates of equation (9). OLS and FE denote ordinary least-squares and fixed effects (within) estimators. All regressions include industry and region dummies. Variables are in logarithmic form (except in the case of the dummy variables). Robust standard errors are given in parentheses. ***, **, and * denote statistical significance at the .01, .05, and .10 levels, respectively

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DISTRIBUIÇÃO ESPACIAL DAS INDÚSTRIAS DINÂMICAS E NÃO DINÂMICAS NA REGIÃO SUL DO BRASIL – 1995 E 2010

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Resumo. A industrialização assim como a desconcentração produtiva são processos desequilibrados, ou seja, não ocorrem ao mesmo tempo em todas as regiões e nem com a mesma intensidade. No Brasil o processo de industrialização é caracterizado pela concentração industrial e posteriormente por uma relativa desconcentração produtiva, em que houve um deslocamento de parte dessa atividade que inicialmente se concentrava na Região Sudeste, sobretudo na Região Metropolitana de São Paulo, para outras Regiões do país. A Região Sul foi uma das regiões que mais ampliou sua participação na produção industrial do país, e os Estados Paraná e Santa Catarina foram os que mais ampliaram suas participações no emprego industrial. A partir de então a indústria da Região Sul torna-se importante em relação à indústria nacional. A concentração e localização industrial aparecem com considerável frequência nos trabalhos acadêmicos e, a literatura aponta que existem fatores externos as empresas que podem influenciar a localização da indústria. A presente monografia investigou como se localizam as indústrias na Região Sul do Brasil, separando os setores industriais em dois grandes grupos, o dinâmico e o não dinâmico. Para tanto foram utilizadas medidas de localização e especialização e outras análises espaciais, encontrando evidências de que as indústrias dinâmicas estão mais concentradas que as não dinâmicas, e que a distribuição industrial na Região Sul pouco se alterou nos últimos 15 anos.

Palavras-chave: Desconcentração produtiva, Indústrias dinâmica e não dinâmica, distribuição espacial.

SPATIAL DISTRIBUTION OF DYNAMIC AND NON DYNAMIC INDUSTRIES IN THE SOUTH OF BRAZIL – 1995 E 2010

Abstract. The industrialization, as well as the deconstruction of industrial production, are unbalanced processes, in other words, they do not exist in the same place at same time neither with the same intensity. In Brazil the industrialization process is characterized by industrial concentration and afterwards by a relative deconstruction of this industrial production when there was a shift in part of this activity which at the beginning was concentrated on Southeast region, mainly in São Paulo metropolitan area, to other places in the country. The southern region was one of the places which most widened its involvement with industrial production inside the country, and Paraná and Santa Catarina states were the ones which most improved their interest on industrial employment. Since then the southern industry became really important regarding the national industry. The industrial concentration and placement are frequently mentioned on academic papers and the existing readings show that there are external factors for the enterprises that may affect the industry placement. This paper has investigated how southern Brazil industries are placed, distinguishing the industrial sector in two big groups, the dynamic and the non dynamic. For this purpose we used location and expertise measures and some other space analysis, finding evidence that the dynamic industries are more concentrated than the non dynamic, and that the industrial distribution on south region has changed little since 15 years ago.

Keywords: Deconstruction of industrial production, industries dynamic and non dynamic, spatial distribution.

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1. Introdução

O processo de industrialização, o qual é relacionado ao desenvolvimento econômico, demonstra-se heterogêneo no espaço, ou seja, não ocorre simultaneamente em todas as regiões e com a mesma intensidade. Segundo Perroux (1977) o desenvolvimento é desequilibrado, e se dá através de impulsos econômicos que são também desequilibrados entre as unidades produtivas. Desta forma é comum que as atividades se concentrem em determinadas áreas. Essas concentrações das atividades econômicas resultam nas grandes diferenças existentes entre as regiões, sobretudo nas desigualdades na distribuição da renda, diferenças que não são inerentes a cada Região, mas sim fruto de um processo cumulativo que envolve algum tipo de retorno crescente (FUJITA, KRUGMAN e VENABLES, 2002).

Na Região Sul do Brasil, o processo de industrialização é caracterizado pela concentração industrial, sobretudo nas Regiões Metropolitanas. Nas décadas de 1970 e 1980, os I e II Planos Nacionais de Desenvolvimento deram novos rumos à industrialização do país, as indústrias que estavam concentradas na Região Metropolitana de São Paulo foram relativamente distribuídas para outras regiões, inclusive para outros Estados (STADUTO *et al*., 2008). A Região Sul foi a que mais recebeu as indústrias vindas do Sudeste, e torna-se então, importante em relação à indústria nacional.

O tema da concentração e localização industrial aparece com considerável frequência nos trabalhos acadêmicos. A literatura aponta que existem fatores externos as empresas, mas internos aos ramos industriais, que podem influenciar a localização da indústria. A concentração econômica pode ser um dos fatores relevantes quanto à localização das indústrias, as regiões concentradas possuem características que podem atrair as indústrias ou repeli-las. A abordagem da economia de aglomeração, utilizada nesse estudo, aponta a ocorrência de externalidades positivas referentes à proximidade geográfica das atividades produtivas. A ciência regional tem despendido considerável atenção às análises de aglomeração, pois esta vertente pode ser relevante na tentativa de explicar as diferenças existentes nas rendas e as desigualdades regionais.

O presente estudo realiza uma análise da localização das indústrias na Região Sul do Brasil. Para tanto são utilizadas medidas de localização e especialização e, outras análises espaciais, com base em doze subsetores industriais – agrupados em dois grandes grupos, dinâmicos e não dinâmicos – e 1188 municípios situados na Região Sul. O agrupamento das indústrias entre dinâmicas e não dinâmicas permite testar se determinadas variáveis interferem na localização das indústrias, como o pressuposto de que as indústrias com maior nível de inovação (dinâmicas) tendem a se concentrar em regiões que possuam mão de obra mais qualificada. As informações utilizadas para a realização da referida análise (número de emprego formal) foram extraídas da Relação Anual de Informações Sociais – RAIS.

2. O processo de industrialização da Região Sul e a economia de aglomeração

A Região Sul inicia seu processo de industrialização com o chamado processo de desconcentração industrial que ocorreu no Brasil a partir de 1970. Segundo Cano (2008), com as políticas de desenvolvimento regional[97] que surgiram na época, somadas pela busca de regiões com elevada base de recursos naturais pelas indústrias, iniciou-se no Brasil um relativo processo de desconcentração industrial regional. Neste processo, as indústrias inicialmente concentradas na Região Sudeste, sobretudo na Região Metropolitana de São Paulo, migraram para outras Regiões do país, principalmente para a região Sul.

Essa característica do processo de industrialização que ocorreu não só na Região Sul, mas também em outras Regiões brasileiras remete as abordagens da economia de aglomeração. Alguns autores como Cano (2008) e Lautert e Araújo (2007) apontam que o processo de desconcentração produtiva ocorrido no Brasil é marcado pela presença de deseconomias de aglomeração, as quais no caso

97 Uma das políticas que ilustrou a intenção de reduzir as diferenças regionais e a concentração da indústria foi a criação da Superintendência do Desenvolvimento do Nordeste – Sudene (SOUZA, 2008).

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brasileiro implicou em elevado preço dos terrenos (além de outras deseconomias), e contribui para que as indústrias procurassem outros locais para sua instalação. Por outro lado, quando as indústrias que migraram da Região Sudeste passaram a se concentrar em outras Regiões, caracterizou-se as economias de aglomeração. Alguns trabalhos como os de Pereira e Lemos (2003), Stamm *et al*. (2010) e Staduto *et al*. 2008, apontam que as Regiões Metropolitanas e as cidades médias foram os principais lócus das atividades industriais nesse processo. Segundo esses autores estas áreas possuem algum tipo de economia de aglomeração, ao mesmo tempo em que não incorrem em deseconomias de escala, atraindo então as atividades econômicas.

A literatura referente à economia de aglomeração parte da ideia de que existem externalidades positivas referentes à proximidade geográfica das atividades produtivas. A existência de dois tipos de forças influentes na localização das indústrias é apontada por Krugman (1999 apud Lautert e Araújo, 2007). Segundo este autor há forças centrípetas e centrífugas que interferem na decisão das indústrias quanto a sua localização. As forças centrípetas são as que tornam a Região concentrada atraente, fatores como mão de obra especializada, proximidade com fornecedores de insumos, redução de custos com transporte, efeitos do tamanho do mercado (*linkages*), economias externas puras, podem atrair geograficamente as indústrias para certas regiões. Por outro lado, os fatores centrífugos tendem a afastar as indústrias da concentração econômica para regiões interioranas, em que a poluição, congestionamentos, altos custos para instalação e deseconomias externas puras não impliquem negativamente sobre a produção.

As economias de aglomeração podem ocorrer em diferentes regiões e de maneira distinta. Podem-se distinguir duas classes de economia de aglomeração, ambas são economias externas à firma: 1) as economias de especialização/localização conhecidas também com Marshall-Arrow-Romer (MAR) e; 2) as economias de urbanização/diversificação abordada por Jacobs (GLAESER *et al*., 1992).

As economias de especialização estão associadas à aglomeração de uma mesma indústria ou indústrias correlatas em determinada Região, proporcionadas pelo aumento da escala produtiva e pela transferência de conhecimento (*spillorves* informacionais) entre as firmas. Já as economias de urbanização/diversificação são vantagens proporcionadas pela concentração de atividades econômicas em uma Região, de diferentes indústrias que não são especializadas, mas sim diversificadas, ocorrendo o transbordamento de conhecimento entre elas, facilitando o surgimento de ideias e da inovação.

Tendo em vista a abordagem da economia de aglomeração e o processo de industrialização, o interesse deste trabalho é analisar a distribuição espacial das indústrias na Região Sul do Brasil, identificando suas principais concentrações, a localização dos grupos industriais e o padrão de localização desses grupos.

3. METODOLOGIA

O presente trabalho realiza uma análise da distribuição espacial das indústrias por municípios na Região Sul do Brasil, partindo de dois grandes grupos industriais, o dinâmico e o não dinâmico. A Região Sul é composta por três unidades da federação, Paraná, Santa Catarina e Rio Grande do Sul. Possui 1.188 municípios, sendo que 399 pertencem ao Paraná, 496 ao Rio Grande do Sul e 293 a Santa Catarina.

A delimitação da Região Sul como Região de análise, se justifica pelas características que esta Região possui referente ao processo de industrialização brasileiro, sendo uma das Regiões que mais atraiu a indústria durante este processo, como é apontado por Cano (2008).

A principal variável utilizada para está análise é o número de empregados distribuídos por 12 ramos de atividades industriais. Os dados foram coletados a partir da base de dados da Relação Anual de Informações Sociais - RAIS para os anos de 1995 e 2010. Com intenção de facilitar a visualização e entendimento da análise, os subsetores da indústria são divididos em dois grupos, indústrias dinâmicas e indústrias não dinâmicas, sendo que as indústrias consideradas dinâmicas são mais

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intensivas em tecnologia, enquanto que as não dinâmicas, mas intensivas em mão de obra. A Tabela 1 apresenta os dois grupos analisados e seus respectivos ramos de atividades industriais.

Tabela 1 – Ramos de atividades industriais classificados em dois grandes grupos, dinâmico e não dinâmico

Indústrias Dinâmicas	1- Indústria de produtos minerais não metálicos;
	2 - Indústria metalúrgica;
	3 - Indústria mecânica;
	4 - Indústria do material elétrico e comunicações;
	5 - Indústria do material de transporte;
	7 - Indústria do papel, papelão, editorial e gráfica;
	9 - Ind. química, produtos farmacêuticos, veterinários e perfumaria;
Indústrias Não Dinâmicas	6 - Indústria da madeira e mobiliário;
	10 - Indústria têxtil, vestuário e artefatos de tecidos;
	8 - Ind. da borracha, fumo, couros, peles, similares e ind. diversas;
	11 - Indústria de calçados;
	12 - Indústria de produtos alimentícios, bebidas e álcool etílico.

FONTE: RAIS, elaborado pela autora.

Nas análises dos dados, se utilizou medidas de localização e especialização, visto que, é interesse do estudo a diferenciação espacial. Haddad (1989) aponta que para o conhecimento de padrões regionais de crescimento, ou até mesmo para a formulação de políticas de descentralização industrial, a utilização deste tipo de análise é frequente. Além disso, são importantes devido à intenção de eliminar o "efeito tamanho", o qual segundo Lima (2003) surge quando se analisa regiões com tamanhos diferentes, acarretando correlações positivas nas informações obtidas. As medidas de localização e especialização utilizadas do estudo foram o Quociente Locacional (QL), o Coeficiente de Localização (CL) e, o índice de *Hirschman-Herfindahl (HH)* ajustado. Essas medidas são obtidas pelas equações (1), (2) e (3) respectivamente, as quais são apresentadas abaixo:

$$QL_{ij} = E_{ij} / \sum E_{ij} / \sum_j E_{ij} \,/\, \sum_i \sum_j E_{ij} \qquad (1)$$

Onde:

E_{ij} = Número de empregados no ramo de atividade *i* do município *j*;

$\sum_j E_{ij}$ = Número de empregados no ramo de atividade *i* de todos os municípios;

$\sum_i E_{ij}$= Número de empregados em todos os ramos de atividade do município *j*;

$\sum_i \sum_j E_{ij}$ = Número de empregados em todos os ramos de atividade e todos os municípios.

$$CL_{ij} = \sum_j \frac{(|j^{ei} - \sum_j ei|)}{2} \qquad (2)$$

$$HH_i = \sum_{j=1}^{n} \left[\left(\frac{E_{ij}}{E_i} \right) - \left(\frac{E_j}{E_p} \right) \right]^2 \qquad (3)$$

Em que:

E_{ij}= Emprego na cidade *i* no setor *j*;

E_i: = Total do emprego industrial na cidade *i*;

E_j= Emprego nacional no setor *j*;

E_p= Total do emprego industrial na Região Sul;

n= 1, 2, 3,..., 12 são os setores industriais.

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Foram realizadas também análises sobre a distribuição percentual das indústrias dinâmicas e não dinâmicas na Região Sul, o que serviu para complementar a visão de como se localizam as indústrias na Região Sul.

$$i^e j = \frac{E_{ij}}{\sum_j E_{ij}} \qquad (4)$$

Em que:

E_{ij} = emprego no setor *i* da município *j*;

$\sum_j E_{ij}$ = emprego no setor *i* de todas os municípios.

Além das medidas de localização e especialização, fez-se uso também da estatística espacial e da análise exploratória de dados espaciais (AEDE) para identificar padrões de associação espacial para as variáveis abordadas. Resumidamente, a finalidade da AEDE foi caracterizar a distribuição espacial, os padrões de associação espacial (*clusters* espaciais), verificar a ocorrência de diferentes regimes espaciais, além de identificar observações atípicas.

4 APRESENTAÇÃO E ANÁLISE DOS RESULTADOS

4.1 A Região de Referência: Região Sul do Brasil

A Região Sul possuía uma população total de 27,4 milhões de pessoas em 2010, correspondente a 14,36% da população brasileira nesse ano. No período de 1996 a 2010, de acordo com informações do IPEA (2012), a Região Sul cresceu quase 17%, passando de 23, 5 milhões para os 27, 4 milhões em 2010. Nesse contexto de crescimento populacional existem duas realidades distintas, a saber, a população rural e a população urbana. O aumento da população ocorreu para a população urbana, que cresceu mais que 28% no período, enquanto a população rural diminuiu ao longo dos anos, decrescendo quase 23%. Essas informações revelam o processo de urbanização da população, que migrou do campo para as cidades, sendo atraída pelas atividades urbanas e industriais.

O PIB da Região foi crescente durante quase todo o período analisado, com exceção do ano de 2005, passando de aproximadamente 175 bilhões em 1995, para quase 260 bilhões em 2009, um acréscimo de quase 48%. O crescimento do PIB foi maior do que o da população, o qual pode ser resultado de aumento das atividades econômicas. Essa característica pode ser considerada benéfica, visto que, alguns autores, como Souza (1993), apontam que para que ocorra o desenvolvimento econômico deve haver um crescimento econômico continuo e superior ao crescimento da população, além é claro de outras mudanças estruturais e da melhoria dos indicadores de qualidade de vida.

Quanto ao número de empregos das indústrias dinâmicas e não dinâmicas para cada Estado da Região Sul observou-se que os empregos industriais aumentaram cerca de 80% durante o período analisado, sendo que a indústria dinâmica foi a que apresentou maior aumento, seus empregos tiveram um crescimento de 106,05%. Além disso, quando compara-se a variação do número de empregos industriais da Região Sul com o restante do Brasil, observa-se que o crescimento do número de empregos da Região Sul foi bem expressivo, pois, enquanto o restante do Brasil cresceu 20,04%, apenas a Região Sul teve um aumento de 80, 81% do número total de empregos industriais. Para o setor dinâmico especificamente essa diferença é ainda maior, este setor cresceu na Região Sul 106,05% enquanto que no restante do Brasil a variação foi de 29,16%.

Essas informações estão no mesmo sentido das pesquisas sobre o processo de desconcentração industrial ocorrido no Brasil a partir da década de 1970, no qual a Região Sul foi a que recebeu grande parte das atividades produtivas imigrantes de outras regiões, principalmente da Região Metropolitana de São Paulo. E pelo que demonstraram os dados, esse processo pode ter tido continuidade no período de 1995 a 2010.

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4.2 A localização das indústrias na Região Sul

A partir das análises quanto à distribuição das indústrias dinâmicas e não dinâmicas, para cada município inserido na Região Sul, referentes ao número de empregos dos respectivos setores, é possível fazer algumas constatações a respeito. Antes disso cabe destacar que, no decorrer das interpretações será dado nota de que alguns municípios não apresentaram informações quanto ao número de emprego formal, isso ocorre, pois, o interesse deste estudo é uma análise das atividades industriais na Região Sul, as informações de emprego coletadas são referentes apenas a essas atividades. Portanto, como algumas cidades não possuem atividade industrial, as mesmas aparecem na análise como não tendo informações.

A partir da análise da distribuição percentual do emprego dinâmico para a Região Sul, para o ano de 1995 observa-se que a indústria dinâmica não é tão representativa para a Região Sul como um todo, visto que os municípios que possuem a maior parte de seus empregos no setor dinâmico são minoria na Região. Aproximadamente 488 cidades tem até 34% do emprego no setor dinâmico, 183 possuem até 67% e apenas 114 tem mais que 67% do emprego total da cidade no setor dinâmico. Grosso modo, a maior parte das cidades concentra até 34% de seus empregos na indústria dinâmica, ou seja, é o setor não dinâmico o que mais emprega nesta Região. No ano de 2010 a análise não revelou mudanças relevantes.

O número de cidades que concentram mais que 67% de seus empregos no setor dinâmico aumentou de 1995 para 2010, passando de 114 para 159. Ainda são maioria as cidades que concentram até 34% do emprego no setor dinâmico, 581 municípios. Além disso, o número de cidades com estas características aumentou no período, devido principalmente a emancipação de pequenos distritos, que geralmente concentram seus empregos no setor não dinâmico.

Essa análise realizada a partir da distribuição percentual do emprego apresenta algumas falhas, pois, não considera o efeito escala. Como a análise é realizada com os dados brutos, algumas cidades, mesmo possuindo indústrias dinâmicas podem aparecer com baixos níveis de emprego para a mesma. Isso ocorre pelo fato de alguma empresa não dinâmica se sobressair quanto às dinâmicas, a exemplo do município de Toledo no Paraná. Este município possui uma grande empresa no setor não dinâmico que emprega elevado número de pessoas, os dados revelaram que apenas 10% e 26% dos empregos deste município eram dinâmicos, para 1995 e 2010, respectivamente. Desta forma, proporcionalmente o setor não dinâmico emprega muito mais que o dinâmico, mas esse fato não significa que a cidade não possua empregos neste setor. Toledo possuía 597 empregos dinâmicos em 1995 e em 2010 chegou a 4.310 empregos neste setor.

Assim, apesar da análise da distribuição percentual do emprego revelar que a indústria não dinâmica possui a maior parte dos empregos na Região Sul, levando a crer que esta Região é relativamente tradicional, não é possível afirmar que a mesma não possua considerável número de empregos também para a indústria dinâmica. Desta forma, foram realizadas outras análises que levam o efeito escala em consideração, uma delas é o Quociente Locacional.

Portanto, a partir da análise do QL para o ano de 1995, observa-se que os municípios em que a indústria dinâmica é considerada concentrada/especializada são minoria na Região Sul. Dos 1188 municípios analisados, excluídos 400 municípios por não apresentarem informações quanto ao número de empregos industriais para o ano de 1995, 528 cidades apresentaram um QL menor que 1 e, apenas 262 cidades, QL acima de 1. Portanto, na maior parte das cidades da Região Sul, as atividades consideradas dinâmicas não são muito expressivas, ou não são consideradas atividades básicas para esses municípios.

Para as indústrias dinâmicas no o ano de 2010, tanto o número de municípios com QL maior que 1 quanto o número de municípios com QL menor que 1 aumentaram. Isso se deveu, em parte, a criação de novas cidades, que não eram emancipadas no ano de 1995. Além disso, em um período de 15 anos pode ter havido a instalação de indústrias em cidades que antes não possuíam nenhuma. Todavia, a predominância de cidades com QL menor que 1 para a indústria dinâmica, vista em 1995, permanece para 2010. Aproximadamente 670 cidades apresentam QL menor que 1 para a indústria

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dinâmica no ano de 2010, e 326 apresentam QL maior 1, sendo o setor dinâmico considerado básico para estes municípios.

Quanto às indústrias não dinâmicas ocorre o oposto. As cidades com QLs maiores que 1 são maioria, cerca de 730 cidades, indicando maior concentração de empregados neste setor. Isso pode ser explicado pelo fato de a Região Sul possuir um elevado número de municípios, sendo que a maioria deles é de pequeno porte. Esses municípios geralmente possuem escassa mão de obra qualificada, um dos recursos indispensáveis para as indústrias dinâmicas, mas não tão relevante para as indústrias não dinâmicas, que muitas vezes são atraídas para tais municípios em busca de mão obra barata, dentre outros fatores.

Uma característica relevante é que, de modo geral, os QLs se mostraram mais baixos para o setor não dinâmico do que para o setor dinâmico. Isso demonstra que apesar de a maioria das cidades da Região Sul concentrar suas atividades industriais em indústrias não dinâmicas, nas cidades em que a indústria dinâmica é considerada uma atividade básica, esta é mais concentrada/especializada do que a indústria não dinâmica é para os municípios mais intensificados nesta última.

Essa característica ocorre, pois, como o setor dinâmico se revelou mais concentrado que o não dinâmico, as poucas cidades em que essa atividade é concentrada/especializada apresentam valores elevados de emprego para o ramo, comparativamente ao total da Região de referência. Já no caso das atividades não dinâmicas existem várias cidades que a tem como atividade básica, não sendo tão elevado o número de empregos de cada cidade se comparado ao total da Região Sul.

É importante ressaltar que o fato de uma determinada atividade ser considera básica para uma cidade, não elimina a possibilidade de a mesma cidade ter outros setores básicos. Uma cidade pode ser considerada até mesmo multiespecializada, por apresentar diversos setores importantes. No caso deste trabalho, nenhuma cidade, para o ano de 1995, apresentou QL superior a 1 para indústria dinâmica e não dinâmica simultaneamente. Os QLs do setor não dinâmico para 2010 apresentaram comportamento parecido com os de 1995. O número de municípios com QL menor que 1 foi de 301 e 834 cidades apresentaram QL maior que 1.

Complementando a análise do Quociente Locacional, foi calculado o índice de *Hirschman-Herfindahl* ajustado que irá indicar se uma cidade é diversificada ou especializada para o total das atividades analisadas. Com essa análise é possível revelar padrões locacionais para as indústrias dinâmicas e não dinâmicas, isto é, se é a diversidade ou a especialização produtiva das cidades que influencia na localização das indústrias como atestam as teorias da especialização/localização e diversificação/urbanização.

A especialização no caso do *IHH* sugere que a Região não possui muitas indústrias, é uma análise diferente da especialização sugerida pelo QL, a qual é referente à especialização específica de algum setor analisado, comparado a Região de referência, Sul.

No que se refere ao *IHH* para os dados de 1995, observa-se que a maioria das cidades, especificamente 509 cidades, são consideradas diversificadas de acordo com os resultados do *IHH.* Por outro lado, apenas 179 municípios possuem *IHH* que indica maior especialização. A predominância de cidades diversificadas permaneceu para o ano de 2010, 690 cidades, e 336 cidades obtiveram um *IHH* que as considerou mais especializadas.

A partir da análise do Quociente Locacional e do *IHH* é possível fazer suposições de que as cidades cujo resultado do QL é importante para as atividades dinâmicas coincidem com as cidades que apresentaram, de acordo com o *IHH*, maior diversificação, visto que, as cidades que compreendem as Regiões Metropolitanas e as que fazem parte da área de influência das mesmas apresentam estas características. Tendo em vista que as atividades do setor dinâmico são mais desejadas do que as do setor não dinâmico, devido à sua característica de maior intensidade tecnológica, a abordagem de Jacobs (1969) tem aderência, a qual sugere que é a diversificação das atividades econômicas e não a especialização, as propulsoras para que ocorra crescimento econômico.

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Jacobs (1969) mostra que a aglomeração e diversificação produtiva possibilitam ganhos pecuniários e tecnológicos pela maior divisão social do trabalho produtivo urbano. Desta forma, Regiões que possuem elevado nível de atividade produtiva, no caso deste estudo atividade industrial, sendo estas atividades diversificadas, estão mais suscetíveis a ter maior produtividade do trabalho e garantia de sustentabilidade de longo prazo para suas economias.

No entanto cabe ressaltar que o fato de a maioria das cidades se revelarem mais diversificadas do que especializadas pode estar atrelado à característica desses municípios. Os municípios da Região Sul são em grande parte municípios pequenos e com baixo número de empregos distribuídos entre as poucas atividades industriais presentes nos mesmos, apresentando resultados baixos para o *IHH* e sendo considerados diversificados. Desta forma, é impossível afirmar que todos os municípios que se mostraram diversificados de acordo com o *IHH* possuem necessariamente elevado grau de emprego para o setor dinâmico. Mas é possível constatar que as cidades que possuem elevado QL ou nível de emprego dinâmico são, via de regra, diversificadas.

Outra medida utilizada neste trabalho foi o Coeficiente de Localização. Essa medida permite identificar o grau de dispersão relativo das indústrias analisadas e definir aquela que possivelmente teria menor disposição à concentração espacial. O CL pode variar entre os limites 0 e 1, quanto mais próximo de zero o setor estará distribuído regionalmente de maneira mais uniforme, se mais próximo de 1 indicará que o setor apresenta um padrão de concentração regional maior do que o do conjunto de setores analisados. O Gráfico 1 traz a tendência de convergência ou dispersão dos empregos nas indústrias analisadas para a Região Sul do Brasil, nos anos de 1995 e 2010.

