European Commission

J R C   T E C H N I C A L   R E P O R T S

IPTS WORKING PAPERS ON CORPORATE R&D AND INNOVATION – NO. 01/2013

Innovation and Job Creation: A sustainable relation?

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March 2013

Report EUR 25807 EN

Joint Research Centre

European Commission
Joint Research Centre
Institute for Prospective Technological Studies

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The IPTS WORKING PAPERS ON CORPORATE R&D AND INNOVATION are published under the editorial responsibility of Fernando Hervás, Pietro Moncada-Paternò-Castello and Andries Brandsma at the Knowledge for Growth Unit – Economics of Industrial Research and Innovation Action of IPTS / Joint Research Centre of the European Commission, Michele Cincera of the Solvay Brussels School of Economics and Management, Université Libre de Bruxelles, and Enrico Santarelli of the University of Bologna.

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JRC79261

EUR 25807 EN

ISBN 978-92-79-28533-2

ISSN 1831-9424

doi:10.2791/76791

Luxembourg: Publications Office of the European Union, 2013

Printed in Spain

Abstract

This study compares the employment growth patterns of innovative and non-innovative firms focusing on whether there are systematic differences in the persistence of the jobs created. Using data from a unique longitudinal dataset of 3,300 Spanish firms over the years 2002-2009, obtained by matching different waves of the "Encuesta sobre Innovación en las Empresas españolas" and adopting a semiparametric quantile regression approach, we examine employment serial correlation.
The empirical results of the study indicate that the jobs created by innovative firms generally appear to be rather persistent over time whereas those created by non-innovative firms do not. Among declining firms, non-innovators tend to deteriorate faster in terms of economic performance. In addition, among those firms experiencing high organic employment growth, smaller and younger innovative firms grow more on average than larger innovative firms. Overall, evidence suggests that being innovative supports and stabilises a firm's organic employment growth pattern and being smaller and younger seems to be a sufficient condition to experience high employment growth, i.e. – with regard to the latter – it is not necessary to have a comparably high R&D spending / being an R&D intensive company.

Keywords: Serial correlation; quantile regression; Spanish firms; firm size, firm's age; job creation; YICs.

JEL codes: L11; L25

Acknowledgements

The authors are grateful to the Spanish National Statistics Institute (Instituto Nacional de Estadística, INE), and in particular to Belén González Olmos (INE-Subdirección General de Estadísticas de Empresas): without her great effort and valuable contribution this study would not have been possible. We also thank Cecilia Cabello Valdés (Departamento de Métricas, Fundación Española para la Ciencia y la Tecnología - FECYT) for her support.

Moreover, this work has benefited greatly from the detailed comments and suggestions made by Werner Hölzl (Österreichisches Institut für Wirtschaftsforschung - WIFO), Andries Brandsma and Fernando Hervás (both form the European Commission, JRC-IPTS). The authors are also grateful to the observations and suggestions made by the participants of the OECD's Working Parties on Industrial Analysis (WIPA), and by those who attended the Seminar of Spanish Ministry of the Economy and Competitiveness on "Innovación y creación de empleo"; most of these input have been reflected in the present version of the paper.

This study has been implemented in the framework of the IRMA project – a joint JRC and DG Research and Innovation initiative of the European Commission (see http://iri.jrc.ec.europa.eu).

Non-technical summary

Problem

EU policy aims to support the creation and growth of innovative companies. Such firms, in fact, play an important role in shaping the dynamism of the economy's sectoral composition by favouring the transition towards more knowledge-intensive activities and contributing to overarching economic growth objectives. However, the literature has devoted little attention to verifying whether these firms, compared to non innovative ones, are effectively able to create persistent jobs. Addressing this issue is of outmost importance for setting the right priorities in terms of the European policy agenda.

Research question

The paper aims to verify whether being an innovator or not determines a company's growth trajectory. In particular, this study focuses on companies' organic employment growth patterns, to understand whether changes in employment figures (i.e. job creation / lay-off) are persistent (i.e. if growing one year repeat this performance in the following years) over time or not, whether such persistence (if any) differs between innovative and non-innovative firms, and to which extent (if any) it is affected by firm's size, age, and R&D intensity.