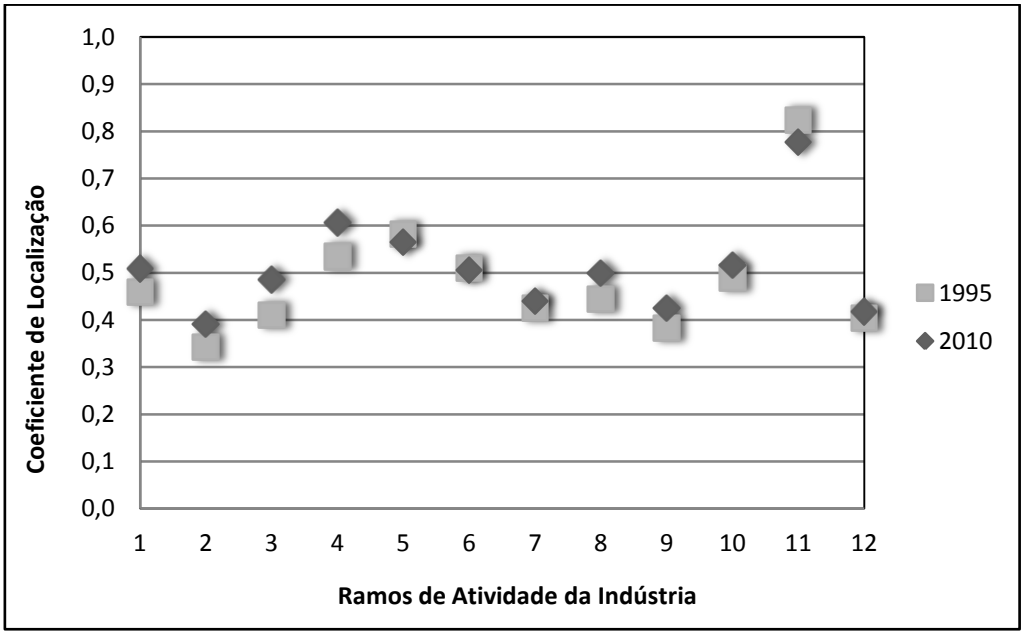

Gráfico 1 – Coeficiente de Localização (CL) do emprego por ramo de atividade industrial na Região Sul, 1995 e 2010

Fonte: Resultado da pesquisa.

Interpretando o Gráfico 1, verifica-se que na Região Sul, entre 1995 e 2010, as indústrias 1, 2, 3, 4 e 8, correspondentes a Indústria de produtos minerais não metálicos, Indústria metalúrgica, Indústria mecânica, Indústria do material elétrico e comunicações e Ind. da borracha, fumo, couros, peles, similares e ind. diversas, respectivamente, são as que apresentaram um padrão de concentração mais intenso para o período, sugerindo uma interdependência entre esses setores, os quais, exceto pelo setor 8, são classificados como dinâmicos. Esta constatação vai de encontro com as outras analises realizadas, de que o setor dinâmico está concentrado em alguns pontos da Região Sul, sendo a interdependência desses setores do grupo dinâmico correspondente à Região em que estão inseridos, Regiões com maior diversificação.

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Os setores 5, 6, 7, 10 e 12, correspondentes a Indústria do material de transporte, Indústria da madeira e mobiliário, Indústria do papel, papelão, editorial e gráfica, Indústria têxtil, vestuário e artefatos de tecidos e Indústria de produtos alimentícios, bebidas e álcool etílico, mantiveram-se estáveis entre 1995 e 2010, não houveram mudanças importantes nos valores do coeficiente de localização desses setores. Esses setores, com exceção do setor 5, de Indústria do material de transporte, são considerados setores não dinâmicos.

O setor 11, referente à indústria de calçados, foi o que apresentou o mais elevado coeficiente de localização, tanto para 1995 como para 2010, próximo a 0,9, um elevado grau de concentração. Isso ocorre, pois, apesar de a indústria de calçados ser classificada como indústria não dinâmica e estas estarem melhor distribuídas na Região Sul, o setor calçadista especificamente é altamente concentrado no Estado do Rio Grande do Sul. Regiões como o Vale do Paranhana, Serra Gaúcha, Vale do Taquari e, sobretudo, o Vale dos Sinos, são considerados polos calçadistas de relevante importância para a produção nacional (LAGEMANN, 1986). Por outro lado a indústria metalúrgica, setor 2, foi a que apresentou menor CL, estando abaixo de 0,4 em 1995 e 2010, sendo o ramo melhor distribuído. Relação contraria a esperada, já que o setor melhor distribuído pertence ao grupo de setores dinâmicos.

O Gráfico 1 revela também que a maioria das indústrias dinâmicas apresentaram tendência de concentração, ainda que não sendo muito expressivas, o que indica que essas indústrias não estão ocupando novas áreas, permanecendo as indústrias não dinâmicas como as que predominam na Região Sul do Brasil.

O que ocorre é que as atividades com menor densidade tecnológica, característica das indústrias não dinâmicas tendem a estar localizadas no interior dos Estados e em cidades menores. Isso se deve ao fato de nessas cidades a força de trabalho não ter uma tradição de salários e a mão de obra não impor muita resistência para a aceitação de trabalhos, mesmo os pouco remunerados. Como na Região Sul a maioria das cidades possui essas características, as indústrias não dinâmicas são melhor distribuídas e empregam mais que as indústrias dinâmicas.

Por outro lado, as indústrias dinâmicas que são mais intensivas em tecnologia, acabam se concentrando em poucas áreas, as quais pertencem principalmente as Regiões Metropolitanas. Estas Regiões apresentam condições de empregabilidade mais seletivas devido as suas características de oferta e da estrutura produtiva e possuem mão de obra mais qualificada.

Além das Regiões Metropolitanas, as chamadas cidades médias – não há um consenso quanto a intervalo populacional das cidades médias, geralmente são consideradas cidades médias as que possuem entre 100 e 500 mil habitantes – também podem apresentar características que atraiam atividades industriais, principalmente as dinâmicas, evidenciando possíveis lugares de maior eficiência econômica. Algumas cidades como Londrina e Cascavel localizadas no Estado do Paraná e Joinvile situada em Santa Catarina, se encaixam nesta classificação de cidades médias e, mesmo não estando situadas nas Regiões metropolitanas de seus Estados, apresentam elevado número de empregos dinâmicos, representado por um QL maior que 1, elevado valor para a distribuição percentual do emprego e baixo *IHH*, sendo consideradas diversificadas. Nas cidades pequenas prevalecem os setores não dinâmicos, mas os setores dinâmicos não são exclusivos das cidades médias e grandes aglomerações. Por exemplo, a cidade de São Pedro do Paraná, localizada na Região noroeste do Estado, possui poucas atividades industriais e é uma cidade pequena, a mesma tem a indústria Mecânica, a qual é considerada dinâmica como predominante na cidade. O QL dinâmico deste município para 2010 foi igual a 2,25, sendo a cidade considerada especializada neste setor vis à vis a Região Sul.

Sinteticamente, as análises apresentadas mais uma vez sugerem a maior concentração das atividades dinâmicas em relação as não dinâmicas. O *IHH*, apesar de estar viesado pelo fato de haver na Região Sul grande número de municípios com pouco emprego para as indústrias, sendo estes empregos distribuídos entre as também escassas atividades industriais dessas cidades, culminando em resultados baixos para o *IHH*, o qual indica diversificação, pode mostrar que as áreas com elevada

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aglomeração industrial geralmente são diversificadas. A análise do CL revelou padrões de concentração mais elevados para as indústrias dinâmicas, e as indústrias não dinâmicas mostraram-se melhor distribuídas na Região Sul.

Na seção seguinte são apresentadas outras análises, confirmando as constatações obtidas até o momento com mais robustez por meio da análise exploratória de dados espaciais, ou seja, os exames realizados serão examinados por meio de testes estatísticos, aplicando especificamente a estatística *I de Moran*.

4.3 A DISTRIBUIÇÃO ESPACIAL DAS INDÚSTRIAS DINÂMICAS E NÃO DINÂMICAS

4.3.1 Análise Global Univariada

Como forma de verificar a existência ou não de autocorrelação espacial para as indústrias dinâmicas e para as indústrias não dinâmicas na Região Sul, foram realizadas análises de correlação espacial. Fora utilizado o *I* de *Moran* como estatística de teste para a hipótese nula de aleatoriedade espacial, ou seja, de que os valores observados da variável de interesse não dependem de sua localização ou que são distribuídos aleatoriamente ao longo do espaço (ALMEIDA, 2004). A estatítica *I* de *Moran* pode assumir valores positivos e negativos, conforme o tipo de correlação espacial existente, a saber, autocorrelação espacial positiva e negativa.

Desta forma, fora calculado o *I* de *Moran* global univariado para as variáveis: distribuição percentual do emprego e QLs para os setores dinâmico e não dinâmico e, o *IHH* ajustado, todas elas para os anos de 1995 e 2010. Estes testes mostram significância estatística de similaridade no espaço, não somente utilizando uma análise visual tal como foi feito para as medidas de localização e especialização realizadas. Tomando os valores do *I* de *Moran* para todas as variáveis, pode-se então rejeitar a hipótese nula de aleatoriedade espacial, isto é, há uma similaridade entre os valores das variáveis estudadas e da localização espacial das mesmas.

Há evidências de que exista autocorrelação positiva entre as variáveis estudadas, mesmo com baixos valores para o *I* de *Moran*. Em outras palavras, cidades que possuem valores para suas variáveis acima da média são adjacentes a cidades com elevados valores para as variáveis ou; cidades que apresentaram valores abaixo da média para as variáveis são vizinhas de municípios que também apresentaram valores reduzidos das variáveis.

Ao analisar as correlações do *I* de *Moran* global univariado para a variável distribuição percentual do emprego, observa-se que há presença de autocorrelação espacial positiva para os setores dinâmicos e também para os não dinâmicos, tanto para 1995 como para 2010, ainda que pequena. Isso representa que os valores das variáveis de determinado município *i* são influenciados pelos valores das variáveis nos municípios contíguos *j*.

As associações se revelaram bem parecidas para os setores dinâmicos e não dinâmicos e ambos os setores mostraram uma associação mais forte para o ano de 1995, de 0,1477 e 0,1191, respectivamente. Os valores do *I* de *Moran* para a distribuição percentual do emprego dinâmico e não dinâmico foram estatisticamente significantes a 1%, com exceção do emprego não dinâmico para o ano de 2010, que foi significante a 10%. As variáveis distribuição percentual do emprego dinâmico e não dinâmico perderam força em suas associações no decorrer do período.

Para facilitar a vizualização dos valores do *I* de *Moran* local para a variável distribuição percentual do emprego dinâmico e não dinâmico e seus respectivos graus de significância, apresenta-se a tabela 2.

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Tabela 2 – Valores da estatística *I* de *Moran* e grau de significância da distribuição percentual do empreso dinâmico e não dinâmico para os anos 1995 e 2010

Variável	*I* de *Moran*	Significância
Distribuição (%) do emprego dinâmico – 1995	0,1477	1%
Distribuição (%) do emprego dinâmico – 2010	0,0654	1%
Distribuição (%) do emprego não dinâmico – 1995	0,1191	1%
Distribuição (%) do emprego não dinâmico – 2010	0,0246	10%

Fonte: Resultados da pesquisa.

Quanto à análise do *I* de *Moran* para a variável QL dos setores dinâmico e não dinâmico, em 1995 e 2010, observa-se que existe aucorrelação espacial positiva, apesar de pequena, a exemplo do ocorrido com a distribuição percentual do emprego. Em 1995 como em 2010, os valores do *I* de *Moran* da variável QL dinâmico e não dinâmico foram estatisticamente significantes, todos ao nível de 1%.

Tabela 3 – Valores da estatística *I* de *Moran* global univariado e grau de significância do Quociente Locacional dinâmico e não dinâmico para os anos 1995 e 2010

Variável	*I* de *Moran*	Significância
QL dinâmico – 1995	0,1025	1%
QL dinâmico – 2010	0,1479	1%
QL não dinâmico – 1995	0,0407	1%
QL não dinâmico – 2010	0,1194	1%

Fonte: Resultados da pesquisa.

Quanto à análise com base nos valores do *IHH*, observa-se também uma autorrelação positiva entre as viráveis no espaço, e estatisticamente significante aos níveis de 5% e 1% para 1995 e 2010 respectivamente. Isso indica que regiões mais diversificadas tendem a influenciar as cidades próximas a esta primeira a também serem diversificadas. O mesmo ocorre com as regiões especializadas.

Tabela 4 – Valores da estatística *I* de *Moran* global univariado e grau de significância do *IHH* para os anos 1995 e 2010

Variável	*I* de *Moran*	Significância
IHH – 1995	0,0403	5%
IHH – 2010	0,0963	1%

Fonte: Resultados da pesquisa.

De modo geral é possível perceber que ocorreram algumas mudanças para essas estatistícas para o ano de 2010. As vairáveis que apresentaram associações mais fortes, isto é, os valores mais elevados do *I* de *Moran* foram o QL da indústria dinâmica em 2010 e a distribuição percentual do emprego dinâmico em 1995. Em outras palavras, isso representa que existe maior correlação espacial entre os municípios que possuem a indústria dinâmica como básica e que tem um elevado percentual de emprego dinâmico.

Tanto para 1995 como para 2010 o *I* de *Moran* calculado para todas as variáveis revelou-se relativamente baixo, indicando uma fraca dependência espacial dessas variáveis, mas ainda assim há dependência entre elas e isso não deve ser ignorado.

4.3.2 Análise Local Univariada

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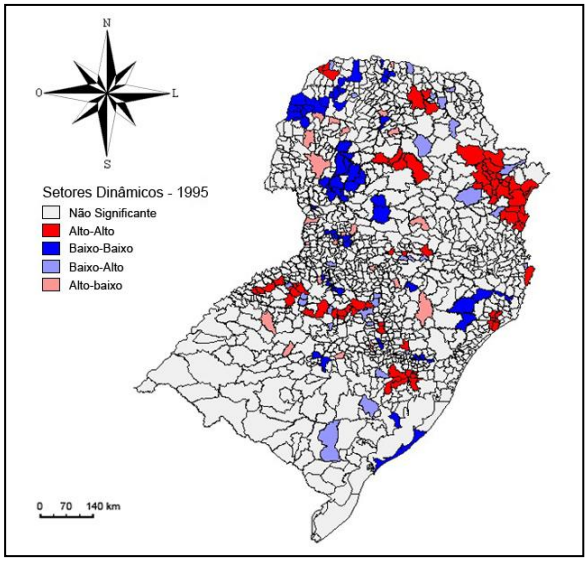
Como forma de identificar se a indicação dos padrões globais de associação espacial estão em consonância com padrões locais, utiliza-se o indicador de *I* de *Moran* local, o qual tem a capacidade de capturar padrões locais de associação linear. O cálculo do *I* de *Moran* local e univariado permite identificar a ocorrência de *clusters* na distribuição espacial das variáveis. Os *clusters* são concentrações ou agrupamentos espaciais de determinada atividade produtiva, os quais, segundo as definições de Altemburg & Meyer-Stamer (1999) e Lins (2000) possuem uma clara especialização produtiva, além de relações inter firmas, a jusante e a montante.

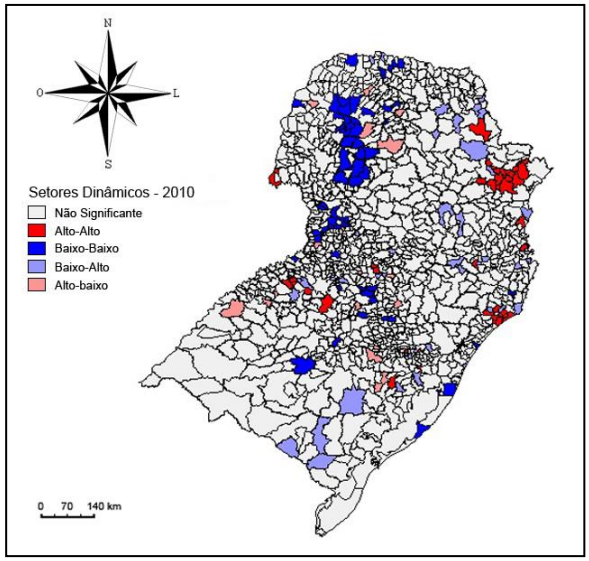
As figuras 1, 2, 3 e 4 apresentam os mapas de *cluster* para a Região Sul, com relação a distribuição percentual do emprego dinâmico e não dinâmico, para os anos de 1995 e 2010.

Figura 1 – Mapa de *cluster* distribuição percentual do emprego setor dinâmico em 1995



Fonte: Resultados da pesquisa.

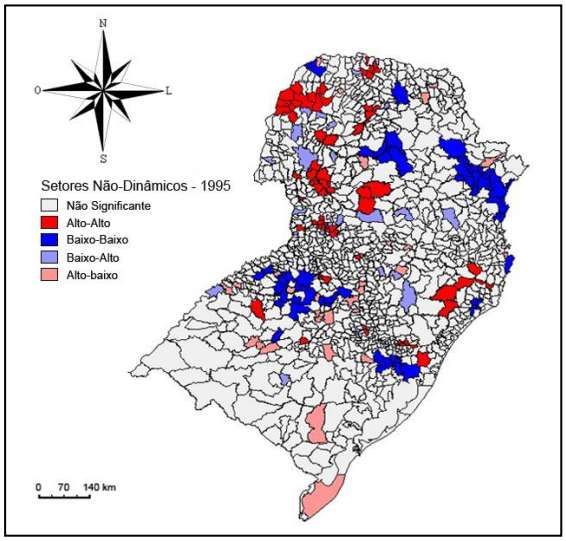
Figura 2 – Mapa de *cluster* distribuição percentual do emprego setor dinâmico em 2010



Fonte: Resultados da pesquisa

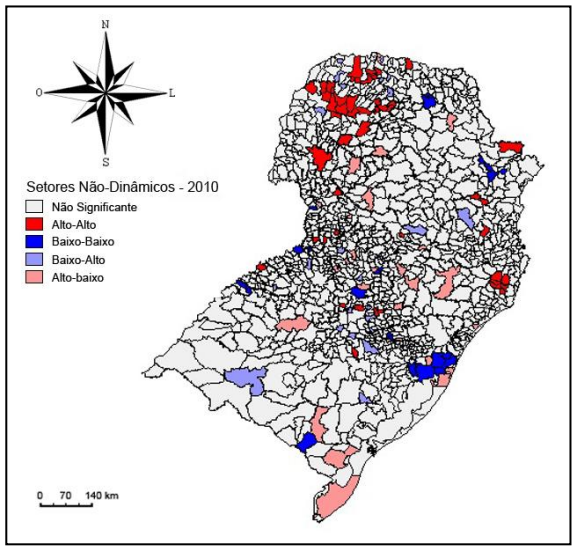
A distribuição de *clusters* para a variável distribuição percentual do emprego revelam a ocorrência de alguns *clusters* na Região Sul, tanto para o setor dinâmico quanto para o não dinâmico. Esta análise significa que em determinadas Regiões a ocorrência de indústrias dinâmicas influenciam Regiões vizinhas, quanto a existência ou não de indústrias dinâmicas.

Figura 3 – Mapa de *cluster* distribuição percentual do emprego setor não dinâmico em 1995



Fonte: Resultados da pesquisa.

Figura 4 – Mapa de *cluster* distribuição percentual do emprego setor não dinâmico em 2010



Fonte: Resultados da pesquisa.

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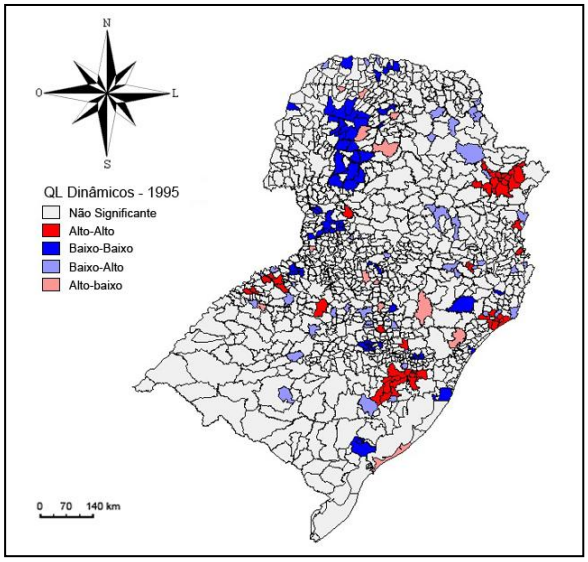
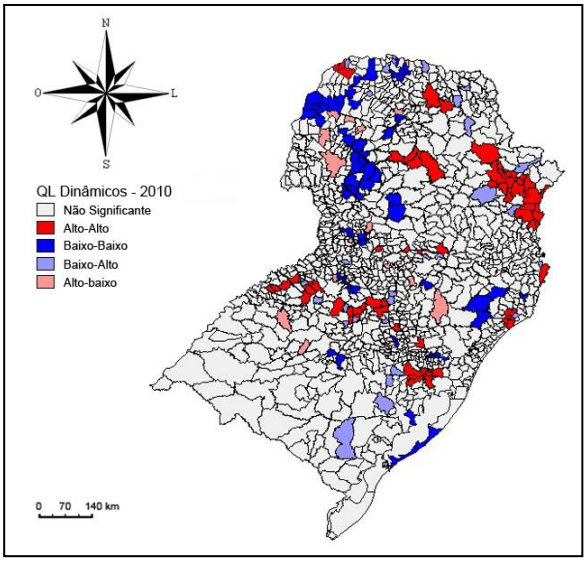
Os *cluster* aparecem com mais frequência em algumas cidades médias e nas Regiões Metropolitanas. Quanto ao ano de 2010, observa-se que a formação de *clusters* diminuiu, mas não houve grande alterações na formação de *cluster* para a variável distribuição percentual do emprego.

Figura 5 – Mapa de cluster Quociente Locacional Setor dinâmico em 1995



Fonte: Resultados da pesquisa.

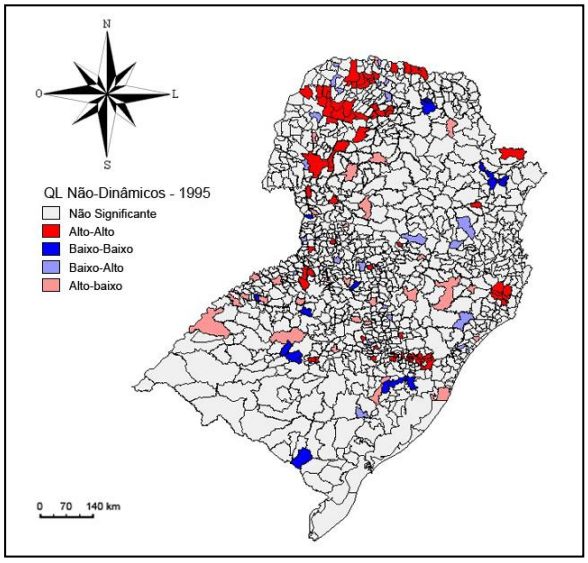
Figura 6 – Mapa de cluster Quociente Locacional Setor dinâmico em 2010



Fonte: Resultados da pesquisa.

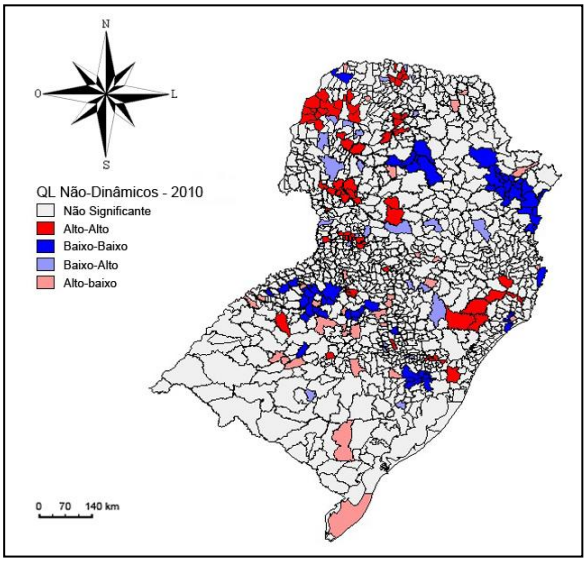
Os mapas de *clusters* referentes aos QLs dos setores dinâmico e não dinâmico, apresentados pelas figuras 5, 6, 7 e 8, revelaram a formação de alguns *clusters*, apesar de isolados e relativamente pequenos para os anos de 1995 e 2010. A Região Metropolitana de Curitiba se destaca com a formação de um *cluster* com relação alto-alto para o setor dinâmico.

Figura 7 – Mapa de cluster Quociente Locacional Setor não dinâmico em 1995



Fonte: Resultados da pesquisa.

Figura 8 – Mapa de cluster Quociente Locacional Setor dinâmico em 2010



Fonte: Resultados da pesquisa.

A figura 9 apresenta os mapas de *cluster* referentes ao *IHH* ajustado. Essa análise utilizando o *IHH* como variável revela se cidades consideradas diversificadas ou especializadas interferem nos municípios vizinhos quanto a diversificação ou especialização dos mesmos. Cabe apontar que os *clusters* baixo-baixo são referentes aos municípios mais diversificados, de acordo com a

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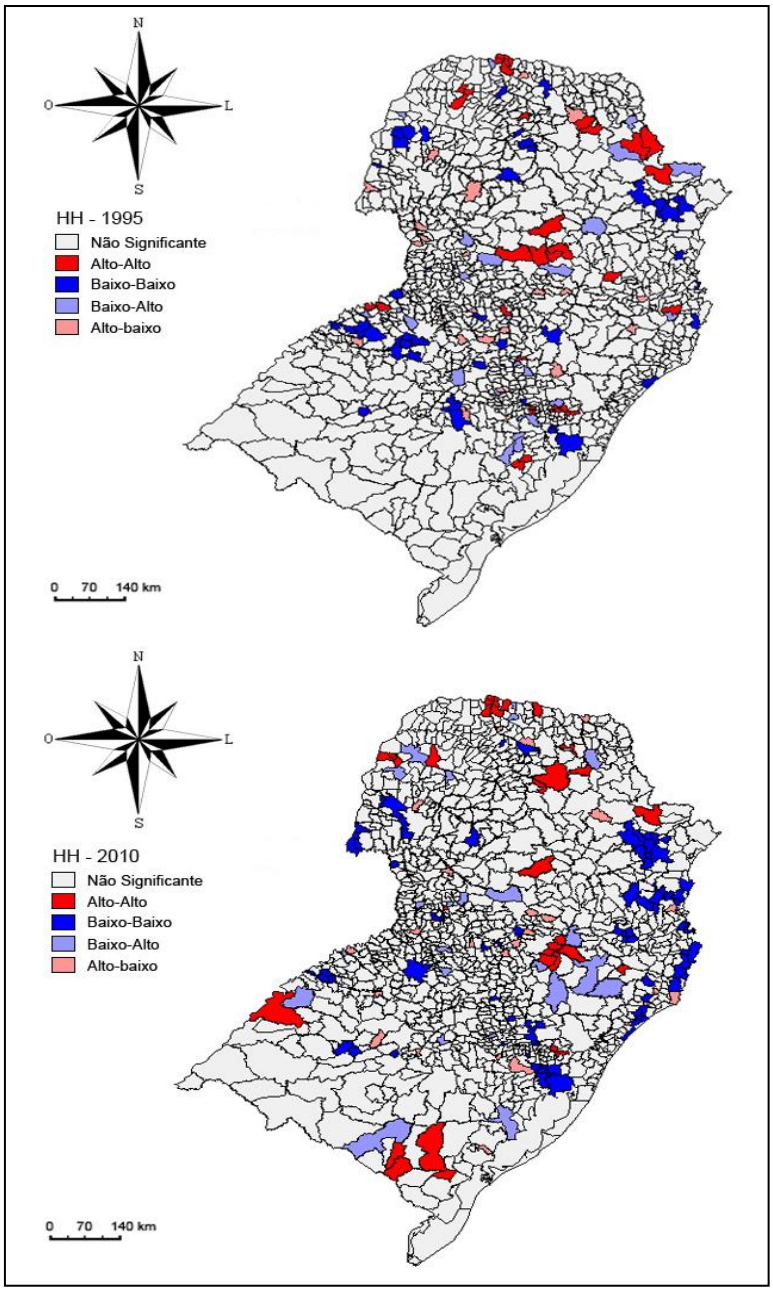
interpretação dos resultados do índice *HH*, em que quanto mais próximos de 0 for o resultado, mais diversificado será o município. Por outro lado, partindo desse mesma premissa, os *clusters* alto-alto dizem respeito aos municípios mais especializados, pois, quanto maior o *IHH* mais especializada será a cidade.

Sendo assim identifica-se a formação de *clusters*, alguns alto-alto, outros baixo-baixo, sendo que para o ano de 2010 identifica-se maior formação de agrupamentos. Os resultados para o mapa de *clusters* com relação ao *IHH* revelam que regiões diversificadas assim como especializadas exercem influência nas variáveis de cidades vizinhas. Essa informação sugere que as indústrias consideram, no tocante a sua localização, a diversidade ou especialidade da Região em que vão se fixar. As teorias de aglomeração industrial se mostram aderentes, tanto as de diversificação/urbanização de Jacobs, como a de especialização/concentração de MAR.

Figura 9 – Mapa de *cluster* para Índice *Hirschman-Herfindahl* de na Região Sul em 1995 e 2010



Fonte: Resultados da pesquisa.

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Pode-se incorrer a partir das análises de autocorrelação espacial, para todas as variáveis utilizadas, que há elevada concentração de atividades indústriais em certas áreas, e alguns *clusters* indicam influência das variáveis de determinada Região nas variáveis das regiões próximas a esta primeira quanto a concetração industrial.

Se existe a formação de *cluster* alto-alto presume-se que as atividades indústriais consideraram a possibilidade de terem melhor desempenho se localizarem-se em áreas em que já haja elevada presença de indústrias. Por outro lado, a ocorrência de *clusters* alto-baixo indicam que as indústrias consideram a possibilidade de incorrerem em deseconomias de escala devido à elevada concentração desta atividade na Região. As deseconomias de escala podem implicar em elevado preço dos terrenos e alugueis, ou até mesmo elevados sálarios, o que irá desestimular a indústria a se fixar em determianadas Regiões. O contrário ocorre com os *clusters* de relação baixo-alto. As indústrias se localizam em determinadas Regiões que ainda não possuem elevada concentração indústrial justamente por não incorrerem em deseconomias de escala.

Considerando estas relações é possível confirmar as suposições realizadas com base nas análises de localização e especialização quanto a distribuição espacial das indústrias na Região Sul, em que, resumidamente, há maior incidência de indústrias não dinâmicas e estas estão mais espalhadas na Região. O setor dinâmco, ao contrário, se concentra em algumas áreas, geralmente áreas mais diversificadas. É possível comprovar estatisticamente a existência de correlações entre as variáveis analizadas, variáveis que se resumem a ocorrência de atividades industrais em determinada área.

Conclusão

O presente trabalho procurou realizar uma análise a cerca do modo como se distribuem espacialmente as indústrias dinâmicas e não dinâmicas na Região Sul do Brasil em 1995 e 2010. Considerou-se para a realização desta análise as teorias de aglomeração, subdivididas em especialização/localização e diversificação/urbanização. Utilizando as medidas de localização e especialização e a análise exploratória de dados espaciais, foi possível identificar onde estão localizadas as indústrias dinâmicas e não dinâmicas na Região Sul e alguns padrões locacionais e, interpretá-los à luz da teoria econômica.

Quanto à distribuição percentual e as medidas de localização e especialização, os resultados sugerem que as indústrias não dinâmicas são mais bem distribuídas na Região Sul do que as indústrias dinâmicas. Além disso, essas indústrias possuem a maioria dos empregos industriais na Região, uma diferença de quase 300 mil empregos no ano de 2010. A indústria dinâmica se concentra em áreas que possuem maior diversificação com relação à atividade industrial, principalmente nas Regiões Metropolitanas dos Estados e em algumas cidades médias, sendo coerente a teoria de diversificação/urbanização de Jacobs (1969).

Nota-se que as indústrias dinâmicas da Região Sul tiveram um crescimento importante no período, bem superior ao aumento de empregos da indústria não dinâmica. A primeira cresceu 106,06% e a segunda 65,52%, sendo o Estado do Paraná o que mais aumentou seus empregos dinâmicos, aproximadamente 150% de aumento. Contudo, o padrão de localização dessas indústrias pouco se alterou no período, elas ainda se concentram em poucas áreas, as quais são principalmente as Regiões Metropolitanas e algumas cidades médias.

O *I* de *Moran* calculado apresentou-se positivo, revelando que existe uma autocorrelação espacial entre as variáveis analisadas, que foram a distribuição percentual do emprego, o QL e o *IHH*. Para todas as variáveis identificou-se a formação de alguns *clusters*, tanto alto-alto como baixo-baixo. A autocorrelação positiva alto-alto para o QL revela que regiões com QL elevado, ou seja, especializadas, influenciam regiões vizinhas a serem também especializadas. Quanto à relação baixo-baixo para essa mesma variável, a análise sugere que regiões que não são especializadas em determinada indústria influenciam as regiões vizinhas a também não serem especializadas. Essas relações ocorreram tanto para as indústrias dinâmicas como para as não dinâmicas, sendo que as

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relações alto-alto para a indústria dinâmica revelaram *clusters* nas RMs e as não dinâmicas apresentaram alguns *clusters* no interior dos Estados.

Para a variável distribuição percentual do emprego os *clusters* com relação alto-alto revelaram que regiões que possuem elevado nível de emprego, tanto dinâmico como não dinâmico, a exemplo do QL, são rodeados por cidades com também elevado nível de emprego. O contrário ocorre com os *clusters* de relação baixo-baixo.

Para o *IHH* ocorreu o mesmo, nos *clusters* de relação alto-alto regiões especializadas influenciam regiões vizinhas a serem especializadas e os com relação baixo-baixo sugerem que regiões diversificadas incitam cidades próximas a serem diversificadas. É importante lembrar que a especialização na análise do *IHH* é o elevado número de empregos em uma Região em um ou poucos setores industriais, já a diversificação é a maior distribuição do emprego em vários ramos da indústria.

Ademais, verificou-se que não houve mudanças muito relevantes na distribuição espacial das atividades no Sul do país para o período analisado (1995-2010), mesmo sendo um período de estabilidade e de grande crescimento para a economia como um todo, demonstrado pela grande variação do PIB da Região Sul e do restante do Brasil, 22,32% e 461,63%, respectivamente. Houve uma tênue alteração da distribuição e homogeneização espacial das indústrias e da localização dos setores tecnologicamente mais complexos em regiões mais desenvolvidas, consequentemente, não houve relevantes reduções das disparidades regionais.

Desta forma, um aspecto importante deste estudo é a possibilidade de surgirem políticas públicas que atuem nas diferenças regionais, visto que foram identificados os padrões locacionais das indústrias e a distribuição espacial das mesmas, revelando a elevada heterogeneidade espacial da atividade industrial no Sul do Brasil. Cabe registrar que o presente estudo não esgota as análises sobre o tema de distribuição espacial das indústrias, este assunto revela-se complexo, comportando outras metodologias e análises.

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KNOWLEDGE SPILLOVERS AND ECONOMIC PERFORMANCE OF FIRMS LOCATED IN DEPRESSED AREAS: DOES GEOGRAPHICAL PROXIMITY MATTER?

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Abstract. Extensive literature on the contribution of knowledge spillovers to growth and development at the regional level exists but these studies mainly features regions characterised by a high level of economic development. This paper assesses the importance of knowledge spillovers for firms located in relatively small, peripheral and economically depressed areas. Based on both primary (direct surveys to 257 firms) and secondary data, we concluded that the more relevant knowledge spillovers for firms located in a depressed region of northern Portugal (*Vale do Ave*) are inter-regional and international. This suggests that the contacts established with sources of knowledge from outside the region under analysis and abroad are crucial for the performance of firms. Despite the innovative intra-industry environment impacts positively on the economic performance of firms, our results convey that in such peripheral and depressed region geographical proximity is not critical for the firms' economic performance.

JEL-codes: R11, B52, D80, O31, O32

Key-words: Depressed areas; evolutionary economic geography; knowledge spillovers, innovation

1. Introduction

Knowledge is defined by several authors, in line with Polanyi (1958), as a learning process that involves cognitive structures and the assimilation of different types of information. A new concept emerges from the diffusion of knowledge: knowledge spillovers. These correspond to a transmission mechanism by which firms benefit from the knowledge produced by other organizations (Sena, 2004). Specifically, knowledge spillovers enable firms to use a greater range of external knowledge, which influences their ability to innovate (Webster, 2004; Yang et al., 2010).

Relating knowledge spillovers with innovation activities is crucial and the evolutionary approach to economic geography appears as essential to frame this relationship as it focuses on the importance of organizational routines within the firm on innovation processes (Boschma and Frenken, 2006).

The importance of knowledge spillovers has been the focus of a significant number of studies that intend to assess, among other aspects, their contribution to regional growth and to explain the differences in economic performance of firms located in distinct regions (Funke and Niebuhr, 2005; Döring and Schnellenbach, 2006; Rodriguez-Pose and Crescenzi, 2008). These studies emphasize, in particular, the positive impact that knowledge spillovers - from the same region or neighbouring regions - have on the regions' growth (Rodriguez-Pose and Crescenzi, 2008). The analysis of the geographical reach of knowledge spillovers is central to a large part of these studies. For some (e.g., Bode, 2004; Verspagen and Schoenmakers, 2004), knowledge diffuses only over short distances, while others (e.g., Bathelt et al., 2004, Teixeira et al., 2008) show that geography is not as relevant in terms of proximity, meaning the transmission of knowledge can occur over long distances.

Notwithstanding the valuable contributions to the literature, most studies on knowledge spillovers refer to countries and regions with relatively high levels of development - USA (e.g., Jaffe, 1986), or, in the European context, Germany (e.g., Beise and Stahl, 1999; Bode, 2004; Funke and Niebuhr, 2005), Sweden (Andersson and Karlsson, 2007) and Italy (Caragliu and Del Bo, 2011). Moreover, they use innovation variables such as patents to measure knowledge spillovers, which correspond to only a part of the innovation process of organizations, especially those larger in size and resources, mostly

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located in relatively dynamic and developed areas. The few studies (e.g., Fitjar and Rodríguez-Pose, 2011) that have measured knowledge spillovers employing other variables, such as product and process innovation within firms, and that recognize the importance of using different sources of knowledge more related to the routines of firms in innovation processes, have also focused on more developed countries.

More peripheral countries, such as Portugal, have only very recently become the object of interest in terms of research. In particular, Faria and Lima (2012) and Natario et al. (2012) found that the variables measuring innovation and spillovers are positively related to firm performance (Faria and Lima, 2012) and the geographical scope of spillovers in peripheral regions is local, regional and national (Natario et al., 2012). It would be important to also assess within peripheral countries, whether and to what extent the positive effect of knowledge spillovers found in the (few) existing studies occurs in economically depressed areas/regions.

The present study, using the concept of depressed areas (PRASD, 2004), analyses the importance and mechanisms of knowledge spillovers to the economic dynamics of firms located in these areas (in this case, the *Vale do Ave*, a region of Northern Portugal) in a relatively peripheral country such as Portugal (Fontes, 2005).

The paper is organized as follows. Section 2 presents a literature review that systematizes the main contributions produced on the concept of knowledge spillovers, within the framework of economic geography and, more specifically, the Evolutionary Economic Geography research line. An overview of the empirical studies that have been submitted in this field is also presented. Section 3 describes the methodology adopted in this study and the empirical results are detailed in Section 4. Finally, we present the conclusions and the main lines for future research.

2. Importance of knowledge spillovers for the economic performance of firms

2.1. Concept of knowledge spillovers

The complex and nonlinear nature of knowledge has been emphasized by authors such as Polanyi (1958), for whom knowledge is a process that involves cognitive structures that assimilate the information and place it in a broader context, combining a learning process. In his turn, Plotkin (1994) regards knowledge as a dynamic picture in which information can be stored, processed and assimilated, assuming a relational characteristic. Dohse (2001) also believes that knowledge depends on the time and context in which it is generated, it is not static but dynamic and its evolution depends on the institutional framework.

Concerning the types of knowledge, Polanyi (1967) distinguishes between explicit and tacit knowledge. According to this author, explicit or codified knowledge is a kind of organized knowledge and it is formalized by certain documents, such as publications. On the other hand, tacit knowledge is embedded in individuals and corresponds to innate values as their own skills. It is a kind of knowledge that develops in individuals through their skills, practices and actions, so it is difficult to transmit. Concepts such as learning-by-doing (Arrow, 1962) and learning-by-using (Rosenberg, 1982) are key elements in the acquisition of tacit knowledge. Know-how is the more difficult form of tacit knowledge for individuals to assimilate and it is not directly or easily transmissible (Cohen and Levinthal, 1990). Knowledge can be incorporated in patents (Greunz, 2005), in machinery and equipment, and can be apprehended through experience, research, observation and learning (Malecki, 2010).

The concept of knowledge spillovers has been emphasized by several authors (e.g., Griliches, 1992; Audretsch and Feldman, 2004). These spillovers constitute a process by which firms benefit from the knowledge of other organizations (Sena, 2004), corresponding to a flow of knowledge from a source firm to a beneficiary firm (Griliches, 1992). Knowledge spillovers are still defined as an externality that results from the diffusion of a new technology, product or production process between spatial units such as firms, cities, regions and countries (Caragliu and Del Bo, 2011), and may result from

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failures in the available mechanisms to protect knowledge generated in innovative firms (Kaiser, 2002). Thus, the process of the creation and diffusion of knowledge has two types of effects: a direct effect on firms that produce knowledge and an indirect effect, related to the possibility of knowledge being absorbed by other firms (Adams and Jaffe, 1996).

There are different theories that discuss knowledge spillovers. Knowledge is seen as a major factor explaining the growth differences between regions (Döring and Schnellenbach, 2006), particularly the differences that exist in terms of corporate performance (Faria and Lima, 2012). In this context, the productivity of a firm tends to depend on knowledge spillovers, including the knowledge that such a firm can absorb (Ornaghi, 2006). In the evolutionary economics framework (e.g., Dosi, 1988), knowledge is considered as intrinsically dynamic, it has a cumulative and path dependence nature, and is not transmitted automatically.

A key question that emerges from the analysis of knowledge spillovers is its link with innovation. In fact, knowledge spillovers influence the innovativeness of firms, because they can draw on a wider range of external knowledge to conduct innovative activities (Yang et al., 2010). The knowledge diffuses from a source firm to another, when the receptor firm uses this knowledge in innovation activities (Griliches, 1992). Webster (2004) confirms this link between knowledge spillovers and innovation. Through an analysis of large Australian firms, the author measures the reasons that lead firms to engage in innovation activities. The results indicate that the routines common to all industries and knowledge spillovers influence the innovative capacity of firms. Thus, knowledge spillovers seem to be a critical part of the activity and innovative capacity of firms (Czarnitzki and Kraft, 2012).

Knowledge spillovers can be categorized into intra-industry spillovers, occurring between firms from the same industry, and inter-industry spillovers that occur between firms in different industries (Steurs, 1995; Kaiser, 2002). In fact, knowledge is not equally accessible to all firms (Jaffe, 1986). According to Henderson and Cockburn (1996), a firm can more easily exploit the knowledge from firms in the same industry (intra-industry spillovers) rather than from that developed in other industries (inter-industry spillovers).

Knowledge spillovers do not occur only inside a given region, but can spread to other regions, so the origin of spillovers may be local but may arise outside of the study area too (Audretsch and Feldman, 2004). In this respect, there is a distinction between intra-regional spillovers, which occur within the geographical boundaries of a spatial unit, and inter-regional spillovers, which come from neighbouring regions, highlighting the important role that geography plays in the creation and dissemination of knowledge (Rodriguez-Pose and Crescenzi, 2008).

Additionally, depending on the location of the producing agents and receivers of knowledge, there are national and international spillovers. Such spillovers have been emphasized by authors like Harabi (1997) and Negassi (2009). However, there is controversy associated with the geographical scope of spillovers. According to several authors (e.g., Bode, 2004; Verspagen and Schoenmakers, 2004), these occur more frequently among geographically close agents, considering the problem of the transmission of tacit knowledge. On the other hand, other authors (e.g., Bathelt et al., 2004; Teixeira et al., 2008) emphasize that spillovers can occur in geographically distant locations. In this context, Bathelt et al. (2004) distinguish between the concepts of local buzz and pipelines. The buzz is related to short geographical distances that facilitate the generation and dissemination of tacit knowledge, contrary to the definition of pipelines that correspond to the diffusion of knowledge over large geographical distances.

Hence the question that arises is how can geography facilitate the dissemination of knowledge spillovers. According to Howells (2002), the importance of geography for knowledge spillovers depends on the type of knowledge and the context of its creation and transfer. Explicit knowledge can be transferred across large distances and at lower costs, whereas the transfer of tacit knowledge involves direct interaction and thus broad spatial proximity (Anselin et al., 1997).

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2.2. Importance of knowledge spillovers for the dynamics of firms and regions

The studies that analyze the importance of knowledge spillovers for the dynamics of firms and regions focus, in general, on the impact of such spillovers on indicators of the economic performance of firms and regions, for example, the growth rate of GDP per capita of the region (e.g., Rodriguez-Pose and Crescenzi, 2008); and innovation, such as the number of innovations introduced through public research (Beise and Stahl, 1999), or the number of patents granted (Bode, 2004). These studies analyze the dynamics of firms and regions by including variables as measures of knowledge spillovers (Table 1), such as patents of neighbouring regions (Bode, 2004), R&D (e.g., Rodriguez-Pose and Crescenzi, 2008) or accessibility (Andersson and Karlsson, 2007).

Referring to inter-regional spillovers, Bode (2004), Funke and Niebuhr (2005) and Rodríguez-Pose and Crescenzi (2008) analyze regions, in particular regions in Germany, in the case of the first two studies, and the European Union in the study by Rodríguez-Pose and Crescenzi (2008). Considering a distinct unit of analysis, Andersson and Karlsson (2007) study the importance of knowledge spillovers in German cities.

For the German regions, Bode (2004) examines the impact of knowledge spillovers on the number of patents granted to commercial firms in these regions, while Funke and Niebuhr (2005) evaluate their impact on the region's growth measured by Gross Value Added per worker. Rodríguez-Pose and Crescenzi (2008) also analyze the impact of spillovers on the growth of EU regions, in this case measured by the growth rate of GDP per capita in the region. These three studies yield similar conclusions with regard to proximity, showing that the effects of spillovers decline with distance.

Bode (2004) considers two different measures, weighted by distance, for knowledge spillovers: patents and employment in R&D of neighbouring regions. The author concludes that the regions benefit from being near innovative regions with a higher number of patents because the intensity of spillovers is larger. However, the effect of spillovers decreases when the region's innovative capacity rises. Funke and Niebuhr (2005) also found that regional growth is characterized by a spatial pattern because spillovers diminish with distance. This study analyses the effect of knowledge spillovers, measured by the effect of the region's potential R&D on regional growth and concludes that this variable has a positive impact for the German regions.

Rodríguez-Pose and Crescenzi (2008) reach the same conclusion, in their analysis of the EU regions (NUTS 1 and 2), using as a proxy for knowledge spillovers the accessibility to innovative activities undertaken in neighbouring regions, weighted by R&D. For this purpose, they develop an accessibility index to innovation that seeks to measure the potential of innovative activity that is carried out in neighbouring regions, representing the accessibility of a region to an activity in another region. Given the cost of knowledge transmission, they calculate the interregional distances in terms of the minutes required to travel through the two regions. The authors conclude that spillovers decrease with distance, but they have a positive effect on regional growth measured by the growth rate of GDP per capita in the region.

However, Andersson and Karlsson (2007), in a study on the municipalities in Sweden, conclude that the impact of interregional accessibility (captured through three types of knowledge measured at the municipal level - business R&D, R&D in universities and patents) is not statistically significant on the growth of the municipality, measured by the respective gross product. It should be noted that this same study develops the analysis at both the intra-regional and intra-municipal level and concludes that spillovers have a positive and statistically significant impact on the growth of the city.

These four studies focus their analysis on the impact of inter-regional spillovers, using R&D, accessibility and proximity as variables to measure spillovers. The first three (Bode, 2004; Funke and Niebuhr, 2005; Rodríguez-Pose and Crescenzi, 2008) conclude that the effects of spillovers diminish with distance, whereas in the last study (Andersson and Karlsson, 2007), no clear-cut conclusion is reached regarding this matter.

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Studies on intra-regional spillovers focus mostly on EU regions (Rodriguez-Pose and Crescenzi, 2008) and on municipalities in Sweden (Andersson and Karlsson, 2007). There are however some studies that focus on U.S. firms (Jaffe, 1986) and Germany (Beise and Stahl, 1999), analyzing the effect of knowledge spillovers on different variables. More specifically, Andersson and Karlsson (2007) and Rodriguez-Pose and Crescenzi (2008) analyze the effect of knowledge spillovers on regional growth, while Jaffe (1986) and Stahl and Beise (1999) analyze the effect of spillovers on the number of patents and innovations, respectively.

Table 1: Overview of the empirical studies on the importance of spillovers for businesses and regional growth

Spillovers type	Studies	Unit of analysis	Method	Proxy for knowledge spillovers	Impact of spillovers on	Conclusions
Inter-regional	Bode (2004)	74 regions in western Germany	Spatial econometric analysis	Patents in neighbouring regions weighted by distance	Number of patents granted to commercial enterprises	The region benefits from being close to innovative regions (the intensity of spillovers is larger).
				R&D employment in neighbouring regions weighted by distance	Number of patents granted to commercial enterprises	The effects of spillovers decrease with the increase of innovative capacity in the region.
	Funke and Niebuhr (2005)	71 regions in Germany	Regression Analysis	Potential R&D, function of R&D employment in the region and in other regions and of a distance parameter	Productivity growth measured by gross value added per worker	Positive coefficient for potential R&D. The regional growth is characterized by a spatial pattern (spillovers decline with distance).
	Andersson and Karlsson (2007)	286 municipalities (81 regions) in Sweden	Multiple regression analysis by OLS	Function of accessibility (travel time between municipalities) to three types of knowledge (R&D business, R&D of Universities, stock of patents) and the knowledge-intensive workforce	Variation in value added per employee in the municipality (measured by gross product of municipality)	The inter-regional accessibility to all three types of knowledge is statistically insignificant.
	Rodriguez-Pose and Crescenzi (2008)	166 regions in the EU - 25	Multiple regression analysis by OLS	Accessibility Index: function of R&D expenditure in the neighbouring region and travel time between regions (minutes)	Growth rate of GDP per capita in region	Spillovers decreases with distance; knowledge spillovers from neighbouring regions improve regional growth.
Intra-regional	Jaffe (1986)	432 firms in the U.S.A.	Multiple regressions by OLS	Proximity between firms and expenditure in R&D of other firms	Patents	Positive impact of proximity and expenditure in R&D; the relationship between expenditure in R&D and proximity is positive.
	Beise and Stahl (1999)	2300 firms in Germany	Model of binary choice	Function of expenditure in R&D, firm size and proximity to public research institutions	Number of innovations introduced by public research	Positive impact of firm size and expenditure in R&D, but there is no significant impact of proximity to public research.
	Andersson and Karlsson (2007)	286 municipalities (81 regions) in Sweden	Multiple regression analysis by OLS	Function of accessibility (travel time between municipalities) to three types of knowledge (R&D business, R&D of Universities, stock of patents) and the knowledge-intensive workforce	Variation in value added per employee in municipality (measured by gross product of municipality)	The intra-regional accessibility is positive and statistically significant in three types of knowledge.
	Rodriguez-Pose and Crescenzi (2008)	166 regions in the EU – 25	Multiple regression analysis by OLS	R&D expenditure as percentage of GDP in region	Growth rate of GDP per capita in region	R&D helps to explain the differences in terms of regional growth.
Intra-municipal	Andersson and Karlsson (2007)	286 municipalities (81 regions) in Sweden	Multiple regression analysis by OLS	Function of accessibility (travel time between zones of municipalities) to three types of knowledge (R&D business, R&D of Universities, stock of patents) and the knowledge-intensive workforce	Variation in value added per employee in municipality (measured by gross product of municipality)	The intra-municipal accessibility is positive and statistically significant in three types of knowledge.

Source: Authors' compilation.

Thus, Rodriguez-Pose and Crescenzi (2008), based on an analysis of EU 25 regions, consider the regional investment in R&D a proxy of local innovative effort, representing the intra-regional

spillovers. The expenditure on R&D as a percentage of GDP in the region helps to explain the differences in growth across EU regions, so this variable has a positive impact on the regional growth rate of GDP per capita.

Andersson and Karlsson (2007) obtain the same conclusion regarding the effect of intra-regional knowledge spillovers. In their study on German cities, the authors found that intra-regional accessibility is positive and statistically significant in the three types of knowledge considered (business R&D, R&D in universities and stock of patents). This means that the effect of knowledge spillovers on the city's growth is limited to existing resources in the region.

Regarding the intra-regional spillovers, the issue of the spatial dependence of patents is crucial to highlight the presence of knowledge spillovers, which means it can be applied at firm level. Focusing on the U.S., Jaffe (1986) measured the spillovers through proximity between firms and expenditure on R&D from other firms and found that there was a positive impact of spillovers on these firms' patenting activity.

The study by Beise and Stahl (1999), aimed at determining whether spillovers have an impact on the number of innovations introduced by firms through access to public research, also include variables such as R&D and proximity, in this case, to research at public institutions. They consider as measures of the spillovers, spending on R&D, firm size and proximity to public research institutions as identified by firms. The authors conclude that, in the case of Germany, firm size and expenditure on R&D have a positive impact, but no significant impact is derived from the proximity of businesses to public research institutions, contrarily to findings from other studies on intra-regional accessibility to R&D in universities, for example, in Andersson and Karlsson (2007). This latter study examines another type of spillovers, the intra-municipal, using three measures of knowledge, business R&D, R&D in universities and patents, where accessibility to knowledge is measured between areas belong to each municipality. As in the case of intra-regional spillovers, intra-municipal accessibility emerges as statistically significant and positive in the three types of knowledge, so its effect on municipality growth is positive, as measured by the variation in added value per employee of the municipality.

In summary, these studies show the importance of knowledge spillovers as a determinant of economic performance (e.g., Rodriguez-Pose and Crescenzi, 2008) and innovation (Beise and Stahl, 1999).

The studies analyzed employ variables that reflect the formal part of business innovation, embodied in indicators such as patents or R&D. Such activities, however, have little expression in less developed regions, particularly in depressed regions. In this context (see Table 2), Fitjar and Rodríguez-Pose (2011) analyzed 436 firms in a peripheral region of southwest Norway, using the innovation capacity of firms as the dependent variable, measured through the development of new or significantly improved products or by the fact that the innovation is new to the firm or the market. These authors conclude that the development of innovations is positively and significantly influenced by the diversity of information sources used by businesses. They also conclude that sources used by regional and national firms do not significantly influence the development of innovations. In contrast, international sources emerge as significantly and positively related to innovation. In this study, geographical proximity does not seem to be relevant, whereas other types of proximity, such as cognitive and organizational proximity seem crucial. This result is to some extent challenged by Natario et al. (2012), who conclude, by analyzing the innovation process of small and medium enterprises (SMEs) located in the peripheral areas of *Guarda*, *São Miguel* and *Santa Maria* in the Azores, that the level of cooperation between firms and knowledge sources is higher in innovative firms, presenting a more local, regional or national scope of activity rather than international.[98]

The knowledge sources are also important in Bonte (2008). This author analyses the dissemination of knowledge and geographical proximity (for a maximum driving time of 2 hours) on the level of trust

98 Similarly to Fitjar and Rodríguez-Pose (2011), aspects related to innovation and spillovers are captured through the number of employees involved in innovation activities, the level of collaboration (low, medium, or high) and the scope of activity (local, regional, national or international).