Methodological approach

This research draws on a balanced panel of a total of 3,304 Spanish firms over the period 2002 – 2009, obtained matching eight waves of the annual Spanish Community Innovation Survey (*Encuesta sobre Innovación en las Empresas*). This survey is conducted every year by the Spanish National Statistics Institute (*Instituto Nacional de Estadística*, INE) and it is the source of data that is then provided to EUROSTAT for the different waves of the Community Innovation Survey (CIS). It uses an econometric methodology which is appropriated for analysing firms' heterogeneity and in cases where outliers (i.e. declining and/or high growth firms) are of interest.

Findings

The main finding of the paper is that, employment creation is persistent over time in the case of innovative firms and it is not in the case of non-innovative firms. Furthermore, this study indicates that a) among those firms experiencing high organic employment growth, smaller and younger innovative firms grow more on average than larger innovative firms, b) among declining firms, non-innovators tend to deteriorate faster in terms of economic performance, and c) larger and older firms have a bigger buffer in times of declining growth.

Policy implications

The findings of this study confirm the important role that innovative companies can play in helping the economies to accelerate job creation at the exit of the economic crisis and to ensure more stable levels of employment in the longer run. The empirical evidence provided reinforces in particular the urgent need to put in place relevant support instruments targeting the growth of innovative companies in Europe, as well as those aiming at broadening the number of existing companies that undertake innovative activities in order to remain competitive.

Other considerations

This study also demonstrates that gathering firm-level data across EU countries is feasible, and that the related analyses can certainly provide EU policy-makers and other stakeholders with a better understanding of the growth dynamics of EU innovative firms - as the "Innovation Union initiative" claims – on which to base future policy initiatives. It would in particular support the design of specific instruments – at EU and Member State levels – targeting the needs of innovative firms.

1 Introduction

As acknowledged in the new research and innovation agenda of the European Union – 'Europe 2020 Strategy' – and follow-up initiatives such as the 'Innovation Union' flagship initiative and the new 'Industrial policy for a globalisation era', there is an urgent need to establish long-term business sector policies in Europe. These policies mainly aim at favouring the creation and growth of EU innovative companies. There is common understanding that such firms play an important role in shaping the dynamism of the economy's sectoral composition by favouring the transition towards more knowledge-intensive activities and contributing to job creation and overarching economic growth.

This study aims to contribute to the debate on the role of innovative companies[1] and enrich the knowledge on the matter. In this regard, our main goal is to verify whether innovative companies do show a different growth patterns with respect of non-innovative firms. In other words, we wonder whether being an innovator or not determines a company's employment growth trajectory.

This work conceptually builds upon a previous analysis by Ciriaci *et al* (2012), which investigated the correlation of employment, sales and innovation sales growth of a panel of Spanish firms. Ciriaci et al. (2012) focussed on innovative firms only, and on the role of size and age on firm's growth performance and ability to repeat a growth episode over time. Evidence from this earlier study unveiled that – while in the case of employment and sales growth an innovative SME was more likely to experience high-growth episodes than a larger innovative firm (although of a not persistent nature) – when looking at innovative sales, i.e. the opposite evidence was found. In fact, being an SME appeared to be an obstacle to high-growth episodes and persistency in terms of innovative sales. Therefore, their results cannot be used to understand whether being innovative helps job creation persistency. The present study aims to go a step further. Using the same original panel of 3,304 Spanish firms over the period 2002 – 2009 and a semi-parametric quantile regression approach, it analyses whether the jobs created are persistent over time or not, whether such persistence (if any) differs between innovative and non-innovative firms, and to which extent (if any) it is affected by firm's size, age, and R&D intensity.

Although there is a quite extensive literature on firms' growth and many authors in the field (see e.g. Hölzl, 2008; Coad and Rao, 2006; Coad, 2007a; Bottazzi and Secchi, 2003) has shown that the autocorrelation of growth rates may provide valuable information on companies' growth trajectories, little attention has been devoted to the analysis of the extent to which serial correlation (if any) is affected by a company innovativeness. Yet, an answer to this question – which is the main one of this study - could be of outmost importance for our overall understanding and also for setting the right priorities in terms of the European policy agenda.