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in customer-supplier relationships in 179 aeronautical firms in Germany. Therefore, as in previous studies, this study analyses the importance of access to external knowledge (customers and suppliers) for the achievement of product and process innovations. The appropriability of knowledge in also analyzed, understood as the risk of generated knowledge in the firm to move on to other firms. The level of trust in firms tends to be higher when partners have been important sources of external knowledge in the past.

Table 2: Overview of the empirical studies on innovation types and knowledge sources

Studies	Unit of analysis	Independent variables (related with *spillovers* and innovation)	Impact on	Method	Conclusions
Ornaghi (2006)	3151 industrial firms in Spain	R&D investment in and out of the firm; product and process innovations; R&D of other firms weighted by their proximity	Production and sales (deflated values)	Generalized Method of the Moments	The variables positively influence the growth of firms; product innovations have higher technological diffusion than process innovation.
Bönte (2008)	179 aeronautical firms in Germany	Relevance of clients and suppliers as external sources of knowledge and of recruitment activities; knowledge appropriability	Level of trust in the proximity/distance of clients/suppliers	Ordinary Least Squares	Geographical proximity has a positive impact on trust level: this level is higher when partners have been important sources of external knowledge in the past; trust is low when firms are not able to protect their innovations.
Fitjar and Rodriguez-Pose (2011)	436 firms from a peripheral region in South west Norway	Different collaboration levels, degree of importance and location of sources	Probability of the firm introducing a new or a significantly improved product or the development of a new product by the firm	Logit model	The development of innovations is positively and significantly influenced by the diversity of knowledge sources used by firms; international sources are significantly and positively related with innovation.
Czarnitzki and Kraft (2012)	920 German innovative firms	Knowledge flows for the development of a product or a process (competitors, clients, suppliers, research institutions, patents)	Profit margin	Probit model	The spillovers of competitors have a positive impact on profits, in opposition to the spillovers associated with clients, customers or research institutions, which do not have any effect.
Faria and Lima (2012)	1396 Portuguese firms	Development of innovation activities and the associated expenditures; relative weight of innovative firms and the relative weight of firms that innovate at the product level or at the process level	Added value	Ordinary Least Squares	The variables that measure innovation and spillovers are positively related with the performance of the firm: firms assimilate more knowledge from process innovations.
Natário et al. (2012)	111 firms from peripheral areas in Portugal (Guarda, São Miguel and Santa Maria in the Azores)	Number of employees allocated to R&D activities Collaboration level (low, medium, high) Activity scope (local, regional, national or international)	Innovation (if the firm innovates or not) Relative weight of new goods' sales (just for innovative firms) Innovation area (product innovation, process innovation, marketing innovation)	Logit model Tobit model Probit model	The number of employees associated with innovative activities is significant and has a positive relationship with innovation; the collaboration level is higher in innovative firms (local, regional or international context. R&D intensity is not significant; firms in the manufacturing sector are more focused on product and process innovations.

Source: Authors' compilation.

Moreover, trust is hampered when firms are not able to protect their innovations. Bonte (2008) also concludes that geographical proximity has a positive impact on cooperation and confidence level.

Referring to the different types of innovation, Czarnitzki and Kraft (2012) employ a sample of 920 innovative firms in Germany, with explanatory variables of firm performance, measured by profit margin, related to knowledge flows that were essential to the development of a product or process, in particular from competitors, customers, suppliers and research institutions. The authors conclude that spillovers from competitors have a positive impact on profits, unlike spillovers from customers, suppliers or research institutions which did not reveal any effect on the firms' performance. In the

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case of Faria and Lima (2012) and Ornaghi (2006), despite having concluded that innovation and spillovers are positively related to business performance, the impact of externalities differ in the type of innovation - for the first authors, firms assimilate more knowledge from process innovations than product innovations (although the difference is small), whereas for Ornaghi (2006), product innovations have a relatively higher technological diffusion than process innovations.

3. Methodology

3.1 The selection of the depressed municipalities of Vale do Ave

Vale do Ave is located in the *Minho* region of northern Portugal and is composed of eight municipalities: *Fafe*, *Guimarães*, *Póvoa de Lanhoso*, *Santo Tirso*, *Trofa*, *Vieira do Minho*, *Vila Nova de Famalicão* and *Vizela*. This area is classified as depressed (according to *Resolução do Conselho de Ministros* nº11/2004), based on its local Purchasing Power Index, lower than 75% of the national Purchasing Power Index. The municipalities of *Vila Nova de Famalicão*, *Santo Tirso*, *Guimarães* and *Trofa* have a Purchasing Power Index of, respectively, 82.4%, 80.4%, 79.8% and 79.5%, exceeding the national average of 75%, so they are not considered depressed municipalities. In contrast, the municipalities of *Vizela*, *Fafe*, *Póvoa de Lanhoso* and *Vieira do Minho* (with a Purchasing Power Index of 65.6%, 64.8%, 58.4% and 55.4%, respectively), are considered depressed, and businesses located in these municipalities are the target of our analysis (Figure 1).

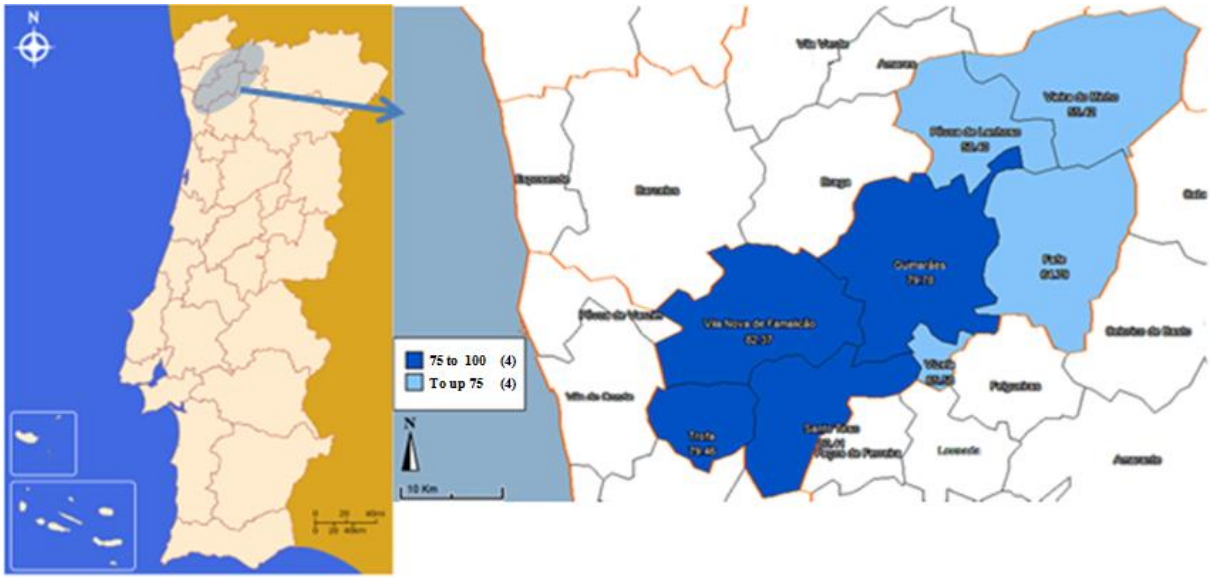

Figure 1: Purchasing Power Index by municipality in *Vale do Ave*, 2009
Source: Authors' compilation based on data from INE (Portuguese Statistics Institute) (2011a).

According to the division of firms by sector of activity (cf. data from INE, 2011b), retail and wholesale is the sector with the greatest number of firms in the municipalities of *Vale do Ave* in general (27.4%) and in the depressed municipalities in particular. Manufacturing is also very relevant in terms of number of firms (16.2%), particularly in the municipalities of Fafe (18.9%) and Vizela (20.3%), emerging with the second highest weight after the trade sector.

For a country of intermediate development and it less developed regions, the dynamics of its tradable goods sector and industrial competitiveness are very important. Thus, we decided, in line with several recent studies (e.g., Saito and Gopinath, 2011; Poldahl, 2012), to restrict our analysis of knowledge spillovers in the manufacturing sector.

The manufacturing industry in the depressed municipalities of Vale do Ave is mainly comprised of firms belonging to the textile and clothing industries (see Table A1 in Appendix). For the municipalities of Fafe, Póvoa de Lanhoso, Vieira do Minho and Vizela, the weight of these sectors in the total manufacturing industry is 71.2%, 44.0%, 34.0% and 63.6%, respectively, showing their significant importance for these municipalities .

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The turnover per firm in Vale do Ave is 268.9 thousands of euros, below the average for Portugal (316.6 thousands of euros). The municipalities in question all have a turnover below the average of Vale do Ave.

There is a high percentage of individual firms in Vale do Ave, but below the Portuguese national average. All the depressed municipalities have a proportion of individual firms equal or higher than the average of Vale do Ave. Firms in Portugal, especially in Vale do Ave, are predominantly small, as evidenced by the proportion of firms that have less than 10 workers. However, it is noteworthy that regarding the number of individuals employed by the firm, the average for Vale do Ave (4.2) is higher than the national average (3.5) and the average for the North. Only the municipality of Vizela presents a higher figure (4.7) when compared to the average for Vale do Ave.

Employees with a low level of education predominate in all municipalities (below the 3rd cycle of basic education). Employees with higher levels of education (Undergraduate, Master and PhD) have limited expression in the total workforce of Vale do Ave, representing 7% of the total in this region compared to 13% for Portugal as a whole. It should also be noted that in all the depressed municipalities of Vale do Ave this percentage does not exceed 5%.

3.2 Data collection and sample representativeness

The process of data collection was based on a survey applied to firms in the depressed municipalities of Vale do Ave.[99] The survey is divided into three parts. In the first part (A), firm data for the years 2009-2011 was requested in order to characterize the sample in terms of economic activity, the municipality to which the firm belongs, sales, Gross Value Added and total number of employees, as well as their disaggregation by Undergraduate, Master and PhD qualifications. The second part of the survey (part B) intended to assess the types of innovation (product and process) implemented by firms, including the collaborations that they perform in terms of introducing these innovations. In order to measure the activities related to obtaining and producing new knowledge, some questions for the year 2008 were made about the amounts spent on R&D activities, acquisition of machinery, equipment and software and other external knowledge. The last part of the survey (part C) aimed to assess the contacts that firms establish with different sources of knowledge (e.g., customers, suppliers, universities) in terms of their importance to the firm and their location.

The addresses of the firms in the municipalities under analysis were collected between 12th and 20th March 2012. In order to infer the viability of the survey questions, pilot tests were conducted in that same week, with three firms in the Vale do Ave region, not included in the municipalities under analysis. Given the success of these tests, application of the survey began on 21st March 2012. The questionnaire was sent as a Word file to firms in the municipalities under analysis from an address created exclusively for the purposes of this research. Given that some firms did not have access to email, the survey was also sent by fax. The implementation of the survey was closed on 21st May 2012, although several direct contacts with the firms[100] were required over this period.

Based upon the distribution of firms by sector in manufacturing industries, a simple quota sampling was established, in order to ensure the sample's representativeness not only by municipality, but also by sector. The initial goal was to obtain a representative sample of 300 firms in the four municipalities under review, which corresponds to 20.6% of the total manufacturing enterprises in these municipalities, distributed as follows (see Table A2 in Appendix): 165, 50, 10 and 75 for the municipalities of Fafe, Póvoa de Lanhoso, Vieira do Minho and Vizela, respectively.

99 In terms of survey questions, we tried to follow as closely as possible the templates of the Community Innovation Survey (CIS). Although it is possible, by protocol, to access data from CIS 2008, this latest document is not representative at the municipal level, or even NUTS III, including a very small number of firms from the municipalities considered. Thus, there was no alternative but to directly survey the firms located in these municipalities.

100 Many telephone contacts were not valid, so it was not possible to contact those firms. Moreover, some of the firms were already insolvent and others were not willing to respond to our survey. Others also had to be excluded from the analysis because they did not have activity for the period under study. These firms were replaced by others in order to maintain the sample representativeness by sector in each municipality.

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Given the difficulties encountered during the survey process, we only obtained 259 responses from firms located in the municipalities considered (average response rate of 86.3%), which were distributed by municipality in number (response rate) as: 132 (80.0%) in Fafe, 45 (90.0%) in Póvoa de Lanhoso, 8 (80.0%) in Vieira do Minho and 74 (98.7%) in Vizela.

3.3 The specification of theoretical model

Based on the literature review developed in Section 2, the theoretical relationship between the economic performance of firms and knowledge spillovers, controlling for a set of factors/determinants that, according to this same literature, will tend to influence performance, is put forward as follows:

$$\text{Performance of the company}_i = f\left(\begin{array}{c} \underbrace{\begin{array}{c}\text{Location of knowledge sources}\\ \text{(municipality, Vale do Ave except municipality, outside Vale do Ave, outside the country),}\\ \text{Companies that innovate in product or process by industry in Vale do Ave}\end{array}}_{\text{Knowledge spillovers}} \\ \underbrace{\begin{array}{c}\text{Importance of contacts with knowledge sources :}\\ \text{Universities, suppliers, consultants and private institutions of Research and Development}\end{array}}_{\text{Contacts}} \\ \underbrace{\text{Innovation index (implementation of product and process innovations)}}_{\text{Implementation of innovation activities}} \\ \underbrace{\text{Collaborations in the activities of product and process innovation}}_{\text{Collaborations}} \\ \underbrace{\begin{array}{c}\text{Internal and external Research and Development, acquisition of machinery,}\\ \text{equipment and software and other external knowledge}\end{array}}_{\text{Obtaining and production of knowledge}} \\ \underbrace{\text{Industry, total number of employees, human capital}}_{\text{Company characteristics}} \\ \underbrace{\text{Purchasing Power Index}}_{\text{Municipality characteristic}} \end{array}\right)$$

The first group of determinants corresponds to knowledge spillovers. The location of knowledge sources (e.g., suppliers, universities) was used as a proxy for knowledge spillovers (see Table 3), based on Fitjar and Rodríguez-Pose (2011) and Natario et al. (2012). We developed an index that corresponds to the number of sources that the firm has from each location (municipality, Vale do Ave except the municipality, outside Vale do Ave and outside the country) in order to assess the importance of proximity of knowledge sources for corporate performance. In addition to knowledge sources, we used another variable as a proxy for knowledge spillovers, the intra-industry pool of knowledge and innovation, which corresponds to the ratio of firms that innovate in product or process by sector in Vale do Ave, based on data from 2006 to 2008, from CIS. This variable is in line with the procedures followed in the study by Faria and Lima (2012).

The group of contacts corresponds to the level of importance attributed to the information and knowledge sources (Bonte, 2008; Fitjar and Rodríguez-Pose, 2011, Czamitzki and Kraft, 2012). We recoded those variables in order to obtain an index of contacts with universities, suppliers, consultants and private R&D institutions, which includes the use and importance attributed to a particular source.

Our model also incorporates the implementation of innovation activities, particularly product and process, in line with Ornaghi (2006) and Faria and Lima (2012). Regarding the implementation of product and process innovations, we developed an index, an Innovation Index, which is the sum of the different types of innovations implemented by firms (e.g., new or improved goods, new or improved services). Moreover, at the level of collaboration in the development of product and process innovations (Fitjar and Rodríguez-Pose, 2011), we recoded the variables in order to determine whether these have an impact on corporate performance.

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The activities of producing and obtaining knowledge (Ornaghi, 2006; Czamitzki and Kraft, 2012), in particular internal R&D, external R&D, acquisition of machinery, equipment and software, and other external knowledge, have been relativized by the sales value.

Finally, we added control variables for the characteristics of firms and municipalities. The group of firm characteristics includes those related with the industry/sector to which the firm belongs and human capital, including the weight of employees with Undergraduate, Master or PhD qualifications in the total number of employees, intended to measure whether the education level of employees influences the performance of firms. We also added a variable to our model that corresponds to a characteristic of the municipalities, the local Purchasing Power Index, which indicates each municipality's level of economic development.

Table 3: Model variables and proxies

Group of variables		Variables	Proxies	Studies
Performance		Performance of the firm (average for the years 2009-2011)	Gross Value Added per worker in ln	Faria and Lima (2012)
Knowledge spillovers	Knowledge sources	Localization of knowledge sources (municipality, Vale do Ave except municipality, outside Vale do Ave, outside the country)	Number of sources from each location - Index 0 to 8 in ln	Fitjar and Rodríguez-Pose (2011), Natário et al. (2012)
	Intra-industry pool of knowledge and innovation	Firms that innovate in product or process by industry in Vale do Ave	Ratio of firms that innovate in product or process by industry in Vale do Ave	Faria and Lima (2012)
Contacts		Importance of contacts with knowledge sources: Universities, suppliers, consultants and private institutions of R&D	Development of a composite variable with the following variables: - Utilization (dummy variable: 0 if no, 1 if yes) - Importance (1 if none, low, medium, 2 if high) Importance index from 0 to 2 (Utilization x Importance) in ln	Bönte (2008), Fitjar and Rodríguez-Pose (2011), Czamitzki and Kraft (2012)
Implementation of innovation activities		Innovation Index (implementation of product and process innovations - goods, services, methods of manufacture or production, methods of logistics, delivery or distribution, activities to support processes)	Innovation Index - sum of implemented innovations by the firm - index of 0 to 5 (0 means no innovation and 5 means that the firm implements all the different types of innovation) in ln	Ornaghi (2006), Faria and Lima (2012)
Collaborations		Collaborations in the activities of product and process innovation	Collaborations in product innovation (0 if there is no collaboration, 1 if it is primarily the firm or group, 2 if it is the firm in cooperation or primarily other firms or institutions) in ln	Fitjar and Rodríguez-Pose (2011)
			Collaborations in process innovation (0 if there is no collaboration, 1 if it is primarily the firm or group, 2 if it is the firm in cooperation or primarily other firms or institutions) in ln	
Obtaining and production of knowledge		Internal R&D External R&D Acquisition of machinery, equipment and software Acquisition of other external knowledge	Ratio of Internal R&D by sales Ratio of External R&D by sales Ratio of acquisition of machinery, equipment and software by sales Ratio of acquisition of other external knowledge by sales	Ornaghi (2006), Czamitzki and Kraft (2012)
Firm characteristics		Industry	Industry: dummy variable (0 if it is other industries, 1 if it is clothing and textile industries)	Natário et al. (2012)
		Total number of employees (average for 2009-2011)	Total number of employees in ln	Fitjar and Rodríguez-Pose (2011)
		Human capital (average for 2009-2011)	Ratio of number of employees with Undergraduate/Master/PhD in the total number of employees	Faria and Lima (2012)

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Municipality characteristic	Purchasing Power Index	Purchasing Power Index in ln	Rodriguez-Pose and Crescenzi (2008)

Source: Own elaboration.

4 Empirical results

4.1. Descriptive analysis

There is a concentration of firms around relatively low values of sales per employee, with an average of 50801 euros/year. The same applies to Gross Value Added per employee, a measure of firm performance used in our econometric model, whose average value stands at 10604 euros/year.

The clothing and textile industries have a high weight in the municipalities under analysis, so we joined these two categories into a single industry, while the remaining cases are treated together (other industries). In the total of the four municipalities (see Table A3 in Appendix), 64.5% of the firms belong to the clothing and textile industries. In the municipalities of Fafe and Vizela, the percentage of firms in this industry is high (72.7% and 63.5%, respectively). The importance of this industry is much lower in Vieira do Minho ('only' 25.0%), when compared to the other municipalities.

Regarding the human capital of firms located in the municipalities studied, we found that the percentage of employees with higher education (Undergraduate, Master or PhD) is relatively low - on average, only 3.2% of employees in enterprises located in these municipalities has an undergraduate degree or higher, being particularly low in Vieira do Minho (1.1%). The weight of employees engaged in R&D is even lower for the municipalities as a whole (0.8%).

In relation to types of innovations, we found that approximately half (51.0%) of the firms stated they have implemented innovations to support process activities, where innovation in manufacture or production methods is the most significant (47.9%). On average, only 19.3% of the firms innovate in logistics, delivery or distribution.

Concerning the collaboration of firms by type of innovation, we classified the five types of innovation mentioned above into two major groups, product innovation and process innovation. In all the municipalities, there is a small percentage of firms that collaborate with other firms or institutions, where the implementation of innovations is carried out primarily by the firm or the group to which it belongs. In fact, in the four municipalities, the development of product innovations is mainly conducted by the firm or the group to which it belongs (83.4%) and a low percentage by the firm in cooperation with other firms or institutions (16.0%), with only 0.6% occurring in other enterprises or institutions. The same is true for the development of process innovations, because only 13.2% of the firms cooperate with other firms or institutions, whereas 5.4% of the firms indicate that these innovations are mainly developed by other firms or institutions.

Finally, it appears that firms in all the municipalities spend more on the purchase of machinery, equipment and software. In fact, the weight of this spending in sales is 5.7% for all municipalities, although Fafe and Póvoa de Lanhoso present a slightly higher figure (6.6%). In contrast, the acquisition of other external knowledge has little or no relevance in these municipalities.

The main information and knowledge sources for innovation activities used by firms in these municipalities are (see Table A4 in Appendix): the firm itself, customers and suppliers. In contrast, the least used information sources are universities or other higher education institutions and state laboratories or other public organizations with R&D activities. Specifically, about 70% of the surveyed firms use their own firm (or group of firms) and customers to obtain information/knowledge, and in these cases, more than 80% consider these sources as highly relevant to their activities - these two groups shared a pole position on the most relevant source of information for the surveyed firms.

The external sources of information that require some pro-activity and organizational complexity by firms – e.g., universities and other higher education institutions - are barely used (only 4.6% of the

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surveyed firms admit to their use, and from these, only half consider this source as very important for the development of their activities, with only 8.3% regarding it as the most important source).

In addition to resources and importance of knowledge sources, it is critical to assess the respective location (Table A5 in Appendix), especially if they belong to the municipality in analysis or to Vale do Ave except the municipality, outside Vale do Ave or outside the country. This feature allows us to assess the potential existence of geographical knowledge spillovers.

According to the data collected, almost all the firms and groups of firms that constitute an information and knowledge source relevant to the firm's innovation activities during the period 2006-2008, are located in the same municipality of the reference firm (the surveyed firm). Similarly, but to a lesser extent, competitors or other firms in the same industry are located near the firm of reference - or in the municipality or in other municipalities of Vale do Ave. Customers, suppliers and professional and business associations seen as relevant to the firm's innovation activities are located primarily in Vale do Ave (except the municipality where the firm is located) or outside Vale do Ave.

Universities or other higher education institutions and state laboratories or other public institutions with R&D activities that are relevant to the activities of the firms analyzed are located mainly outside Vale do Ave, but inside the country. Foreign entities seem to be considered important only for a minority of firms, involving clients/consumers (36.5%), equipment suppliers and related (16.9%), consultants, laboratories or private R&D institutions (10.0%) and competitors or other firms in the same industry (6.1%).

These data seem to indicate that the surveyed firms generally fail to perform prospection and to use information and knowledge sources for innovation outside their restricted scope of location and/or action.

Based on a correlation analysis (Table A6 in Appendix), in terms of knowledge spillovers, sources located at greater geographical distance from the firm (outside Vale do Ave and outside the country), reveal a closer relation with the firm's economic performance. In other words, on average, firms that recognize that the most critical information and knowledge sources for their innovation activities are located outside Vale do Ave and especially outside the country, are those that have higher levels of productivity. Still regarding spillovers, the importance of firms in the same sector of activity that innovate in product or process in Vale do Ave also seems to be related to the highest economic benefits for the firms themselves; we found particularly that a larger number of firms in the same industry in Vale do Ave that innovate tend, on average, to be correlated with better firm performance.

Furthermore, the use of universities and other higher education institutions and suppliers as sources of knowledge for innovation activities emerge as positively associated with better performance in firms of these depressed municipalities of Vale do Ave.

We also found that innovation (in its different dimensions) appears associated with good economic performance. Thus, a higher number of different types of innovation (e.g., new goods, new services) are associated with higher economic performance, measured by Gross Value Added per worker. Additionally, collaboration with other firms or institutions in the development of product and process innovations appears correlated with firms that have higher productivity.

In relation to firm characteristics, we observed a negative correlation of Gross Value Added per worker with industry. This means that firms belonging to the textile and clothing industry have, on average, lower productivity than their counterparts in other industries. We also concluded that firm size (total number of employees) and, in particular, the respective human capital (weight of employees with higher education in total number of employees) is positively correlated with firm performance, showing that larger firms with higher levels of qualification/education are more productive.

Finally, regarding correlations between independent variables, it is crucial to note that there is a strong correlation between the Innovation Index and collaboration in terms of the development of

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product and process innovations, such as between the location of sources in the municipality itself and Vale do Ave (except the municipality itself). Also, there is a high correlation between the industry dummy variable and the ratio of firms that innovate in product or process by industry in Vale do Ave.[101]

4.2 Results of the econometric estimation

Given the strong correlation between the Innovation Index and the proxy variables of collaboration in the development of product and process innovations, as well as between the location of sources of knowledge and information for innovation activities from the firm's municipality and in Vale do Ave except the municipality, we decided it would be appropriate to estimate four different models (see Table 4). Thus, Model 1 includes collaborations in terms of product and process innovations and Model 2 considers the innovation index. These two models comprise the knowledge sources located in Vale do Ave except the municipality. Models 3 and 4 are similar to Models 1 and 2 but include knowledge sources located in the firm's municipality rather than in Vale do Ave except the municipality.

The estimation (via method of ordinary least squares) of the four models (see Table 4), produced similar results, with an acceptable quality of adjustment (cf. adjusted R^2).

Taking into account standard significance levels (1%, 5% and 10%), we found that knowledge spillovers associated with geography, measured in this study by the location of sources of knowledge, emerge with huge importance. Thus, knowledge sources located in the firm's municipality (Models 3 and 4) and located in Vale do Ave except the municipality are statistically significant and negative. Firms that have a greater number of sources of knowledge for innovation activities located in their municipality or Vale do Ave except their municipality tend to observe, *ceteris paribus*, a lower level of productivity. In contrast, firms with a greater number of knowledge sources for innovation activities outside Vale do Ave, and especially abroad, emerge as, *ceteris paribus*, more productive.

Table 4: Results of the econometric estimation

Group of variables		Proxies	Model 1	Model 2	Model 3	Model 4
Knowledge Spillovers	Number of knowledge sources (in ln) located	in the municipality			-0.464**	-0,435**
		in Vale do Ave except the municipality	-0.572***	-0.531***		
		outside Vale do Ave	0.332*	0.359*	0.315	0,342*
		outside the country	0.410*	0.441*	0.463**	0,491**
	Pool of knowledge and innovation	Ratio of firms that innovate in product or process by industry in Vale do Ave	1.255*	1.340**	1.093*	1,187*
Contacts (index in ln)		Importance of Universities	0,178	0.194	0.134	0.153
		Importance of suppliers	0,176	0.169	0.111	0.11
		Importance of consultants and private R&D institutions	-0,122	-0.117	-0.145	-0.14
Implementation of innovation activities		Innovation Index (in ln)	0,423***		0.379***	
Collaborations		in product innovation (in ln)		0.164		0.163
		in process innovation (in ln)		0.343		0.271
Obtaining and production of knowledge		Ratio of internal R&D by sales	-0,145	0.255	-0.164	0.225
		Ratio of external R&D by sales	10,186	15.483	0.673	6.285

101 Therefore, due to a potential problem of multicollinearity, it is not advisable to put these two variables in the same model. We decided to exclude the industry dummy variable from the results presented in the main text and keep the variable used as a proxy for spillovers in our econometric estimation. The results of econometric estimation without the variable pool of knowledge and innovation and with the industry variable can be consulted in the Appendix (see Tables A7-A8) and did not differ widely from the results presented in this section.

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	Ratio of acquisition of machinery, equipment and software by sales	-0,649	-0.535	-0.654	-0.542
	Ratio of acquisition of other external knowledge by sales	10,072	12.491	7.559	9.967
Firm characteristics	Dimension (total number of employees in ln)	0,216***	0.237***	0.207***	0.226***
	Human Capital (ratio of the number of employees with higher education in the total number of employees)	3,154**	2.984**	3.449***	3.305***
Municipality characteristic	Development level (Purchasing Power Index in ln)	-0,08	-0.061	0.183	0.201
	Constant	7,168	7.114	6.177	6.127
	N	257	257	257	257
	Adjusted R^2	0,203	0.185	0.192	0.175

Note: statistically significant at: * 10% , ** 5% , *** 1%.

In this context, inter-regional knowledge spillovers and particularly international ones emerge as crucial for firms located in depressed regions, in particular, those located in the relatively underdeveloped municipalities of Vale do Ave. Still on the spillovers proxy, associated with the pool of knowledge and innovation of firms in the region belonging to the same industry, it emerges as a key determinant of productivity. In other words, the intra-industry innovation environment associated with firms located in the Vale do Ave region influences positively and significantly the firm's performance. To that extent, the presence of innovative firms in the same industry seems to be critical for firms located in depressed areas – it is here that the importance of intra-industry spillovers resides.

Notwithstanding, the most innovative firms (cf. Models 1 and 3) present, *ceteris paribus*, higher levels of productivity. Firms that show higher levels of collaboration for innovation (product and process) did not emerge as significantly different from other firms. This result is most probably associated with the fact that the main key issue here is not so much the collaboration type, as we measured, but its frequency.

We concluded, finally, that firm size (total number of employees) and the respective human capital (weight of employees with higher education) are positive and statistically significant variables in the four models. Thus, *ceteris paribus*, on average, larger firms and with higher levels of human capital emerge as more productive (with higher levels of Gross Value Added per worker).

5 Conclusions

This study analyzed the importance of knowledge spillovers for the economic performance of firms in a region in Northern Portugal, Vale do Ave, focusing particularly on four municipalities in the region - Fafe, Póvoa de Lanhoso, Vieira do Minho and Vizela - identified as economically depressed areas.

We concluded that geographical proximity does not seem to be an important aspect for the performance of firms in these municipalities. According to the results, municipal and intra-regional knowledge spillovers lead to lower performance levels in the firms of these municipalities. In contrast, contacts with knowledge sources outside Vale do Ave (inter-regional spillovers) and outside the country (international spillovers) appeared as significant for the performance of these firms, having a positive and significant effect. This finding seems to contrast with the results conveyed by the studies that focus on more developed areas, including regions of Germany (Funke and Niebuhr, 2005) and the EU (Rodríguez-Pose and Crescenzi, 2008), which concluded that the effects of spillovers on the growth of these regions diminish with distance.

Regarding the studies on firms located in peripheral areas, Natario et al. (2012) concluded, contrary to our study, that the scope of activity of these firms is local, regional or national, rather than

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international. However, Fitjar and Rodríguez-Pose (2011), who analyzed firms in peripheral areas of Norway, show that international sources play a key role in the innovation performance of firms. In this latter case, geographical proximity does not emerge as particularly important, being the organizational and cognitive proximity critical to business innovation. In the same line, Amin and Cohendat (2000) reported that relative proximity to organizational routines is more important than geographical proximity.

Our study, concluding that inter-regional and international spillovers are crucial for firms in these depressed municipalities of Vale do Ave, seems to show, in line with recent studies, that geographical proximity is not the critical dimension of the firms' economic performance. This result suggests that other types of proximity beyond the geographical are more important for these firms, such as routines in organizational innovation, as Boschma (2005) pointed out.

Still in relation to knowledge spillovers, the innovations developed by other firms also emerged as relevant to the performance of a given firm. We found that the intra-industry innovative environment in Vale do Ave, identified by the pool of knowledge and innovation (measured by the relative weight of firms that innovate in product or process in Vale do Ave by industry), significantly influences the economic performance of a particular firm in these municipalities. These results are in line with Faria and Lima (2012), who demonstrated that, also for a number of Portuguese firms, the percentage of firms involved in innovation activities influences the performance of other firms.

In relation to aspects associated with innovation, the most innovative firms, which implement different types of product and process innovation, are also associated with a higher performance.

With respect to the characteristics of firms, the results show that the employees' qualifications are also important, and that firms with a higher percentage of skilled employees have a better performance. Additionally, innovation activities developed in these firms, as well as the contacts made with inter-regional and international sources of knowledge in the years from 2006 to 2008, were found to positively influenced the firm's performance, as measured by Gross Value Added per employee in the triennium from 2009 to 2011. This evidence confirms the relevance of the phenomenon of path dependency, as supported by evolutionary economic geography (Boschma and Frenken, 2006).

In terms of economic policy, the results highlight that it is crucial to promote policies that encourage businesses, particularly in depressed areas, to develop innovations, but especially given the positive effect of inter-regional and international spillovers, to establish contacts with sources from other regions, particularly at the international level. These international contacts are relevant to the economic performance of a firm, in particular the contacts established with clients, suppliers of equipment, materials, components or software and consultants, laboratories or private R&D institutions, which correspond to the most used knowledge and information sources for innovation activities at international level by the firms in these depressed areas.

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Appendix

Table A1: Firms (% of total) by sector of activity in the manufacturing industry, 2009

Manufacturing industries	Fafe	Póvoa de Lanhoso	Vieira do Minho	Vizela
Manufacture of food products	3.0	8.3	8.0	3.3
Manufacture of beverages	1.0	1.7	2.0	0.5
Manufacture of textiles	12.6	5.8	2.0	29.9
Manufacture of wearing apparel	58.6	38.2	32.0	33.7
Manufacture of leather and related products	3.0	0.8	0.0	11.2

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Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	4.6	9.5	12.0	2.2
Manufacture of paper and paper products	0.6	0.4	0.0	3.3
Printing and reproduction of recorded media	0.9	3.7	0.0	2.7
Manufacture of chemicals, chemical products and man-made fibres, except pharmaceutical products	0.5	1.7	0.0	0.5
Manufacture of rubber and plastic products	0.0	0.4	2.0	0.3
Manufacture of other non-metallic mineral products	2.6	3.3	4.0	2.2
Manufacture of basic metals	0.4	0.8	0.0	0.0
Manufacture of fabricated metal products, except machinery and equipment	7.6	11.6	36.0	6.0
Manufacture of computer, communication equipment, electronic and optical products	0.1	0.0	0.0	0.0
Manufacture of machinery and equipment n.e.c.	1.4	0.4	0.0	0.3
Manufacture of furniture	1.1	2.1	0.0	1.4
Other manufacturing activities	1.2	11.2	2.0	0.5
Repair, maintenance and installation of machinery and equipment	0.7	0.0	0.0	1.9
Total (number)	801	241	50	365

Source: INE (2011b).

Table A2: Sample representativeness

	Population								Sample				Answers			
	Fafe		Póvoa de Lanhoso		Vieira do Minho		Vizela		Fafe	Póvoa de Lanhoso	Vieira do Minho	Vizela	Fafe	Póvoa de Lanhoso	Vieira do Minho	Vizela
Manufacturing industries	**Nº**	**%**	**Nº**	**%**	**Nº**	**%**	**Nº**	**%**	**Nº**	**Nº**	**Nº**	**Nº**	**Nº**	**Nº**	**Nº**	**Nº**
Manufacture of food products	24	3.0	20	8.3	4	8.0	12	3.3	5	4	1	2	1	4	1	2
Manufacture of beverages	8	1.0	4	1.7	1	2.0	2	0.5	2	1	0	0	1	1	0	0
Manufacture of textiles	101	12.6	14	5.8	1	2.0	109	29.9	21	3	0	22	18	3	0	22
Manufacture of wearing apparel	469	58.6	92	38.2	16	32.0	123	33.7	97	19	3	25	78	19	2	25
Manufacture of leather and related products	24	3.0	2	0.8	0	0.0	41	11.2	5	0	0	8	5	0	0	9
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	37	4.6	23	9.5	6	12.0	8	2.2	8	5	1	2	7	3	2	2
Manufacture of paper and paper products	5	0.6	1	0.4	0	0.0	12	3.3	1	0	0	2	1	0	0	2
Printing and reproduction of recorded media	7	0.9	9	3.7	0	0.0	10	2.7	1	2	0	2	2	2	0	2
Manufacture of chemicals, chemical products and man-made fibres, except pharmaceutical products	4	0.5	4	1.7	0	0.0	2	0.5	1	1	0	0	1	1	0	0
Manufacture of rubber and plastic products	0	0.0	1	0.4	1	2.0	1	0.3	0	0	0	0	0	0	0	0
Manufacture of other non-metallic mineral products	21	2.6	8	3.3	2	4.0	8	2.2	4	2	0	2	4	2	0	3
Manufacture of basic metals	3	0.4	2	0.8	0	0.0	0	0.0	1	0	0	0	2	0	0	0

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Manufacture of fabricated metal products, except machinery and equipment	61	7.6	28	11.6	18	36.0	22	6.0	13	6	4	5	6	6	3	5
Manufacture of computer, communication equipment, electronic and optical products	1	0.1	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0	0	0
Manufacture of machinery and equipment n.e.c.	11	1.4	1	0.4	0	0.0	1	0.3	2	0	0	0	3	0	0	0
Manufacture of furniture	9	1.1	5	2.1	0	0.0	5	1.4	2	1	0	1	2	1	0	1
Other manufacturing activities	10	1.2	27	11.2	1	2.0	2	0.5	2	6	0	0	0	3	0	0
Repair, maintenance and installation of machinery and equipment	6	0.7	0	0.0	0	0.0	7	1.9	1	0	0	1	1	0	0	1
Total	**801**	**100**	**241**	**100**	**50**	**100**	**365**	**100**	**165**	**50**	**10**	**75**	**132**	**45**	**8**	**74**

Source: Own elaboration.

Table A3: Values of relevant variables in the model, by municipality and overall (%)

	Fafe (N=132)	Póvoa de Lanhoso (N=45)	Vieira do Minho (N=8)	Vizela (N=74)	Total of the four municipalities
Firms that belong to textile and clothing industry	72.7	48.9	25.0	63.5	64.5
Ratio of employees with higher education in total number of employees	3.5	5.2	1.1	1.7	3.2
Ratio of employees engaged in R&D in total number of employees	0.7	1.2	0.0	0.8	0.8
Firms that innovate in goods	36.4	51.1	50.0	48.6	42.9
Firms that innovate in services	50.8	40.0	37.5	40.5	45.6
Firms that innovate in manufacturing or production methods	48.5	48.9	50.0	45.9	47.9
Firms that innovate in logistics, delivery or distribution methods	20.5	20.0	12.5	17.6	19.3
Firms that innovate in support activities to processes	48.5	51.1	50.0	55.4	51.0
Collaboration in product innovations:					
Primarily the firm or the group to which it belongs	84.1	77.4	83.3	86.0	83.4
Firm in cooperation with other firms or institutions	15.9	19.4	16.7	14.0	16.0
Primarily other enterprises or institutions	0.0	3.2	0.0	0.0	0.6
Collaboration in process innovations:					
Primarily the firm or the group to which it belongs	81.2	79.3	100.0	81.3	81.4
Firm in cooperation with other firms or institutions	15.3	13.8	0.0	10.4	13.2
Primarily other enterprises or institutions	3.5	6.9	0.0	8.3	5.4
Ratio of R&D activities undertaken inside the firm by sales	0.2	0.3	0.0	0.4	0.3
Ratio of acquisition of external R&D by sales	0.0	0.1	0.0	0.0	0.0
Ratio of acquisition of machinery, equipment and software by sales	6.6	6.6	5.0	3.7	5.7
Ratio of acquisition of other external knowledge by sales	0.1	0.0	0.0	0.0	0.0

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Table A 4: Use and importance of knowledge sources for the firm's innovation activities (for new innovation projects or for their conclusion) in the period from 2006 to 2008

	Firms that use the source (%)	Firms that attribute high importance to the source (%)	Firms that classify the source in the first place (%)
Inside the firm or other firms in the same group	70.7	85.9	51.9
Suppliers of equipment, materials, components or software	56.8	63.9	6.1
Clients or customers	70.3	86.3	53.6
Competitors or other firms in the same sector of activity	25.5	28.8	3.0
Consultants, laboratories or private R&D institutions	18.9	70.0	2.0
Universities and other institutions of higher education	4.6	50.0	8.3
State laboratories or other public institutions with R&D activities	0.8	0.0	0.0
Professional or business associations	29.7	22.4	1.4
Conferences, fairs, exhibitions	46.3	58.3	5.0
Scientific journals and technical, professional and commercial publications	16.2	16.3	0.0

Table A5: Location of knowledge and information sources for the firm's innovation activities (for new innovation projects or for their conclusion) in the period from 2006 to 2008

	Location			
	Municipality (%)	Vale do Ave except municipality (%)	Outside Vale do Ave (%)	Outside the country (%)
Inside the firm or other firms in the same group	98,9	1,1	0,5	0,0
Suppliers of equipment, materials, components or software	29,7	65,5	62,8	16,9
Clients or customers	39,2	61,3	59,1	36,5
Competitors or other firms in the same sector of activity	66,7	63,6	25,8	6,1
Consultants, laboratories or private institutions of R&D	12,0	60,0	38,0	10,0
Universities and other institutions of higher education	8,3	33,3	58,3	0,0
State laboratories or other public institutions with activities of R&D	33,3	33,3	66,7	0,0
Professional or business associations	18,8	40,0	48,6	0,0

Note: Each firm surveyed could choose more than one answer option, hence percentages do not add up to 100%.

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Table A6: Correlations between relevant variables in the model

Group of variables		Proxies	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Performance		1. Productivity (ratio of Gross Value Added per worker in ln)	1	0.040	0.035	0.228**	0.254**	0.171**	0.160*	0.131*	0.002	0.277**	0.163**	0.217**	0.089	0.079	0.062	0.055	0.200**	0.289**	0.269**	0.018
Knowledge Spillovers	Number of knowledge sources (in ln) located	2. in the municipality		1	0.615**	0.486**	0.122	-0.061	0.109	0.464**	0.262**	0.257**	0.297**	0.132*	0.068	0.061	0.155*	0.044	0.044	0.034	0.052	0.030
		3. in Vale do Ave except the municipality			1	0.494**	0.103	0.027	0.127*	0.495**	0.260**	0.335**	0.322**	0.229**	0.080	0.141*	0.128*	0.099	0.077	0.083	0.029	-0.019
		4. outside Vale do Ave				1	0.287**	0.049	0.289**	0.494**	0.156*	0.352**	0.304**	0.265**	0.125*	0.201**	0.077	0.048	-0.123*	0.238**	0.184**	0.019
		5. outside the country					1	-0.008	0.120	0.228**	0.194**	0.244**	0.170**	0.191**	0.094	0.143*	0.032	-0.041	0.013	0.336**	0.087	-0.007
	Pool of knowledge and innovation	6. Ratio of firms that innovate in product or process by industry in Vale do Ave						1	0.012	0.071	-0.096	0.123*	0.119	0.129*	0.050	0.050	-0.007	-0.045	-0.630**	-0.073	0.237**	-0.135*
Contacts (index in ln)		7. Importance of Universities							1	0.087	0.012	0.177**	0.180**	0.169**	0.120	0.036	0.045	-0.013	-0.068	0.132*	0.327**	-0.094
		8. Importance of suppliers								1	0.024	0.221**	0.181**	0.166**	0.096	0.078	0.058	0.077	-0.108	0.128*	0.086	0.026
		9. Importance of consultants and private institutions of R&D									1	0.178**	0.198**	0.110	0.085	0.184**	-0.017	0.073	0.140*	0.172**	-0.064	0.012
Implementation of innovation activities		10. Innovation Index (in ln)										1	0.779**	0.751**	0.135*	0.155*	0.100	0.101	-0.053	0.232**	0.142*	0.000
Collaborations		11. Collaborations in product innovation (in ln)											1	0.454**	0.088	0.103	0.029	0.053	-0.061	0.164**	0.113	-0.041
		12. Collaborations in process innovation (in ln)												1	0.110	0.099	0.087	0.056	-0.054	0.132*	0.222**	0.014
Obtaining and production of knowledge		13. Ratio of internal R&D by sales													1	0.022	-0.027	-0.008	0.015	0.134*	0.122	0.007
		14. Ratio of external R&D by sales														1	-0.029	0.026	-0.056	0.079	0.020	-0.051
		15. Ratio of acquisition of machinery, equipment and software by sales															1	-0.032	-0.007	-0.124*	0.037	-0.039
		16. Ratio of acquisition of other external knowledge by sales																1	0.056	0.011	0.076	0.032
Firm characteristics		17. Industry (0 if is other industries, 1 if is clothing and textile industries)																	1	0.138*	-0.214**	0.200**
		18. Dimension (total number of employees in ln)																		1	0.070	0.048
		19. Human Capital (ratio of the number of employees with higher education in the total number of employees)																			1	-0.098
Municipality characteristic		20. Development level (Index of Purchasing Power in ln)																				1

Note: statistically significant at: * 5%, ** 1%. N=257.

Table A7: Results without the variable pool of knowledge and innovation

Group of variables	Proxies	Model 1	Model 2	Model 3	Model 4
Knowledge Spillovers	Number of knowledge sources (in ln) located in the municipality			-0,478**	-0,453**
	Number of knowledge sources (in ln) located in Vale do Ave except the municipality	-0,557***	-0,515***		
	Number of knowledge sources (in ln) located outside Vale do Ave	0,344*	0,371*	0,340*	0,370*
	Number of knowledge sources (in ln) located outside the country	0,385*	0,418*	0,431*	0,461**
Contacts (index in ln)	Importance of Universities	0,032	0,037	-0,01	-0,002
	Importance of suppliers	0,155	0,147	0,097	0,097
	Importance of consultants and private institutions of R&D	-0,176	-0,179	-0,184	-0,184
Implementation of innovation activities	Innovation Index (in ln)	0,465***		0,419***	
Colaborations	in product innovation (in ln)		0,218		0,219
	in process innovation (in ln)		0,363		0,287
Obtaining and production of knowledge	Ratio of internal R&D by sales	0,253	0,723	0,187	0,648
	Ratio of external R&D by sales	13,495	19,69	2,948	9,434
	Ratio of acquisition of machinery, equipment and software by sales	-0,727	-0,603	-0,72	-0,594
	Ratio of acquisition of other external knowledge by sales	7,56	10,051	5,249	7,712
Firm characteristics	Dimension (total number of employees in ln)	0,210***	0,231***	0,201***	0,221***
	Human Capital (ratio of the number of employees with higher education in the total number of employees)	4,168***	4,047***	4,411***	4,317***
Municipality characteristic	Development level (Index of Purchasing Power in ln)	-0,297	-0,279	-0,018	-0,001
	Constant	8,305	8,27	7,222	7,195
	N	259	259	259	259
	Adjusted R^2	0,205	0,184	0,197	0,178

Note: statistically significant at: * 10% , ** 5% , *** 1%.

Table A8: Results without the variable pool of knowledge and innovation and with the variable industry

Group of variables	Proxies	Model 1	Model 2	Model 3	Model 4
Knowledge Spillovers	Number of knowledge sources (in ln) located in the municipality			-0,408**	-0,377*
	Number of knowledge sources (in ln) located in Vale do Ave except the municipality	-0,465**	-0,419**		
	Number of knowledge sources (in ln) located outside Vale do Ave	0,268	0,291	0,264	0,29
	Number of knowledge sources (in ln) located outside the country	0,411*	0,442*	0,450**	0,477**
Contacts (index in ln)	Importance of Universities	0,068	0,078	0,037	0,049
	Importance of suppliers	0,093	0,083	0,046	0,044
	Importance of consultants and private institutions of R&D	-0,133	-0,131	-0,132	-0,128
Implementation of innovation activities	Innovation Index (in ln)	0,435***		0,396***	
Colaborations	in product innovation (in ln)		0,17		0,171
	in process innovation (in ln)		0,358		0,295
Obtaining and production of	Ratio of internal R&D by sales	0,582	1,031	0,551	0,989

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knowledge	Ratio of external R&D by sales	8,088	13,539	-1,229	4,755
	Ratio of acquisition of machinery, equipment and software by sales	-0,664	-0,55	-0,647	-0,534
	Ratio of acquisition of other external knowledge by sales	10,011	12,454	8,269	10,706
Firm characteristics	Industry (0 if is other industries, 1 if is clothing and textile industries)	-0,454**	-0,476***	-0,488***	-0,504***
	Dimension (total number of employees in ln)	0,242***	0,264***	0,237***	0,258***
	Human Capital (ratio of the number of employees with higher education in the total number of employees)	3,586***	3,436***	3,742***	3,618***
Municipality characteristic	Development level (Index of Purchasing Power in ln)	0,543	0,587	0,839	0,865
	Constant	5,072	4,946	3,932	3,873
	N	259	259	259	259
	Adjusted R^2	0,223	0,204	0,218	0,201

Note: statistically significant at: * 10% , ** 5% , *** 1%.

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AN EXPLORATORY SPATIAL ANALYSIS ABOUT THE SPATIAL DISTRIBUTION OF ECONOMIC ACTIVITIES IN PORTUGAL

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Abstract. Economic activities are not distributed evenly throughout the territory. As such, the geographical concentration of economic activities has aroused a great interest in the academic community, following many famous examples of Silicon Valley (California), Route 128 (Boston), Cambridge (UK), the federal state of Baden Wurttemberg (Germany), among others. Since the early contributions of (Thunen, 1826) about the location of agricultural activities around the preindustrial city, many authors have been seeking to describe the factors that determine the distribution of economic activities in the territory. In the early 90s, Michael Porter carried out on behalf of the Portuguese government, a study on the Portuguese economy which identified six priority industry clusters in traditional sectors: wine, tourism, automobile, footwear, textiles, wood and cork (M. Porter, 1994). In 2001, the thematic of clusters was recalled, through the government initiative PROINOVA - Integrated Program to Support Innovation, designed to support the development of innovation clusters in key areas. Currently, the program COMPETE - Operational Program Thematic Factors of Competitiveness (2007-2013) mentions within its Collective Efficiency Strategy the existence of poles of competitiveness and technology and other clusters such as energy, health or agro industrial (Compete, 2009). Given the importance of this matter, taken as a priority in terms of economic development policies, the aim of this paper is to measure and describe the spatial distribution pattern of the main sectors of economic activity in Portugal. For this we follow the methodology of (Guillain & Le Gallo, 2007), combining the locational Gini index with an Exploratory Spatial Data Analysis, applied to the employment data by sector and by municipalities in 2009 and 2010. This approach has the advantage of introducing a spatial dimension to the usual measures of concentration, thus seeking to determine the location pattern of each sector of activity and measure spatial correlation (Guillain & Le Gallo, 2007).

Keywords: Agglomeration, Exploratory Spatial Data Analysis, Locational Gini index, Portuguese municipalities

1. INTRODUCTION

Economic activities are not distributed evenly throughout the territory. Be that at regional, national or intercontinental level, the history of human civilizations shows that communities, through extensive migrations have concentrated increasingly on certain areas which currently represent a small proportion of the total surface of the planet. According to Eurostat data and the latest survey LUCAS (Land Use Cover Area frame Survey, March 2011), the areas designated for residential, commercial and industrial purposes, including infrastructures, occupy only 11% of the total area of Europe at 27 (except Bulgaria, Cyprus, Malta and Romania). As it can be seen in Figure 1, these occupancy rates vary considerably from region to region (NUTS II), with variation of up to 90% in Inner London or below 5% in Iberian Peninsula or northern Europe. The soil, with its environmental, productive and supportive functions, assumes a central role in ecosystems and biodiversity conservation and is a fundamental resource for economic activities. The distribution of different land uses is influenced by numerous biological, geographical and socioeconomic factors and largely determines their occupation through a constant and mutual interaction.

The geographical concentration of economic activities has aroused a great interest in the academic community, following many famous examples like Silicon Valley (California), Route 128 (Boston), Cambridge (UK), the federal state of Baden Wurttemberg (Germany), among others. Since the early

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contributions of (Thunen, 1826) about the location of agricultural activities around the preindustrial city, many authors have been seeking to describe the factors that determine the distribution of economic activities across the territory. Alfred Marshall opposing the Fordism production model describes an alternative model called the industrial district. The industrial district is defined as a production system, geographically limited, and based on an intense division of labor between small and medium sized enterprises within the same industrial sector (Marshall, 1919). According to Paul Krugman, considered the father of the New Economic Geography, agglomeration of firms in a restricted area of the territory arises from the interaction between economies of scale, transport costs and the difference in labor costs between sectors ("Home Market Effect ") in a circular process with positive feedback effects ((Krugman, 1980), (Krugman, 1991)). The cluster concept, another expression for economic agglomeration popularized by the work of Michael Porter, can be defined as a network of interdependent companies and institutions, geographically close to each other and linked together through trades, technologies and common know-how (M. E. Porter, 1998).

In the early 90s, Michael Porter carried out on behalf of the Portuguese government, a study on the Portuguese economy which identified seven priority industry clusters in traditional sectors: wine, tourism, automobile, footwear, textiles, wood and cork (M. Porter, 1994). In 2001, the thematic of clusters was recalled, through the government initiative PROINOVA - Integrated Program to Support Innovation, designed to support the development of innovation clusters in key areas (Choringas, 2009). In this context, the program identified seven mega clusters: food, habitat, fashion, leisure, mobility, health and personal services, and information and entertainment, and three clusters: footwear, automobile and Software (Choringas, 2009). Like the Porter report, also PROINOV was abandoned prematurely. Currently, the program COMPETE - Operational Program Thematic Factors of Competitiveness (2007-2013) mentions within its Collective Efficiency Strategy the existence of poles of competitiveness and technology and other clusters such as energy, health or agro industrial (Compete, 2009).

Given the importance of this matter, taken as a priority in terms of economic development policies, the aim of this paper is to measure and describe the spatial distribution pattern of the main sectors of economic activity in Portugal. For this we follow the methodology of (Guillain & Le Gallo, 2007), combining the locational Gini index with an Exploratory Spatial Data Analysis, applied to the employment data by sector and by municipalities in 2009 and 2010. This approach has the advantage of introducing a spatial dimension to the usual measures of concentration, thus seeking to determine the location pattern of each sector of activity and measure spatial correlation (Guillain & Le Gallo, 2007).

Our paper is divided as follows: in the next section, we describe the data and methodology used to estimate the pattern of concentration and location of different sectors of economic activity. The main results are presented in the third section and section 4 concludes with some final comments.

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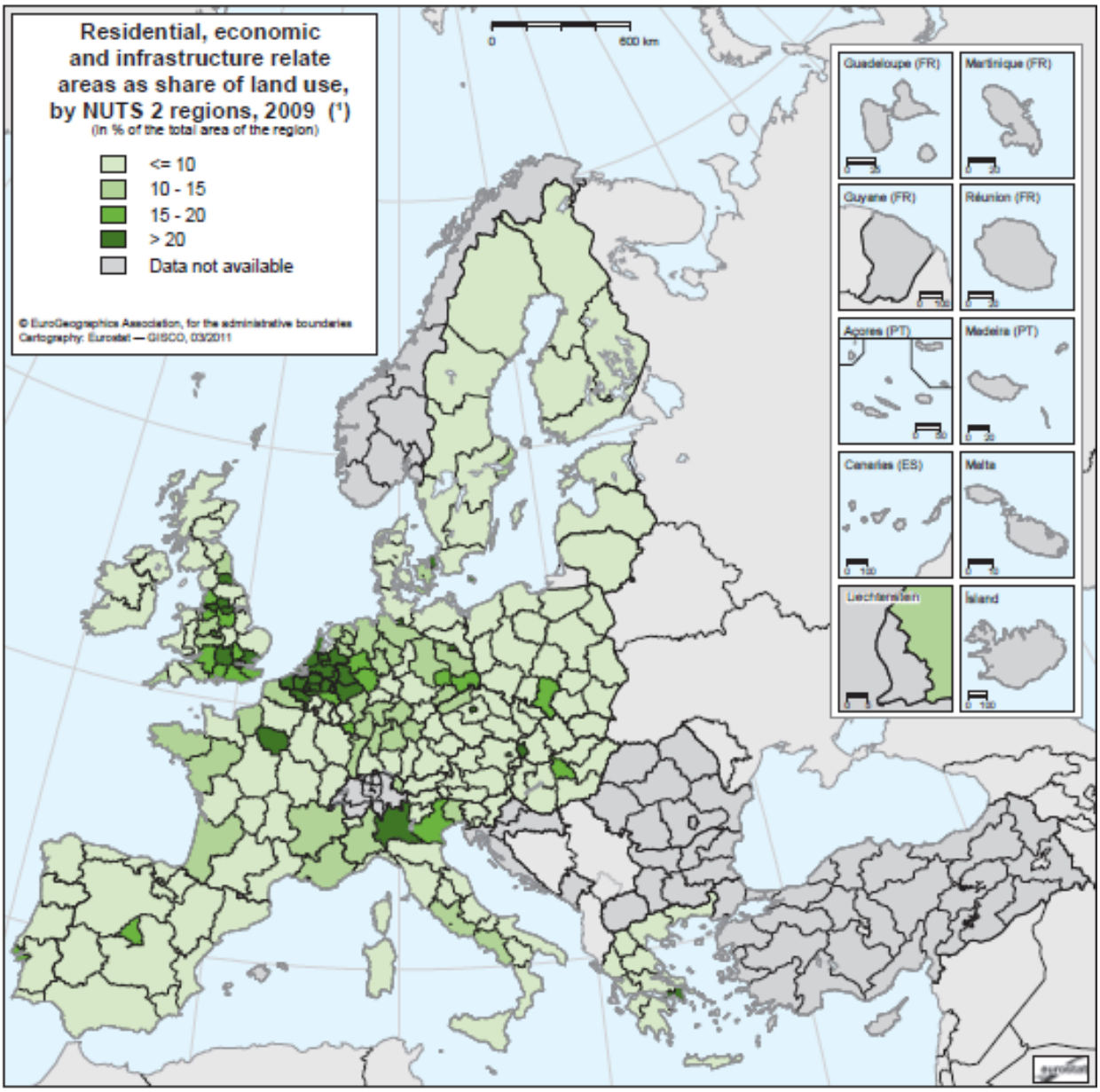

(¹) Bulgaria, Cyprus, Malta and Romania were not included in the LUCAS 2009 survey.
Source: Eurostat (online data code: lan_lu_ovw)

Figure 1

2. METHODOLOGY AND DATA DESCRIPTION

It is not easy, nor is there consensus on the methodology to measure or assess empirically the effects of clustering of economic activities.[102] In this article, we seek to combine concentration measurements with the new tools of spatial econometrics, based on the methodology followed in (Guillain & Le Gallo, 2010). As a measure of concentration we use the locational Gini Coefficient whose expression is:

$$G_m = \frac{1}{4\bar{\mu}_x}\frac{1}{n(n-1)}\sum_{i=1}^{n}\sum_{j=1}^{n}|x_i - x_j| \qquad (1)$$

Where:

102 See for alternative methods: Ellison, G., & Glaeser, E. L. (1997). Geographic concentration in U.S. manufacturing industries: A dartboard approach. Journal of Political Economy, 105, 889-927.

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$G_{m,,}$ represents the locational Gini coefficient of economic sector m;

n, the numbers of municipalities;

$$x_{i(j)} = \frac{\text{Municipality i'(j') share of employment in sector m}}{\text{Municipality i'(j') share of total employment}}$$

And finally,

$$\bar{\mu}_x = \frac{\sum_{i=1}^{n} x_i}{n}$$

The locational Gini coefficient of a sector assumes a zero value when the distribution of the respective employment is uniform in all the municipalities. If the total employment in a sector of economic activity is concentrated in a single municipality the locational Gini coefficient takes the value 0.5. Although the locational Gini coefficient is a good indicator of the degree of concentration or dispersion of various sectors of economic activity, it tells us nothing, firstly, on the pattern of geographic distribution, and secondly on the specific location of possible clusters. That is, assuming that there is a phenomenon of concentration of handwork of a particular economic sector in some cities, it may be useful to know, first, if there is a specific pattern of distribution within these councils and secondly, considering the existence of agglomeration effects, where are these clusters.

Moran's I statistic seeks to answer the first question. It measures the relation between the normalized deviation of a variable at a specific location and the normalized deviation in neighboring geographic units for the same variable. Considering a row-standardized contiguity matrix (type queen) w, the Moran's I statistic is given by:

$$I_m = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(x_i-\bar{\mu}_x)(x_j-\bar{\mu}_x)}{\sum_{i=1}^{n}(x_i-\bar{\mu}_x)^2} \qquad \textbf{(2)}$$

The spatial weight matrix W is a matrix of contiguity matrix in which $w_{i,j} = 1$ if *i* and *j* are neighbors, $w_{i,j} = 0$, otherwise and $w_{i,i} = 0$, by convention. The Moran's I Statistic constitutes a measure of spatial autocorrelation for a given attribute, ranging from -1 to 1 like any other correlation index. A Moran's I Statistic close to zero (technically, close to -1 / (n-1)) indicates a random pattern. When above -1/(n-1) (toward +1), it indicates a tendency toward clustering and when below -1 / (n-1) (toward -1) it indicates a tendency toward dispersion.

The locational Gini coefficient and the Moran's I Statistic give us valuable indications on the tendency of economic sectors to concentrate and form clusters (Arbia, 2001). However, it tells us nothing about the spatial location of these specific manifestations of agglomeration. Thus, these global indexes if relevant can be an invitation to explore other local measures of agglomeration. The statistical LISA (Local Indicator of Spatial Association) decomposes the Moran's I Statistic in order to identify the individual contribution of each local site (in our case, each municipality). It measures for each geographical unit the spatial autocorrelation of the variable between this unit and all the neighboring units according to the criteria of the spatial weight matrix. The local version of Moran's I Statistic index for each municipality *i* is given by (Anselin, 1995):

$$\mathrm{I_i} = \frac{\sum_j \mathrm{w_{ij}}(\mathrm{x_i}-\bar{\mu}_\mathrm{x})(\mathrm{x_j}-\bar{\mu}_\mathrm{x})}{\sum_{\mathrm{i}=1}^{\mathrm{n}}(\mathrm{x_i}-\bar{\mu}_\mathrm{x})^2} \qquad \textbf{(3)}$$

Where notation j concerns only the neighboring values of municipalities i. As such, Local Indicators of Spatial Association (LISA) indicate the presence or absence of significant spatial clusters or outliers for each location. A randomization approach is used to generate a spatially random reference distribution to assess statistical significance with 999 permutations. The observation of the position of each municipality in the four quadrants of the Moran Scatterplot for each sector of economic activity allows the distinction of four different categories:

- Municipality with a high proportion of workforce in the sector m and positive autocorrelation with the neighborhood: type HH (high-high)

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- Municipality with a high proportion of workforce in the sector m and negative autocorrelation with the neighborhood: type HL (high-low)
- Municipality with low proportion of workforce in the sector m and positive autocorrelation with the neighborhood: type LL (low-low)
- Municipality with low proportion of workforce in the sector m and negative autocorrelation with the neighborhood: type LH (low-high)

The Moran Significance Map, unlike the Moran Map shows only those geographical units where the LISA is significant and identifies each with a color types. As part of our analysis, we are particularly interested in the types HH and HL, the first for her centrifugal dynamics and the second because of its shadow effect on the neighborhood.

The study area corresponds to the Portuguese continental territory. For this study we used data of workforce employed in enterprises according to the CAE-Rev.3 (Classification of Economic Activities) available in the Regional Statistical Yearbook of the National Statistics Institute (INE, IP, System Integrated Business Accounts) for the biennium 2009-2010, and disaggregated across the 284 municipalities of mainland Portugal. In a first level of aggregation, we studied the manufactory sector taken as a whole (sector C), the construction sector (sector F) and the tourism sector (sector I). In a second approach, we disaggregate the manufactory sector in various subsectors, namely: footwear (15), textiles and clothing (13 +14), wood, cork and furniture (16 +31), chemical and rubber (20 +21 +22 +23), metallurgy and basic metal products (24+25), automobile (29 +30 +33), food and beverages (10 +11) and machinery and equipment (26 +27 +28). These choices were strongly influenced by the availability of data which forces us to aggregate several related subsectors.

3. RESULTS AND DISCUSSION

Based on data for the eleven sectors and subsectors described above, we proceed with a first analysis of the first and more comprehensive measures of concentration and agglomeration, leaving for the second part the analysis of the existence of possible effects of local clusters.

Table 1 show for each of the sectors and subsectors the locational Gini index, the Moran's I Statistic and the respective rankings.[103] For the three global sectors (tourism, construction and manufacturing), we found lower concentration, which is natural taking into account its higher degree of aggregation. As for the Moran's I Statistic, we find that it is in the manufacturing sector that agglomeration effects are felt most, followed by tourism and construction. The case of tourism should be interpreted with caution since this tendency for aggregation of municipalities with higher proportion of workforce employed in tourism may have to do only with geographical and climatic factors rather than socio-economic dynamics. As for construction, and like other service sectors oriented to people, the phenomenon of agglomeration reflects mostly the population densities rather than sectorial dynamics.

Table 1

Activities	Gini	Ranking	Moran'I	Ranking
footwear	0,4729	1	0,2533	9
textiles and clothing	0,4075	2	0,5684	1
machinery and equipment	0,3978	3	0,2684	8
automobile	0,3740	4	0,1559	11
chemical and rubber	0,3164	5	0,3712	5
wood, cork and furniture	0,2876	6	0,2840	7
food and beverages	0,2645	7	0,2385	10
metallurgy and metal products	0,2296	8	0,4758	3
Tourism	0,1916	9	0,4641	4
Construction	0,1813	10	0,2963	6
Manufactory sector	0,1465	11	0,5595	2

103 All Moran's I Statistic proved highly significant.

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Looking now to the various sub-sectors of the manufacturing sector, and crossing the locational Gini index and the Moran's I Statistic, we can distinguish four patterns of concentration / agglomeration. Firstly we have the subsectors with high concentration of activities with a strong tendency to aggregate. Fall into this category as textiles and clothing. There are municipalities with a high proportion of workers in this subsector and this concentration tends to spread through other neighboring municipalities. Secondly we have the subsectors with high concentration of activities but with a lower tendency for aggregation.[104] Belong to this group the subsector footwear, automotive and machinery and equipment. In this case, technological factors associated with economies of scale seem to be dominant, despite some sprawl dynamic. Thirdly, we have the sub-sectors of activity less concentrated but with strong tendency to agglomerate represented by a single subsector, metals and metal products. In this pattern, the dynamics of agglomeration between several municipalities supersede the measures of concentration that remain moderate. Finally, there is a rather undefined pattern with low concentration and low tendency to aggregate, in which fall the remaining sub-sectors of the manufacturing industry: chemical, rubber, wood and cork furniture and food and beverages.

Figures 2-9 represent the Moran Significant map and help us to understand better patterns of geographic location. The different types HH, LL, LH and HL appear on maps respectively marked in red, blue, light blue and pink. We have chosen not to display the maps relating to the construction and machinery and equipment because we do not found any clear pattern of clustering. The first map (Figure 2) represents the manufactory sector. It clearly shows a pattern of industrial location in three relatively distinct poles: the first corresponds to the municipalities of Leiria and Marinha Grande, a second corresponding to the district of Aveiro and a third covers a number of municipalities between Porto and Braga, thus covering the regions of Grande Porto and Ave. The second map (Figure 3) corresponds to the tourism sector, with a clear geographic concentration in the south (Algarve) and in the Alentejo coast, motivated, in our view, essentially by climatic factors.

The next maps (Figures 4-9) illustrate the spatial distribution of several manufactory subsectors described above. Figure 4 corresponds to the Moran Significance Map of textiles and clothing subsector and identifies two industrial spots. The first one is localized in the north of Porto and comprising the Ave Valley, and part of the Cávado and Minho-Lima regions. Therein lays the stronghold of the Portuguese textile industry. The second spot, in the central region, covers part of the Serra da Estrela, Cova da Beira regions and also includes the Guarda municipality. The first case is not surprising, considering the sector modernization effort that patent in multiple partnerships with various private and public research units in a broad effort in converting and adapting to globalization.[105] The second case invites a better account of existing dynamics. Considering the existence of a spatial agglomeration in the Moran Significance Map, this leads us to believe that the wool sector is eventually resisting despite major closures that have dominated the last decades.

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104 A small tendency but still significant and positive.

105 The CITEVE - Technological Centre for the Textile and Clothing Industries of Portugal is an establishment localized in Famalicão created in 1986 aims to support the development of technical and technological capacities of textile and clothing, and by fostering the diffusion of innovation, promoting quality improvement and instrumental support for the definition of industrial policies for the sector.

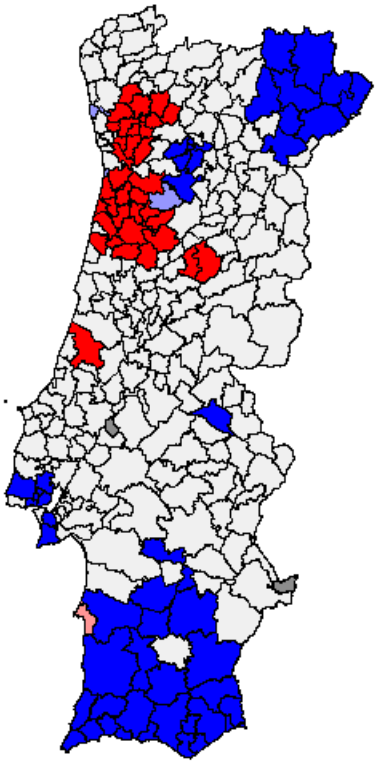

FIGURE 2: MANUFACTURING SECTOR

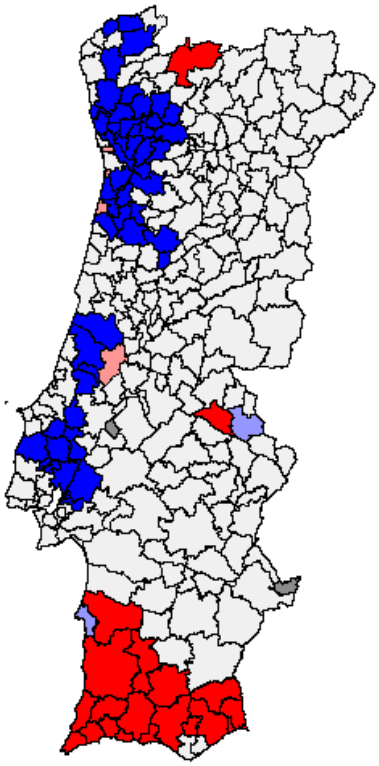

FIGURE 3: TOURISM

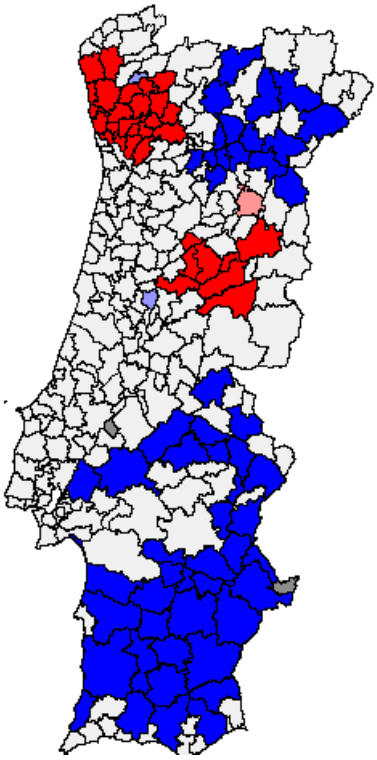

FIGURE 4: TEXTILE AND CLOTHING

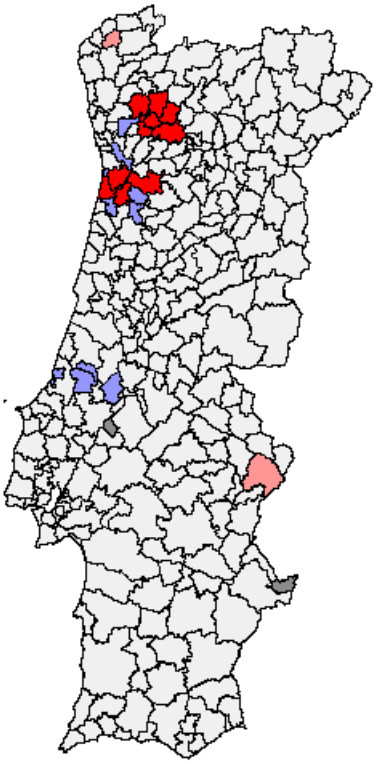

FIGURE 5: MANUFACTURING FOOTWEAR

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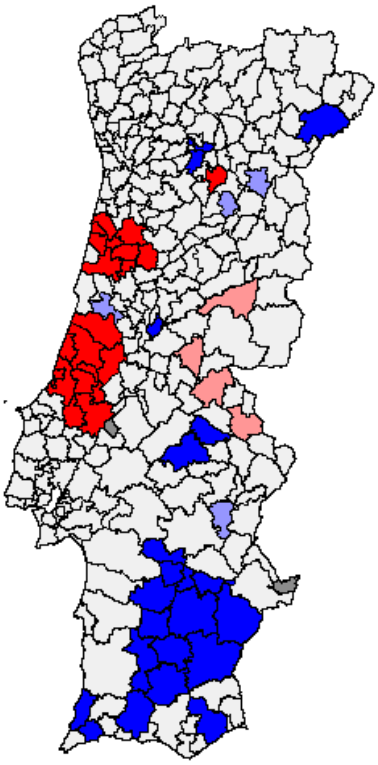

FIGURE 6: RUBBER AND CHEMICALS PRODUCTS

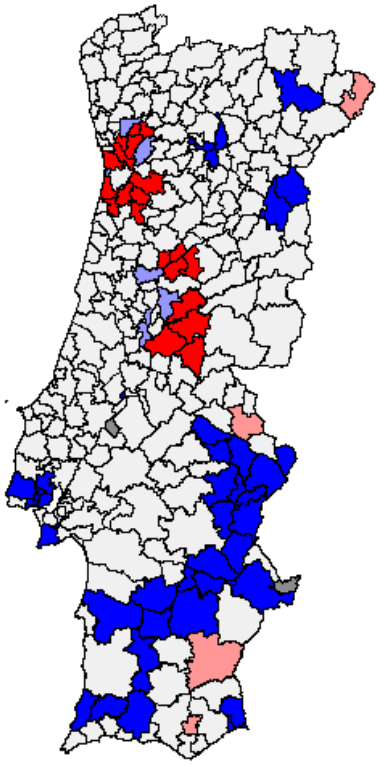

FIGURE 7: WOOD, CORK AND FURNITURE

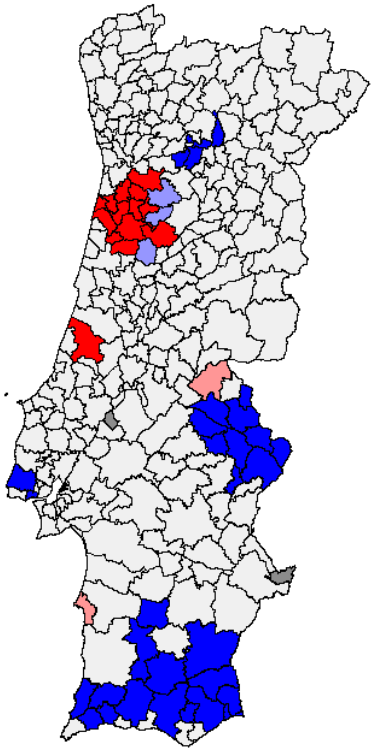

FIGURE 8: METALLURGY AND METAL PRODUCTS

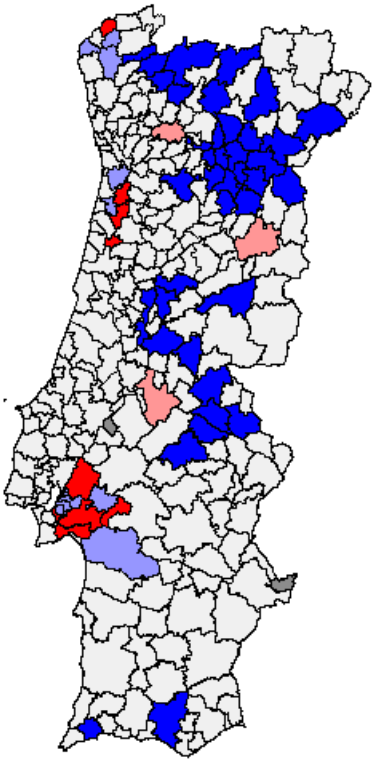

FIGURE 9: AUTOMOBILE INDUSTRY

Figure 5 describes the footwear sector and displays also two regional clusters, one located in the north of Portugal covering the municipalities of Vale do Ave (Guimarães, Fafe) and Tâmega (Amarante etc.), and a second one in the region of Entre-Douro-e-Vouga (with the municipalities of Ovar, Feira, S. João da Madeira, Oliveira de Azeméis and Arouca). Without going into details about

the existing dynamics that may be at the origin of these geographical agglomeration, we noted a number of existing structures in both areas through which local actors seek to collectively develop strategies in such important areas such as research , vocational training or internationalization.[106]

The subsector of rubber and chemicals products, corresponding to the map in Figure 6, is one of the most diversified, including chemicals and synthetic fibers, pharmaceuticals, rubber and plastics activity. The map shows two agglomerations. The first comprises several municipalities in the regions of Baixo-Vouga and Baixo-Mondego (Aveiro, Cantanhede, Mortágua etc.). The second covers an extensive area covering coastal counties ranging from Santarem to Pombal. The map also reveals some HL municipalities with a high concentration of workforce in this sector, but without sprawl effects in neighborhood. Usually they correspond to inland municipalities in which a single company can employ a significant proportion of the local workforce. Such is the case in Portalegre with the IMG Group, dedicated to the production of resin. The subsector of wood, cork and furniture (Figure 7) identifies three geographical agglomerations, the first in the center region (Serta, Proenca-a-new, and Oleiros Pampilhosa da Serra), the second covering municipalities in the Baixo-Vouga and Entre-Douro-e-Vouga regions and finally, in the north region, the most important clusters of furniture, with epicenter in the municipality of Paços-de-Ferreira (known as the furniture capital), which aggregates several neighboring municipalities of Tâmega region. The fact that we do not have disaggregated information on the cork sector prevents us from identifying the relevant cluster of cork localized in the municipality of Santa Maria da Feira. Figure 8 identifies patterns of location for the sub-sector of metallurgy and metal products, with two spots, the first covering partially the municipality of Leiria and the second covering the regions of Baixo-Vouga (Aveiro, Anadia, Agatha, among others), Entre-Douro-e-Vouga (Oliveira-de-Azeméis, Vale-de-Câmara etc.) and also de municipality of Tondela. This subsector comprehends several activities such as molding industry (in Marinha-Grande), manufacture of metallic structures, pipes and profiles, or even more differentiated sectors such as motorcycles or bicycles (with particular emphasis on the municipality of Águeda). Finally, we have the sub-sector of the automotive industry with a cluster clearly identified in the peninsula of Setúbal (Setúbal and Palmela municipalities among others) with epicenter in the Autoeuropa complex. Even within the automotive industry, some spots still appear in the Center with the municipalities of Oliveira de Azemeis, Albergaria-a-Velha and Oliveira do Bairro, mainly related to the sector of components. The map also identifies some individual municipalities HL, like Guarda, which was an important center for car production around the Renault plant, within which some companies producing components (like copper conductor cable) are still working.

4. CONCLUSION

The current policy guidelines of economic policies regarding sectorial development recognize the importance of physical space or geographical proximity as one of the crucial factor of success. Strategies for Collective Efficiency, launched by public authorities, mention the poles of competitiveness and clusters as structural elements of the development strategy. This article does not seek to explain the social or economic mechanisms underlying geographical aggregation dynamics. Our aim is to give a contribution in the quantitative approach of these matters, thus seeking to assess as objectively as possible these agglomeration effects, combining instruments for measuring concentration with spatial econometrics techniques.

The results indicate different levels of concentration, not always correlated with the tendency to agglomeration. That is, we can have highly concentrated sectors with strong contagion effects to neighboring municipalities (textiles) and other, equally concentrates, but with less tendency to sprawl around (automotive and footwear). It should nevertheless be stressed that, to a greater or lesser degree, all sectors showed positive autocorrelation with a high degree of significance.

106 Examples: Footwear Technology Centre of Portugal in S. João da Madeira and APICCAPS - Portuguese Association of Manufacturers of Footwear, Components, Leather Goods and their substitutes based in Oporto.

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We identified several clusters at the regional level, of which we highlight tourism, textiles and clothing, footwear, wood and furniture, metallurgy and metal products and automobile production. The existence of these traditional activities naturally invites us to recall the Porter report whose recommendations pointed precisely to revitalize these sectors (M. Porter, 1994). Although these results certainly claim for a finer analysis, if possible with higher levels of disaggregation of sectors, but also breakdown the geographical units, they point to an objective reality which should not be underestimated. We must not overlook the creation of new emerging industries. But we must also, as Porter says, support our traditional sectors, with an innovative view, seeking to explore new technologies, new products and new processes, and trying to increase the value chain of firms. By assuming the importance of territory and geographical proximity for the success of economic activities, we are, implicitly, mentioning the importance of tacit part of knowledge that is not coded. This know-how is normally transmitted through organic or informal channels, between different generations, and helps to characterize the culture and the social values of a region. It takes decades to build and should not be despised.

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A INTERNACIONALIZAÇÃO NO SETOR DA CORTIÇA: ESTUDO EXPLORATÓRIO ÀS EMPRESAS

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Resumo. Com a globalização dos mercados, a concorrência é cada vez maior e torna-se imperativo que as empresas procurem penetrar em novos mercados, para desta forma sobrevivam às conjunturas económicas e situações adversas. No atual contexto económico a internacionalização surge como fator essencial para o aumento de competitividade das empresas. Neste trabalho foi desenvolvido um estudo exploratório com vista a estudar o processo de internacionalização das empresas do setor corticeiro, composto maioritariamente por micro e pequenas empresas localizadas no concelho de Santa Maria da Feira. Neste sentido este trabalho procura analisar e tentar compreender a internacionalização do setor corticeiro, no concelho que agrega mais empresas e produtos de cortiça. Assim contribui para identificar as perspetivas de evolução deste setor, perspetivas das empresas, as vantagens competitivas a nível internacional, pontos fortes, pontos fracos, oportunidades, ameaças que possui para ser líder mundial neste setor. Para estudar o processo de internacionalização das empresas do setor da cortiça, foi elaborado um inquérito. A construção do questionário partiu do estudo preliminar, que passou por uma revisão da literatura e do estudo de teorias de autores e a sua consistência quando relacionada com a internacionalização. O inquérito foi entregue em 200 empresas, associadas da APCOR e com instalações no concelho de Santa Maria da Feira. Responderam ao inquérito 121 empresas. A opção por este concelho teve por base o facto de ser o maior aglomerado de empresas do setor corticeiro. Trata-se de uma amostra de conveniência em termos geográficos, embora se entenda que é uma amostra representativa do setor. O artigo está organizado em quatro partes, reservadas à revisão da literatura sobre a internacionalização das empresas de cortiça, à metodologia usada para realização dos inquéritos, à sua análise através da estatística descritiva e fatorial e por fim discussão dos resultados obtidos e respetivas conclusões. Desta investigação podemos concluir que apesar de algumas empresas estarem fortemente implantadas no mercado internacional, a maior parte dedica-se quase exclusivamente à produção com forte orientação para a qualidade. Os fatores de sucesso deste setor são: Capacidade de Inovação, Capacidade de Investimento, Domínio da Cadeia de Distribuição, Qualidade do Produto.

Palavras-chave: cortiça, comércio internacional, estratégias de internacionalização, internacionalização.

THE INTERNATIONALIZATION IN CORK SECTOR: BUSINESS EXPLORATORY STUDY

ABSTRACT. With the globalization of markets competition is increasing and it is imperative that companies seek to get into new markets, in order to survive the economic conditions and adverse situations. In the current economic context internationalization emerges as a key factor for the increase of the competitiveness of companies. In this market research, there has been developed an exploratory study in order to observe the process of internationalization of the cork industry, that consists mostly of micro and small businesses located in Santa Maria da Feira. This work seeks to analyze, and it tries to understand the internationalization of the cork industry, in the municipality that includes the most companies and cork products, in order to help to identify the prospects of development of this sector, prospects of companies, the competitive advantages internationally, strengths, weaknesses, opportunities and threats that come with being world leader in this sector. To study the process of internationalization of the cork industry, we developed a survey. The construction of the questionnaire came from the preliminary study, which went through a literature

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review and study of theories of authors and their consistency when related to internationalization. The survey was delivered in 200 companies, APCOR members and facilities in the municipality of Santa Maria da Feira. 121 companies responded to the survey. The choice of this municipality was based on the fact that it owns the most cork companies. Geographically, this is a convenience sample, although it is a representative sample of the industry. The paper is organized into four parts, which are reserved to the review of the literature on the internationalization of cork enterprises, the methodology used to carry out the surveys, to their analysis using descriptive statistics and factorial and finally to discuss the results and respective conclusions. In this research we can conclude that although some companies are heavily established in international markets, the majority are dedicated almost exclusively to the production with a strong orientation towards quality. The factors of success in this sector are: Innovation Capacity, Investment Capacity, Field of Supply Chain, Product Quality.

Keywords: cork, Internationalization, internationalization strategies, international trade.

Introdução

O setor corticeiro é de extrema importância para Portugal, de acordo com os dados divulgados pela Associação Portuguesa de Cortiça (APCOR) (2011), a área ocupada pelo sobreiro no nosso país representa aproximadamente 34% da área mundial, por outro lado, somos o maior produtor com aproximadamente 49,6% da produção mundial e no que diz respeito à transformação e exportação Portugal detêm uma quota de 61,3%.

O objetivo deste trabalho é analisar com base nos modelos teóricos e nas estratégias de internacionalização a competitividade das empresas do setor da cortiça a nível internacional e a sua cultura de internacionalização, contribuindo desta forma para encontrar lacunas e dificuldades sentidas, ou a inexistência destas, pela inércia da gestão em relação ao crescimento sustentado na internacionalização e na aversão ao risco relacionado com esta temática.

Apresenta-se uma revisão da literatura, com uma abordagem aos modelos de internacionalização, modalidades, estratégias, assim como as vantagens e desvantagens da internacionalização. Posteriormente é apresentada a metodologia que serviu para elaboração do estudo exploratório às empresas no setor da cortiça. Por fim o estudo das respostas ao questionário com a explicação, construção e análise dos dados, finalizando com a conclusão.

Com globalização da economia torna-se impreterível que as organizações se tornem mais competitivas e se adaptem às constantes mutações do mercado. Procura-se com este trabalho saber em que ponto as empresas estão e ao mesmo tempo ter uma ideia de para onde as empresas querem ir.

1 – Revisão da Literatura

De acordo a APCOR (2011) o setor da cortiça em Portugal é uma indústria líder a nível mundial no que diz respeito às exportações, sendo que quase 90% da cortiça produzida em Portugal é exportada.

Conforme Gil (1998) argumenta Portugal foi pioneiro e o principal legislador no âmbito suberícola. A proteção pela lei ao sobreiro é muito antiga no nosso país, sendo esta a espécie que mais legislação protecionista teve até à atualidade. Tem interesse ainda referir que Portugal foi dos primeiros países a elaborar normas para este setor.

A indústria corticeira em Portugal, localiza-se principalmente no distrito de Aveiro mais precisamente no concelho de Santa Maria da Feira. De acordo com o estudo da APCOR (2011), em Portugal existiam 597 empresas em 2009, tendo observado um decréscimo de 28% entre 2000-2009. Por outro lado segundo o Anuário 2011 elaborado pela mesma entidade anteriormente referida, 251

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empresas são associadas da APCOR, estas são responsáveis por 80% da produção e 85% das exportações logo os dados apresentados são representativos da realidade nacional.

1.1 - Internacionalização

Conceito de internacionalização

De acordo com Freire (2008), o processo de internacionalização compreende a necessidade que uma empresa tem, em procurar novos mercados e desta forma continuar a ser competitiva.

Para Welford e Prescott (1994) torna-se imperativo procurar entrar no mercado global, não só numa ótica de sobrevivência mas também como forma de expansão, isto é, como estratégia de crescimento. Por outro lado, Hemais e Hilal (2002), traçam a exportação direta como uma ocasião para adquirir conhecimentos sobre o novo mercado e desta forma a empresa poder chegar a um grau de envolvimento superior, abrindo subsidiárias no país estrangeiro.

Moreira e Dias (2008), referem que na frente desta internacionalização estão grandes Empresas Multinacionais (MNEs) e o resultado está a afetar o comércio internacional de maneira irreversível. Enquanto por um lado as MNEs detém a ambição, posição liderante, capacidade financeira e organizacional, por outro lado, as pequenas e médias empresas nas quais as mais recentes teorias estão mais focalizadas, adaptam as suas estratégias, recursos e estruturas a novos investimentos, com o objetivo de aumentar o seu envolvimento nas operações internacionais.

As teorias clássicas incidiam a problemática do comércio internacional, na diferença resultante dos preços dos bens de distintos países, que apresentariam condições de oferta e de procura distintas. De acordo com Lorga (2003), a sua importância para explicar o fenómeno da internacionalização é um pouco redundante, pois o seu alicerce é a nação, através da análise da especialização internacional de cada país em função dos seus recursos sejam eles naturais ou tecnológicos. De acordo com Stoian e Filippaios (2008), este é um dos modelos teóricos mais reconhecidos em negócios internacionais. Conforme Pinto *et al* (2010), o Paradigma Eclético centra-se na produção realizada no estrangeiro através do IDE e procura responder ao porquê de internacionalizar descriminando os motivos e razões assim como a localização da componente produtiva e por último como desenvolver as operações internacionais relacionadas com as MNEs.

Por outro lado a Escola de Uppsala de Johansson e Vahlne (1977), aborda a internacionalização como um processo de aprendizagem, do ponto de vista cíclico causal. Neste processo as causas são vistas como cíclicas não havendo influência do mercado ou concorrência. Santos et al (2011), referem a Escola de Uppsala como um modelo evolucionário, sendo o seu processo gradual, na medida em que as incertezas devido às diferenças entre países carecem de uma preocupação acrescida. Este modelo pode ser caracterizado em quatro fases: a exportação, a exportação por meio de intermediários, seguindo-se a abertura de uma subsidiária de vendas e por último a construção de uma unidade de produção num mercado externo.

Modalidades da internacionalização

As modalidades de internacionalização traduzem uma consequência do crescimento de qualquer empresa, que pressupõe e quer através da exportação ou investimentos diretos uma evolução natural nas empresas competitivas.

As modalidades de internacionalização mais referenciadas são:

Transação – compreendem venda de mercadorias serviços e marcas para empresas exteriores (Hitt, 2005; Freire, 2008; Pedro et al, 2008);

Investimento direto – investimento realizado por uma empresa num país exterior ao qual atua (Freire, 2008; Moreira, 2008; Araújo, 2008);

Projeto – Compreende o investimento pontual em empresas nacionais e externas, em projetos específicos e limitados no tempo (Freire, 2008).

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1.2 - As estratégias básicas de internacionalização

Sendo a temática da internacionalização difícil de precisar, visto que, o ponto fulcral baseia-se em ser o mais competitivo possível e desta forma suplantar as necessidades dos consumidores melhor que a concorrência. De acordo com Doz e Hamel (1998), este facto vem sendo constatado ao longo da historia, e com um incremento da evolução tecnologica e da competição, as empresas foram construindo parcerias, quer com clientes, quer com fornecedores, das quais foram retirados benefícios. Segundo Kogut (1985), as empresas viam na internacionalização uma forma de obterem vantagens ao nível do custo e/ou da diferenciação e com isto obterem ganhos de competitividade. Com base em Porter (1990), é possível constatar que as empresas de sucesso não diferem muito umas das outras e estas procuram vantagens competitivas através da inovação, otimização de processos, estratégias de marketing e design de produtos.

1.3 - As estratégias desenvolvimento internacional das empresas

A teoria da Escola de Uppsala de Johanson e Vahlne (1977), baseia-se em quatro fases do processo de internacionalização de uma empresa:

1º Fase - Existe uma exportação esporádica mas nunca regular;

2º Fase - Evolui para contatos com agentes e distribuidores;

3º Fase - A empresa estabelece uma filial de vendas num mercado externo;

4º Fase - A produção e fabricação dos produtos passa a ser realizada num mercado externo.

No que diz respeito à conceção e à implementação de uma estratégia de internacionalização como referido anteriormente por Dunning (1980), no Paradigma Eclético as localizações possíveis de intervenção são cruciais. A definição dos locais onde as empresas irão atuar, dependerá do local da comercialização e fabrico dos seus produtos ou expansão das suas funções de apoio.

Mais recentemente segundo Dunning e Lundan (2008), a internacionalização possui quatro motivações:

Procura de recursos (*resource-seeking*): Define uma busca por recursos, como matérias-primas, mão de obra e obtenção de competência tecnológica, de gestão ou *know-how* em marketing, que dada a escassez ou inexistência no país de origem, levam a uma necessidade de investimento em países estrangeiros;

Procura de mercados (*market-seeking*): De acordo com os autores esta procura subentende uma necessidade que a empresa, normalmente MNEs, tem em estar presente em certos mercados fornecendo a estes, bens e serviços. Também existe a obrigatoriedade de estar presente onde as empresas concorrentes estão, ou acompanhar os clientes e fornecedores na sua internacionalização;

Procura de eficiência (*efficiency seeking*): Na procura por parte das MNEs em maximizar os lucros quer através de uma maior eficiência na estrutura de abastecimento ou nos seus investimentos em mercados estrangeiros. São exemplos: diversificação de riscos, a obrigação em descobrir as diferenças internacionais subtraindo vantagens que dai advém e redução de custos de transporte, comunicação ou de coordenação;

Procura de ativos estratégicos (*strategic asset-seeking*): As MNEs procuram constantemente explorar ganhos de imperfeições de mercados, ou originá-las em seu proveito próprio. Para isso adquirindo bens físicos, mão de obra especializada, *know-how* em I&D, através de fusões ou *joint-ventures*, de modo a atingirem objetivos de longo prazo.

1.4 – Vantagens e desvantagens da internacionalização

A internacionalização traduz inúmeras vantagens a longo prazo sendo o aumento da competitividade a mais notória e evidente. De acordo com Freire (2008), podemos observar diferentes práticas nas quais ocorre um aumento da competitividade, ao nível da exploração das competências centrais em novos mercados, na medida em que permite um aproveitamento de capacidades inatas da empresa replicando o sucesso interno em mercados externos. Por outro lado, a beneficiação de economias de localização que traduz um aumento da presença em mercados externos nos quais a empresa possui conjunturas mais benéficas, e por último o acréscimo das economias de escala e experiência que representam uma significativa mais-valia nos custos totais. Assim, os custos totais são repartidos por um maior numero de unidades que a empresa possui quer dentro e fora do país, mas também reduzindo os custos unitários que são ocasionados por um progresso na curva da experiência.

Conforme Fryges e Wagner (2008), referem, as empresas que exportam são forçadas a ser produtivas e eficientes em relação aos custos, isto deve-se à sua exposição aos mercados externos e a competitividade acrescida que estes representam.

Como já referido no ponto anterior e segundo Fryges e Wagner (2008), a exportação e a internacionalização acarreta custos acrescidos, que só poderão ser colmatados com um aumento de produtividade sob ameaça de um acréscimo de riscos no processo de internacionalização. A ponderação dos riscos torna-se essencial para a tomada de decisão num processo de internacionalização.

Com isto podemos referir alguns riscos que são delimitadores da internacionalização e que se tornam obstáculos para qualquer empresa. Não obstante de ser o mais importante mas com grande relevo, temos o desafio com que qualquer empresa inicialmente se depara, o de transpor as barreiras à entrada, assim como as capacidades e versatilidades dos recursos da empresa que são testadas ao limite, de acordo com Rocha et al (2010). Por último e segundo Freire (2008), uma empresa quando se internacionaliza expõe a sua tecnologia, *know-how* e produtos a potenciais concorrentes estrangeiros.

2 - Metodologia

A construção do questionário partiu do estudo preliminar, de teorias de autores e a sua consistência quando relacionada com a internacionalização. Por outro lado a consulta do questionário da APCOR (2004) ao setor.

Para estudar o processo de internacionalização das empresas do setor da cortiça, foi elaborado um inquérito. O inquérito foi entregue em 200 empresas, associadas da APCOR e com instalações no concelho de Santa Maria da Feira. Responderam ao inquérito 121 empresas. A opção por este concelho teve por base o facto de ser o maior aglomerado de empresas do setor corticeiro e a proximidade à APCOR. Recorreu-se ao Software SPSS 19 para tratamento do inquérito. Faz-se a análise descritiva dos resultados.

Recorreu-se à Análise de Componentes Principais à Análise Fatorial (ACPAF) para extrair quais os fatores preponderantes no processo de internacionalização. Pestana e Gageiro (2005) e Maroco (2007) entendem que é uma técnica de análise exploratória que tem como objetivo descobrir e analisar um conjunto de variáveis inter-relacionadas de modo a constituir uma escala de medida para fatores que de alguma forma controlam as variáveis originais. Assim, pretendemos recorrer à ACPAF para reduzir o grande número de variáveis consideradas, num número bastante mais pequeno de fatores. No trabalho as variáveis destinadas à análise multivariada advêm de questões obtidas através de respostas numa escala Likert de 1 a 5.

Tendo em conta que no teste de Kaiser-Meyer-Olkin (KMO), seguindo Pestana e Gageiro (2005), (]0,9 – 1,0] - Excelente;]0,8 –0,9] - Ótima;]0,7 –0,8] - Boa;]0,6 –0,7] – Regular;]0,5 –0,6] – Medíocre; KMO<=0,5 – Inadequada) analisa-se se este permite fazer uma boa Análise Fatorial e se associa o teste de Bartlett para ver o seu nível de significância, se este for de 0,000 leva-nos à rejeição da hipótese da matriz das correlações na população ser a matriz identidade. Assim, podemos concluir

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pela adequabilidade da Análise Fatorial. Caso tal não se verifique deve-se reconsiderar a utilização deste modelo fatorial.

Verificada a correlação entre as variáveis em ambos os testes anteriores, podemos prosseguir com a Análise Fatorial, onde iremos analisar o Alpha de Cronbach para verificar a consistência interna dos fatores. Os valores do Alpha de Cronbach, segundo George e Mallery (2003) têm a seguinte interpretação:]0,9 – 1,0] – Excelente;]0,8 –0,9] – Bom;]0,7 –0,8] - Aceitável;]0,6 –0,7] – Duvidoso;]0,5 –0,6] – Pobre; <=0,5 - Inaceitável.

Foi utilizado o modelo de rotação de fatores ortogonal devido à sua maior simplicidade, pois na rotação ortogonal a orientação original entre fatores é preservada, isto é, os fatores após a rotação continuam ortogonais.

Para efetuar a rotação dos eixos fatoriais utilizámos o método ortogonal Varimax com normalização de Kaiser, cujo objetivo, segundo Maroco (2007) é a obtenção de uma estrutura fatorial na qual uma e apenas uma das variáveis originais está fortemente associada com um único fator, estando contudo, pouco associada com os restantes fatores, eliminando os valores intermédios, os quais dificultam a interpretação dos resultados.

Para Tavares (2011), e de acordo com Pestana e gageiro (2005), este tipo de rotação minimiza o número de variáveis com elevados *loadings* num fator, obtendo uma solução na qual cada componente principal se aproxima de ±1, no caso de associação entre ambas, ou de zero, no caso de ausência de associação, pelo que os mesmos autores referem que como rotação ortogonal tem por objetivo extremar os valores dos *loadings*, de modo a que cada variável apenas se associe a um fator (Pestana e Gageiro, 2005), o que torna este método de rotação ortogonal preferido por muitos analistas.

3 - Análise de resultados - descritiva

3.1 - Análise descritiva de resultados

A amostra em estudo é constituída por 121 indivíduos, de uma população 200 que representa as empresas do setor corticeiro, da região de Aveiro.

A correspondência de idades situa-se entre os 19 e os 78 anos, com uma idade média de aproximadamente 40 anos ($\bar{x}$=40,29; s=15,778). Relativamente ao género, verifica-se que 81,0% são do sexo masculino e 19,0% são do sexo feminino. Quanto à frequência da função/cargo na empresa das pessoas inquiridas, verifica-se que 60,3% são pessoal administrativo, 31,4% são administrador/gerente, 6,6% são diretor e 1,7% são outros (um responsável pelos recursos humanos/qualidade e um operário).

Quadro 1 - Resultados do inquérito sobre o peso (%) das exportações na faturação

	Peso (%) exportações (2009)	**Peso (%) exportações (2010)**	**Peso (%) exportações (2011)**
Média	14,41	16,06	16,88
Desvio padrão	20,276	21,753	22,198
Mínimo	1	1	2
Máximo	85	90	90

Fonte: Elaboração própria

No que diz respeito aos dados da empresa o número de colaboradores com frequência de 57,0% situa-se entre 10 a 49 colaboradores (pequena empresa), 37,2% corresponde de 0 a 9 (microempresa), 5,0% corresponde de 50 a 249 (PME), e 0,8% > 250 (grande empresa). Relativamente às empresas que exportam e responderam à questão, estas representam 14% das 121 empresas que foram alvo deste estudo. Em termos de peso (%) das exportações na faturação, 17 empresas responderam a esta questão, sendo que no ano de 2009 a média situou-se

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aproximadamente em 14,4% ($\bar{x}$=14,41), em 2010 subiu para 16,1% ($\bar{x}$=16,06) e em 2011 situou-se nos 16,9% ($\bar{x}$=16,88) (Quadro 1)

As regiões de destino das exportações (Quadro 2) apresentam a EU (100%) como região escolhida pelas 13 empresas que responderam a esta questão, sendo que para além desta região também cinco escolheram os EUA (38%), uma empresa a região de destino da América Central e Sul (8%), uma empresa a África do Sul (8%), uma empresa Austrália e Nova Zelândia (8%) e uma empresa o continente Asiático (8%).

Quadro 2 - Resultados do inquérito sobre regiões de destino

Regiões de destino	Contagem	%
UE	13	100%
EUA	5	38%
América Central e Sul	1	8%
África do Sul	1	8%
Austrália e Nova Zelândia	1	8%
Ásia	1	8%
Total	13	100%

Fonte: Elaboração própria

É notória a predileção pela UE, a que se deve a proximidade geográfica e como grande mercado produtor de vinhos de qualidade, já os EUA pela sua importância a nível mundial como produtor e grande consumidor de vinho. Convém destacar o potencial que a Ásia possui para este setor, dado o seu crescimento económico verificado ao longo destes anos e o potencial que este mercado apresenta para o futuro da cortiça.

Quadro 3 - Resultados do inquérito sobre os subsetores

Subsetores	Contagem	Percentagem (%)
Produtor	0	0%
Preparador	5	4%
Rolheiro	121	100%
Granulador	1	1%
Aglomerador	4	3%
Intermediário	74	61%
Serviços prestados	69	57%

Fonte: Elaboração própria

Sobre os subsetores em que as empresas se incluem (Quadro 3), todas as empresas pertencem ao subsetor rolheiro e dessas 121 empresas, 74 empresas também pertencem ao intermediário, 69 empresas prestam serviços, cinco empresas pertencem ao subsetor preparador, quatro empresas ao aglomerador e uma empresa ao granulador. É de realçar que uma das 121 empresas referiu o subsetor de materiais de construção civil como outro subsetor em que está presente. O subsetor rolheiro aparece como o principal, devido ao fato de o produto mais comercializado e exportado ser a rolha de cortiça natural e de sermos líderes a nível mundial neste setor. Esta sinergia entre empresas ao nível produtivo e comercial, resulta de uma forma natural e já interiorizada entre os empresários e trabalhadores. Assim este setor funciona de um modo organizado no qual a maior parte das empresas dedica-se à produção e algumas exportam o produto final. Relativamente aos revestimentos de piso e de parede, assim como isolamento térmico/acústico, estes apresentam uma frequência baixa mas que no futuro poderá ser mais elevada devido às caraterísticas únicas da cortiça e suas aplicações no setor da construção. Também os *gifs*, personalização de pequenos artigos entre outros produtos que têm ganho relevo no pequeno comércio poderão crescer no futuro e permitir que o *franchising* ganhe uma maior relevância neste setor.

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Quadro 4 - Resultados do inquérito sobre principais produtos comercializados

Principais produtos	Contagem	Percentagem (%)
Prancha / Fardos	0	0%
Rolhas de cortiça natural	120	99%
Rolhas colmatadas	26	21%
Rolhas capsuladas	19	16%
Discos	9	7%
Granulados	7	6%
Rolhas de cortiça aglomeradas	30	25%
Rolhas técnicas 1+1	66	55%
Rolhas de champanhe	47	39%
Revestimento de piso	4	3%
Revestimento de parede	4	3%
Isolamento térmico / acústico	3	2%
Gifts	5	4%

Fonte: Elaboração própria

No que respeita à comercialização de prancha/fardos de cortiça, algumas empresas podem eventualmente comercializar entre si, contudo não o fazem como principal produto, isto é explicado pela localização em Santa Maria da Feira que é essencialmente direcionada para a indústria produtiva e transformadora.

Em relação aos pontos fortes (Quadro 5) é de salientar a capacidade técnica (*know-how*) como a mais relevante para a maior parte das empresas, fruto da experiência acumulada ao longo das gerações que compõem o tecido empresarial do setor da cortiça. As empresas em estudo revelam também uma forte aposta na qualidade do produto e no Código Internacional de Práticas Rolheiras (CIPR). Este último intrinsecamente ligado ao primeiro ponto forte serve de linha orientadora para a qualidade, parametrizando e uniformizando as melhores práticas de fabricação. Sendo esta uma exigência principal dos seus clientes e da APCOR uma vez que o sucesso e liderança deste setor depende em grande parte da qualidade do produto.

Quadro 5 - Resultados do inquérito sobre análise interna - Pontos fortes

Pontos Fortes	Sim	Não	Pontos Fortes	Sim	Não
Esforço Comercial	86,8%	13,2%	Adequação dos recursos humanos ao negócio	55,4%	44,6%
Capacidade de produção	81,0%	19%	Capacidade de investimento	31,4%	68,6%
Qualidade do produto	93,4%	6,6%	Imagem no mercado	38,8%	61,2%
Competitividade	76,9%	23,1%	Solidez financeira	52,9%	47,1%
Disponibilidade de *stocks*	71,1%	28,9%	Higiene e limpeza das instalações	80,2%	19,8%
Capacidade técnica (*Know -how*)	98,3%	1,7%	CIPR	90,1%	9,9%
Capacidade de compra de matéria-prima	70,2%	29,8%	Estrutura familiar das empresas	33,1%	66,9%
Instalações	52,1%	47,9%			

Fonte: Elaboração própria

Na análise ao Quadro 6 é notória a importância dos custos em relação à matéria-prima, que com o decorrer dos anos tenderá a ser mais escassa e o seu custo mais elevado. Já a falta de inovação da maior parte das empresas que não consegue atingir economias de escala ao nível produtivo e em termos tecnológicos, importantes no mercado global em que vivemos. A isto deve-se também à situação económica atual e à dificuldade em termos de obtenção de financiamento que não possibilita grandes investimentos nesta área. Em termos dos recursos humanos, a experiência e produtividade não parece representar um ponto fraco e as economias de escala ao nível dos recursos humanos decorrente da experiência adquirida ao longo de muitos anos irá contribuir para uma qualidade acrescida nos produtos e serviços, também este não assumido como ponto fraco. Já a burocracia e o custo em relação ao licenciamento industrial as opiniões dividem-se, apesar da maior parte não considerar um ponto fraco, este por vezes pode ser um impedimento ao investimento e à celeridade necessária no mundo dos negócios.

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Quadro 6 - Resultados do inquérito sobre análise interna - Pontos fracos

Pontos Fracos	Sim	Não	Pontos Fracos	Sim	Não
Custo da matéria-prima	**96,7%**	3,3%	Esforço financeiro	14,9%	**85,1%**
Gestão comercial	9,1%	**90,9%**	Baixa rentabilidade do negócio	17,4%	**82,6%**
Baixo volume de negócios	8,3%	**91,7%**	Ambiente / higiene e segurança	5,0%	**95,0%**
Elevado preço / valor de produto acabado	9,9%	**90,1%**	Falta de qualidade nos produtos e serviços	2,5%	**97,5%**
Falta de inovação	**64,5%**	33,9%	Instalações	7,4%	**92,6%**
Capacidade de gestão	5,8%	**94,2%**	Licenciamento industrial – Burocracia e custo	47,9%	**52,1%**
Baixa produtividade	5,0%	**95,0%**			
Formação e qualidade dos RH	22,3%	**77,7%**			

Fonte: Elaboração própria

É visível pela análise dos Quadros 6 e 7 que as empresas do setor da cortiça sentem um maior receio de ameaças ao nível externo, do que as fraquezas a nível interno.

Assim como no Quadro 6 foi constatado, não só que o custo representa um ponto fraco mas também o preço das matérias-primas e a capacidade de compra de matéria-prima ainda que inferior, representam uma ameaça evidente para este setor.

Quadro 7 - Resultados do inquérito sobre análise externa - Ameaças

Ameaças	Sim	Não	Ameaças	Sim	Não
Vedantes alternativos	**90,9%**	9,1%	Capacidade de compra de matéria-prima	**57,0%**	43,0%
Preço das matérias-primas	**96,7%**	3,3%	Estratégia setor	2,5%	**97,5%**
Concorrência dentro do setor	**87,6%**	12,4%	Recursos humanos	11,6%	**88,4%**
Grandes empresas do setor	**89,3%**	10,7%	Incêndios	**69,4%**	30,6%
Margens (diminuição)	**87,6%**	12,4%	Impostos	**91,7%**	8,3%
TCA	**78,5%**	21,5%	Diminuição consumo vinho	**96,7%**	3,3%
Falta de qualidade	**85,1%**	14,9%			

Fonte: Elaboração própria

A concorrência a nível internacional em todos os setores também é vivida no setor da cortiça, assim como o monopólio das grandes empresas que "controlam" as exportações, resultando numa diminuição das margens para a maior parte das empresas deste setor. A falta de qualidade e o Tricloroanisole (TCA), que resulta numa diminuição da mesma são também compreendidos como uma ameaça. As empresas em estudo não consideraram os vedantes alternativos a médio e longo prazo (94,2%) como uma oportunidade, visto terem considerado uma ameaça. Contudo este poderá também ser visto como uma oportunidade, ainda que possa concorrer diretamente com a rolha em cortiça.

Quadro 8 - Resultados do inquérito sobre análise externa - Oportunidades

Oportunidades	Sim	Não	Oportunidades	Sim	Não
Novos mercados	**98,3%**	1,7%	Vedantes alternativos a médio e longo prazo	5,8%	**94,2%**
Solução para o problema do TCA	**76,9%**	23,1%	Flexibilidade	**52,9%**	47,1%
Systcode e outras iniciativas com qualidade	**74,4%**	25,6%	Aplicações de novas tecnologias	**86,8%**	13,2%
Esforço comercial	**86,8%**	13,2%	Diminuição do preço da matéria-prima	**79,3%**	20,7%
Descoberta de novas aplicações para cortiça	**87,6%**	12,4%	Rolhas técnicas	**63.6%**	36,4%

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Fonte: Elaboração própria

Para a maior parte das empresas a descoberta de novos mercados para escoamento dos seus produtos, assim como a descoberta de novas aplicações para a cortiça, o subsequente esforço comercial e aplicações em novas tecnologias são as principais oportunidades identificadas. A descoberta para o problema do TCA que compromete a qualidade do produto, iniciativas ligadas à qualidade como o *systecode* e própria flexibilidade representam aspetos positivos com o objetivo efetivo de fazer crescer a vantagem competitiva das empresas do setor da cortiça e representam caraterísticas intrínsecas ao processo de internacionalização.

Quadro 9 - Resultados do inquérito sobre evolução do setor da cortiça

	Média	Moda	Mediana	Desvio Padrão	Muito Negativo%	Negativo %	Razoável %	Positivo %	Muito Positivo%
Ao nível da dimensão do mercado	4,03	4	4,00	0,694	-	-	22,3	52,1	25,6
Ao nível do aparecimento de novos mercados geográficos	**4,08**	4	4,00	0,586	-	-	13,2	65,3	21,5
Das exigências do cliente	**4,74**	4	4,00	4,647	-	-	7,4	52,1	40,5
Da promoção dos produtos de cortiça	4,02	4	4,00	0,605	-	-	17,4	63,6	19,0
Ao nível tecnológico	**4,08**	4	4,00	0,510	-	-	9,1	73,6	17,4
Ao nível da qualidade da matéria-prima	**4,83**	4	4,00	5,133	-	0,8	7,4	66,1	25,6
Ao nível da quantidade da matéria-prima	2,93	3	3,00	0,782	3,3	23,1	51,2	21,5	0,8
Ao nível da concorrência de produtos alternativos	3,43	3	3,00	2,780	-	9,1	66,1	22,3	2,5
Do desenvolvimento de novos produtos de cortiça	3,49	3	3,00	0,647	-	1,7	54,5	37,2	6,6
Do impacto do TCA no mercado de rolhas de cortiça	3,06	3	3,00	2,788	1,7	18,2	77,7	2,5	-

Fonte: Elaboração própria

A perceção de que o setor irá evoluir de acordo com uma maior exigência do cliente, da qualidade de matéria-prima e ao nível tecnológico, é resultado de uma liderança a nível mundial neste setor e do conceito das empresas, que se torna fundamental no processo de internacionalização em qualquer setor. Assim o aparecimento de novos mercados geográficos, promoção dos produtos de cortiça e nível da dimensão do mercado insere-se na mesma lógica de internacionalização e de liderança. Já a quantidade de matéria-prima tende a diminuir no futuro o que parece já estar interiorizado nas empresas. Já o impacto do TCA parece preocupar os empresários sendo penalizador para a qualidade. A concorrência de produtos alternativos, assim como o desenvolvimento de produtos alternativos revela também uma certa preocupação.

No que respeita à evolução da empresa (Quadro 10), podemos concluir que as empresas em estudo consideram que a sua evolução se poderá concretizar maioritariamente ao nível tecnológico, dado que muitas destas empresas não possuem um sistema informático e a sua aposta é quase nula. Assim como os meios de inspeção de qualidade ainda são muito rudimentares, sendo este processo realizado pelos trabalhadores, somente a olho, o que por vezes pode originar uma falta de eficácia e reclamações de clientes. Esta gestão estratégica cautelosa resulta da situação económica que muitas empresas vivem e o próprio ambiente económico não permitir grandes investimentos. É percetível a preocupação e terem a noção do caminho que devem seguir apesar de muitas vezes não ser exequível.

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Quadro 10 - Resultados do inquérito sobre evolução da empresa

	Média	Moda	Mediana	Desvio Padrão	Concordo Nada %	Não Concordo %	Não Concordo nem Discordo %	Concordo %	Concordo Plenamente %
Com maior dimensão em termos de mercado	**3,42**	3,00	3	0,783	,8	7,4	48,8	34,7	8,3
Com uma nova estrutura de distribuição de produtos, com menor recurso a intermediários	**3,26**	3,00	3	0,750	0	9,9	62,0	19,8	8,3
A disponibilizar mais meios para a promoção comercial	3,17	3,00	3	0,654	0,8	7,4	69,4	18,2	4,1
Com novas tecnologias	3,20	3,00	3	0,586	0,8	3,3	74,4	18,2	3,3
Com maior capacidade produtiva	**3,21**	3,00	3	0,531	0	3,3	75,2	19,0	2,5
Com mais meios de controlo e inspeção de qualidade	3,13	3,00	3	0,531	0	5,8	77,7	14,0	2,5
Com um sistema informático mais desenvolvido e evoluído em todas as áreas	3,15	3,00	3	0,494	0	3,3	81,0	13,2	2,5
Com um quadro técnico de maior dimensão e mais capacidades	3,18	3,00	3	0,516	0	3,3	77,7	16,5	2,5
Com capacidades para desenvolver novos produtos	**3,23**	3,00	3	0,559	0	3,3	73,6	19,8	3,3

Fonte: Elaboração própria

De acordo com o Quadro 11 a estratégia comercial escolhida pela maior parte das empresas incidiu no volume de faturação, força de vendas e ainda que em menor escala o mercado geográfico. Sendo diminuto o número de empresas que possui uma estratégia comercial por tipo de produtos, que participam em feiras no estrangeiro e tem catálogos em mais que uma língua, revelando desta forma, uma fraca aposta em se internacionalizarem.

Quadro 11 - Resultados do inquérito sobre estratégia comercial

Estratégia comercial	**Contagem**	**Percentagem (%)**
Por volume de faturação	41	69%
Por força de vendas	31	53%
Por mercado geográfico	17	29%
Por tipo de produtos	12	20%
Participa em feiras no estrangeiro	5	8%
Tem catálogos em mais que uma língua	5	8%

Fonte: Elaboração própria

Relativamente ao número de clientes (Quadro 12), das 121 empresas em estudo a média é de 21 clientes por empresas ($\bar{x}$=21,38). Já em relação ao número de clientes no mercado externo, apenas 15 empresas responderam, sendo que o seu número médio é de 14 clientes ($\bar{x}$=14,47), com um mínimo de um cliente e um máximo de aproximadamente 150 clientes no mercado externo. Esta discrepância, explicada pela fraca internacionalização da grande maior parte das empresas, resulta numa postura de venda para o mercado nacional e principalmente a grandes empresas nacionais, representadas pelas empresas exportadoras que responderam à segunda questão.

Quadro 12 - Resultados do inquérito sobre número de clientes total e dos clientes do mercado externo

		Qual o número de clientes total?	Qual o número de clientes do mercado externo?
N	Responderam	121	15
	Não responderam	0	106
Média		21,38	14,47
Mediana		18,00	3,00
Moda		20	1
Mínimo		8	1
Máximo		200	150

Fonte: Elaboração própria

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É notória a existência de empresas que possuem apenas um cliente no mercado externo e estão a dar os primeiros passos na internacionalização ou apenas fazem vendas esporádicas. No sentido contrário vemos uma empresa que possui 150 clientes e é uma das maiores empresas do setor, estando fortemente implantada no mercado internacional.

Sendo ainda diminuto o número de empresas presentes no mercado externo, a tendência é este número aumentar, dado que a sobrevivência de muitas empresas passa pela internacionalização e pela exportação dos seus produtos aumentando assim a faturação e permitindo obter maiores lucros do que só sendo mero intermediários.

Em relação ao tipo de distribuição mais utilizado (Quadro 13), 118 empresas responderam que a sua distribuição é feita por grandes distribuidores (98%) e destas seis empresas também utilizam a venda direta como forma de distribuição (5%). Aqui é possível constatar a preferência pelos grandes distribuidores de vedantes e principais *players* neste mercado, que depois escoam para o mercado internacional. Assim a venda direta, por ser mais exigente e englobar processos mais complexos que a internacionalização assim o exige, mas que também a nível nacional acarreta maiores riscos, nomeadamente de incumprimentos de pagamentos entre outros. Torna-se desta forma mais fácil a distribuição realizada por grandes distribuidores de vedantes com reputação no mercado.

Quadro 13 - Resultados do inquérito sobre tipo de distribuição mais utilizado

Tipo de distribuição mais utilizado	**Contagem**	**Percentagem (%)**
Venda direta	6	5%
Grandes distribuidores de vedantes	118	98%

Fonte: Elaboração própria

Analisaram-se também as estratégias da empresa (Quadro 14), com base nas estratégicas básicas de internacionalização referidas no primeiro capítulo, sendo que 112 empresas adotam a liderança pelo preço (93%), dessas 104 empresas também possuem uma estratégia de diferenciação em relação à concorrência (87%) e quatro empresas possuem uma estratégia de focalização (3%). É notória a preferência por uma estratégia de liderança pelo preço, seguido muito de perto por uma diferenciação em relação à concorrência. Isto ocorre e tem uma ligação direta com outras conclusões deste estudo, assim é visível uma procura pela eficiência a nível produtivo, para desta forma se diferenciar em relação à concorrência. Também foi possível constatar junto das empresas que as margens e o preço que por vezes é pago pelas grandes empresas nacionais, que depois escoam a sua produção tem sempre por base o preço e a qualidade do produto.

Quadro 14 - Resultados do inquérito sobre estratégia da empresa

	Contagem	Percentagem (%)
Liderança pelo preço	112	93%
Diferenciação em relação à concorrência	104	87%
Focalização	4	3%

Fonte: Elaboração própria

Relativamente ao Quadro 15, podemos observar as vantagens competitivas a nível internacional e qual o impacto para as empresas em estudo, baseado nos modelos de internacionalização discriminados na revisão da literatura. As empresas em estudo observam a produtividade como principal vantagem competitiva seguido pela tecnologia e gestão profissionalizada, existindo uma relação direta com a sua principal atividade que é a produção e a sua preocupação com o produto. É compreensível que a sua perceção seja mais neste sentido, visto que a exportação é maioritariamente realizada por uma diminuta percentagem de empresas nacionais. Assim as questões exportação direta / exportação através de intermediários / unidade de vendas / unidade de produção, localização da unidade produtiva e a diferença de preços entre países tenham um peso menor (razoável), não sendo entendidas como principais vantagens a nível internacional para a grande maioria das empresas em estudo.

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Quadro 15 - Resultados do inquérito sobre vantagens competitivas a nível internacional

	Média	Moda	Mediana	Desvio Padrão	Muito Negativo%	Negativo %	Razoável %	Positivo %	Muito Positivo%
A diferença de preços entre países	3,93	4	4,00	0,648	-	-	24,8	57,9	17,4
Marketing e diferenciação de produto	**4,32**	4	4,00	3,684	-	-	24,8	57,9	17,4
Tecnologia e a gestão profissionalizada	**4,00**	4	4,00	0,592	-	0,8	14,9	67,8	16,5
Exploração de mercado através de produtividade acrescida	**4,37**	5	4,00	0,709	-	0,8	10,7	38,8	49,6
Políticas governamentais - restrição da entrada e saída de bens	**4,13**	4	4,00	4,696	-	3,3	24,0	70,2	2,5
Localização da unidade produtiva	3,63	4	4,00	0,709	-	7,4	28,1	58,7	5,8
Exportação direta/Exportação através de intermediários / Unidade de vendas / Unidade de produção	3,74	4	4,00	0,616	-	0,8	33,1	57,9	8,3

Fonte: Elaboração própria

Em relação às estratégias de internacionalização de empresas e de acordo com Freire (2008) foi construído o Quadro 16. É de realçar a estratégia das empresas, direcionada para a venda esporádica dos seus produtos nos mercados externos e recurso a agentes e distribuidores locais, explicado anteriormente pela sua venda a grandes empresas nacionais vocacionadas para a exportação. Esta inexistente estratégia de internacionalização da grande maior parte das empresas da nossa amostra é colmatada pela sua dedicação quase exclusiva à produção e qualidade do produto. A exportação e internacionalização são confiadas a algumas empresas, estas com uma estratégia de internacionalização forte e eficiente.

Quadro 16 - Resultados do inquérito sobre estratégias de internacionalização de empresas

	Média	Moda	Mediana	Desvio Padrão	Muito Negativo %	Negativo %	Razoável %	Positivo %	Muito Positivo%
Uma venda esporádica de produtos em mercados externos.	**3,83**	4	4,00	0,853	-	5,8	16,5	59,5	18,2
Recurso a agentes e distribuidores locais	**3,90**	4	4,00	0,757	-	5,8	16,5	59,5	18,2
Licenciamento - autorização da licença para uso de tecnologias ou marcas da empresa.	**2,64**	3	3,00	0,717	-	0,8	14,9	67,8	16,5
Franchising – autorização da marca, comercialização de produtos ou produção.	1,88	2	2,00	0,613	24,0	66,1	8,3	1,7	-
Investimento direto - investimento realizado por uma empresa num país exterior	**2,12**	2	2,00	0,622	12,4	65,3	20,7	1,7	-
Projetos chave na mão - constrói instalação industrial e transfere para empresa local.	1,95	2	2,00	0,644	23,1	58,7	18,2	-	-

Fonte: Elaboração própria

Já em relação ao *franchising* – autorização da marca, a quase inexistência deve-se ao caráter industrial e à diminuta existência de lojas que comercializam artigos em cortiça. O investimento direto no estrangeiro é realizado por muito poucas empresas, assim como a quase inexistência de projetos chave na mão o que neste setor não parece ser muito usual.

3.2 - Análise Fatorial às expetativas da empresa e do setor e às vantagens competitivas e internacionalização do setor corticeiro

Apresenta-se neste ponto do trabalho empírico a análise às questões do inquérito onde eram solicitadas respostas através da escala de Likert. O valor de KMO (0,806), permite uma ótima Análise Fatorial e uma vez que o teste de Bartlett tem associado um nível de significância de 0,000 leva-nos à rejeição da hipótese da matriz das correlações na população ser a matriz identidade, mostrando assim que a correlação entre algumas variáveis é estatisticamente significativa. No Quadro 17

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apresentamos os resultados da Análise Fatorial, utilizando para a extração dos fatores o Método das Componentes Principais. Para efetuar a rotação dos eixos fatoriais utilizámos o método ortogonal Varimax com normalização de Kaiser. Verificamos no Quadro 17 que os valores próprios dos quatro fatores são todos superiores a 1 (critério de Kaiser foi cumprido).

A Análise Fatorial resultou na extração de cinco fatores responsáveis por 73,830% da variância total (Quadro 17). A variância não explicada, de 26,170%, poderá estar relacionada com outros fatores menos relevantes, resultantes de outras combinações das variáveis.

Quadro 17 - Variância total explicada pelo processo de internacionalização do setor corticeiro

Componente	Valores Próprios Iniciais			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6,442	33,903	33,903	6,442	33,903	33,903	5,862	30,853	30,853
2	2,680	14,105	48,009	2,680	14,105	48,009	2,617	13,775	44,628
3	2,121	11,165	59,174	2,121	11,165	59,174	1,932	10,171	54,798
4	1,408	7,412	66,586	1,408	7,412	66,586	1,864	9,813	64,611
5	1,376	7,244	73,830	1,376	7,244	73,830	1,752	9,219	73,830

Extraction Method: Principal Component Analysis.

No Quadro 18 o Alpha de Cronbach indica-nos que estamos perante uma consistência interna excelente no fator 1 (Alpha de Cronbach = 0,939), uma consistência interna aceitável no fator 2 (Alpha de Cronbach = 0,791), uma consistência interna duvidosa no fator 3 (Alpha de Cronbach = 0,663), uma consistência interna boa no fator 4 (Alpha de Cronbach = 0,826) e uma consistência interna aceitável no fator 5 (Alpha de Cronbach = 0,792).

Vamos, de seguida descrever como foram denominados e interpretados os fatores selecionados a partir da análise das componentes principais (Quadro 18). Relativamente ao fator 1, a observação das variáveis que contribuem para explicar este fator permite-nos concluir que estamos perante as variáveis relacionadas com a capacidade de inovação. Assim, este fator é explicado pelas empresas que tentam manter-se fortemente competitivas, através das variáveis tecnológicas como os meios informáticos, das novas tecnologias, dos quadros técnicos, mas também da capacidade de desenvolvimento de novos produtos, com novas formas de distribuição de produtos e com meios de promoção comercial. Para o fator 2 contribui um conjunto de variáveis relacionadas com aspetos do mercado corticeiro. A promoção de produtos da cortiça e a procura de novos mercados dão corpo a este fator.

Para o Fator 3 contribuíram um conjunto de variáveis relacionadas com o domínio da cadeia de distribuição segundo as diferentes formas, explorando a diferença de preços entre países e explorando o mercado através de vantagens competitivas.

Quadro 18 - Matriz das componentes do processo de internacionalização do setor corticeiro

Fatores		Component					Interpretação dos Fatores
		1	2	3	4	5	
Fator 1	Com um sistema informático mais desenvolvido e evoluído em todas as áreas	,926					Capacidade de Inovação
	Com maior capacidade produtiva	,899					
	Com mais meios de controlo e inspeção de qualidade	,882					
	Com capacidades para desenvolver novos produtos	,872					
	Com novas tecnologias	,845					
	Com um quadro técnico de maior dimensão e mais	,838					

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	capacidades						
	Com uma nova estrutura de distribuição de produtos, com menor recurso a intermediários	,740					
	A disponibilizar mais meios para a promoção comercial	,689					
Fator 2	Investimento direto		,867				Capacidade de Investimento
	Projetos chave na mão		,818				
	Licenciamento		,739				
	Franchising		,690				
Fator 3	Exportação / Exportação através de intermediários / unidade de vendas/ unidade de produção			,800			Domínio da Cadeia de Distribuição
	Diferença de preços entre países			,721			
	Exploração de mercado através de vantagens competitivas (tecnologia e a gestão profissionalizada)			,704			
Fator 4	Recurso a agentes e distribuidores locais				,895		Dependência da Cadeia de Distribuição
	Uma venda esporádica de produtos em mercados externos				,851		
Fator 5	Ao nível da qualidade da matéria-prima					,904	Qualidade
	Exploração de mercado através de vantagens competitivas (marketing e diferenciação de produto)					,871	
	Variância explicada	33,903	14,105	11,165	7,412	7,244	
	Variância Acumulada	33,903	48,009	59,174	66,586	73,830	
	Valor próprio	6,422	2,680	2,121	1,408	1,376	
	Alpha Cronbach´s	0,939	0,791	0,663	0,826	0,792	

Para o Fator 4 contribuem um conjunto de variáveis que denotam alguma dependência junto da cadeia de distribuição, mas que não deixa de ser um fator importante em termos de internacionalização. São variáveis deste fator o recurso a agentes distribuidores locais e à atenção que deve ser dada mesmo a vendas esporádicas para o mercado externo. O Fator 5 está relacionado com a qualidade que é essencial no processo de internacionalização. Refere-se concretamente à qualidade da matéria prima e diferenciação do produto.

No que respeita à capacidade de exportação, as respostas ao inquérito demonstram que poucas são as empresas que têm autonomia para o fazer diretamente, sendo como é óbvio uma preocupação das empresas. Outro fator com impacto é a capacidade de fazer investimentos, isto é, o "músculo financeiro das empresas".

Relativamente à Análise Fatorial, podemos verificar que as perspetivas estão relacionadas com a capacidade de inovação, quer a nível dos produtos, quer a nível das tecnologias, dependendo também dos quadros técnicos que as empresas apresentam. Outros fatores importantes para a evolução deste setor é a capacidade de investimento e o domínio ou não domínio da cadeia de distribuição. Claramente neste setor muito poucos são os grupos empresariais que dominam a cadeia de distribuição. A grande parte das empresas está dependente dos grandes grupos empresariais do setor para exportar. Um fator essencial no processo de internacionalização é a qualidade da matéria-prima e a diferenciação do produto.

Conclusão final

Na era de globalização que vivemos e com as constantes alterações nos mercados mundiais, as empresas deparam-se com uma concorrência não só local e nacional mas também à escala global.

Com a crise financeira de 2008 e a recessão vivida desde então, as exportações nacionais saíram prejudicadas e o setor da cortiça não foi exceção. A valorização do EUR/USD e o agravamento das condições económicas na UE, destino este o mais importante para as exportações de produtos de cortiça, como constatado na nossa análise de resultados ao inquérito. Sendo esta a realidade atual, as empresas tem que necessariamente delinear uma estratégia de internacionalização eficiente para desta forma se sobressair em relação à concorrência e sobreviverem às situações adversas.

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A cortiça define-se pelas suas caraterísticas únicas que resulta num produto de excelência com múltiplas aplicações. Portugal surge como líder mundial de transformação e exportação de cortiça com uma quota de 61,3%, com uma panóplia de produtos que vão desde as utilizações industriais, construção civil, decoração, vestuário e calçado apesar de a rolha continuar a ser o principal produto produzido, comercializado e exportado. As regiões de destino são principalmente a UE apesar deste setor exportar para todo mundo.

Após as reflexões sobre o tema em questão, pudemos verificar a importância que, o espirito empreendedor dos empresários e gestores, têm numa qualquer organização que queira ter sucesso nos mais diversos mercados e pretenda iniciar um processo de internacionalização.

Como analisado, a análise descritiva demonstrou que as estratégias básicas adotadas pelas empresas incidem numa liderança pelo preço, aliado a uma diferenciação em relação à concorrência. Esta estratégia decorre de um aumento de eficiência produtiva que irá resultar num preço mais competitivo que a concorrência. No setor corticeiro, isto surge como medida essencial para um aumento de competitividade onde as margens de lucro e de venda são diminutas. A estratégia de focalização é seguida por poucas empresas que veem nos nichos de mercados, nomeadamente no vestuário, calçado e *gifs* a escapatória para um crescimento sustentável.

Já com base nos modelos tradicionais de internacionalização as vantagens competitivas a nível internacional revelam principalmente uma aposta na produtividade, na exploração de mercado através de vantagens competitivas nomeadamente a tecnologia, a gestão profissionalizada, *marketing*, diferenciação de produto, a diferença de preços entre países e as vantagens em relação às políticas governamentais de restrição da entrada e saída de bens (Moreira 2009). Relativamente às estratégias de internacionalização (Freire, 2008) as empresas inquiridas revelaram a venda esporádica em mercados externos e o recurso a agentes e distribuidores locais como principais estratégias de internacionalização, sendo que o investimento direto no estrangeiro e a exportação direta é somente realizado por empresas de grande dimensão e quase inexistente na grande maioria de empresas que compõem o setor.

A preocupação com o futuro é notório quer no desenvolvimento de novas aplicações de cortiça e expansão para novos mercados, ainda que não se possa precisar através dos inquéritos, a grande aposta poderá ser os países emergentes, nos quais já existe uma presença de algumas empresas.

Os BRIC representam não só o futuro como também a sobrevivência das empresas, que vêm a escapatória à crise que atinge a moeda única e restringe o seu crescimento. Para isso as empresas têm a noção que terão que apostar na modernização das suas instalações e apostar na tecnologia, para desta forma conseguir economias de escala ao nível produtivo e manterem-se competitivas. Fator este de extrema importância visto a maior parte das empresas são micro e pequenas empresas quase exclusivamente dedicadas à produção.

O fato de a maior parte das empresas que compõem este setor ser de pequena dimensão, pode ser visto não como penalizador, mas sim como um leque de oportunidades. Visto a sua dimensão ser reduzida tem a capacidade de mudar e arriscar de área de negócio e passar a comercializar outros produtos com uma rapidez superior às grandes empresas e desta forma aproveitar oportunidades que possam surgir. Este setor continua a crescer e têm sido descobertas novas aplicações de cortiça, tornando-se essencial para os empresários um olhar atento a nichos de mercado e a procura constante em se diferenciarem da concorrência, nunca descurando da qualidade e constante esforço para continuar a produzir um produto de valor acrescentado.

Através da Análise Fatorial foi possível reconhecer a intenção das empresas no que diz respeito à sua capacidade de inovação, da adequação às novas tecnologias, da sua capacidade e qualidade produtiva. Por outro lado, nas perspetivas para o mercado corticeiro, foi constatado uma vontade por parte das empresas em promover os seus produtos e de descobrirem novos mercados geográficos.

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As empresas em estudo revelam uma fraca capacidade para investir, visto que por um lado, o setor bancário tem dificultado em muito a obtenção de crédito e por outro as empresas não dispõem de capitais próprios para o fazer. Este fato vem prejudicar a sua capacidade para exportar e para o fazer diretamente, sendo que a grande maior parte recorre a intermediários, não dominando a cadeia de distribuição e estes sim com forte capacidade de exportação e fortemente internacionalizados.

A vontade em se internacionalizar e desta forma aumentarem as margens é notório, contudo o não domínio da cadeia de distribuição e a gestão direcionada para a produção e fabrico irá dificultar a sua sobrevivência num mundo empresarial cada vez mais globalizado.

A certificação e uniformização da qualidade dos produtos, como aspeto fundamental de um processo de internacionalização deve continuar a ser uma aposta das empresas, quer ao nível da qualidade mas também do *marketing* que se torna essencial num posicionamento no mercado externo. Sendo este um produto de referência e de qualidade a aposta contínua de que é um produto seguro e com caraterísticas diferenciadoras dos vedantes sintéticos que garante a conservação e acrescenta valor intrínseco ao vinho.

Em suma, podemos referir que o desafio que as empresas têm de vencer é manter um nível de produtividade alto aliado à qualidade de produto, criando desta forma valor acrescentado e procurando novos nichos de mercado para desta forma se distinguirem da concorrência.

A globalização e internacionalização das empresas veio impor uma importância acrescida à modernização, inovação e desenvolvimento tecnológico, gerando desta forma uma capacidade acrescida para responder assertivamente a um mercado global em constante mutação.

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