This paper has five sections. The introduction is followed by a section providing a brief review of the relevant literature on innovative firms' growth. The methodology and database are then presented in section three. Section four gives an overview of the empirical results. The final section provides the conclusions, discusses policy implications and gives some indications for future research.

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[1] In this study, innovative companies are firms that introduced either products/processes new to the market and/or new to the firm and declared that they do invest in intramural R&D over the period 2002 to 2009.

2 Literature

Research on company growth and on the role of innovative activities as growth enabler has been accumulating at a remarkable pace inspired, for instance, by seminal contributions of Gibrat (1931), Schumpeter (1942), Penrose (1959), and Marris (1964).

In general, innovation is perceived as one of the most important drivers of a firm's growth[2], productivity, and survival.[3] The literature on the differences in growth behaviour between these two categories of firms indicates that innovating firms are both more profitable and grow faster than non-innovators (Freel, 2000; Geroski and Machin, 1992). One the main theoretical reasons underpinning this fact seems to hold in the process of research and development, which accompanies adoption of innovation and which is likely to increase the firms external absorptive capacity (Cohen and Levinthal, 1990) and its internal knowledge base – leading to greater flexibility and adaptability. Such differences which evolve between innovators and non-innovators are likely to be persistent (Feel, 2000). Another, even more important, theoretical foundation to explain the different growth behaviour of innovative vs. non-innovative firms is that the outcomes of product/process innovation is a (temporary) period of increased sales or profits (Geroski and Machin, 1992; Freel, 2000): through improved (innovative) product performance and/or reduced cost the innovative firm is able to capture a greater proportion of the available market demand compared to the non-innovative one. These benefits are likely to persist insofar as the innovative firm is able to exert property rights or effectively employ other appropriability devices – e.g. learning curve effects, secrecy, first mover advantages, etc. (Dosi, 1998). Freel (2000) suggests that superior innovative firms' growth in employment, if it occurs, derives from increased sales and improved competitiveness (which are likely to be the direct consequences of successful innovation).

That is not to say that business dynamism is determined simply by the level of R&D expenditure and/or innovative activities, as there are numerous economic factors which may affect a firm's ability to grow, to increase its efficiency and to survive in the market. Differences in firms' performance and growth might also be determined by certain company characteristics such as size (Schumpeter, 1942), age (Nelson and Winter, 1982) and sectoral specialization. Several authors (Carree and Thurik, 1998; Bartelsman *et al*., 2005; Stam and Wennberg, 2010) pointed out that EU firm growth (at aggregated level) was quite affected by the corresponding industry specialization. Some empirical evidence suggests that *ceteris paribus* firms in industries with high entry of new firms grow more than firms in more stable industries (Breschi et al., 2000; Sciascia et al. 2009)[4]. Therefore, these characteristics need to be taken into account when investigating firms' growth trajectories and the persistence of the jobs created.

With regard to the relationship between innovation[5] and job creation, in general, empirical studies at micro-level widely confirm a positive link (see for instance Van Reenen, 1997; Piva and Vivarelli, 2005; Piva, Santarelli and Vivarelli, 2005; Evangelista and Savona, 2003; Mansury and Love, 2008). Greenan and Guellec (2000) however find that the positive employment impact of product and process innovation at the firm level disappears at industry level (where only new

[2] For recent literature reviews on firms' growth see e.g. Coad, 2009, and Moncada-Paternò-Castello and Cincera, 2012.

[3] Other economic factors determining the growth of innovative company are e.g. intangible assets which in turn are very much dependent on firm, technological, sector and socio-economic/market environment characteristics. Furthermore, complementarities among several types of investments at firm level (such as R&D, human capital, ICTs, physical capital, (international) collaboration) were identified as being very important too with the potential of causing higher returns if realised jointly rather than devoting resources solely to one of these activities.

[4] Unfortunately and additionally, such dynamic new sectors or markets characterised by high-growth rates and firm dynamics are fewer in numbers in Europe compared to other world regions.

[5] Note that some of the mentioned studies approximated firms' innovative activities by means of its R&D expenditures

products lead to new jobs). In fact, innovative firms may face temporarily no demand constraint (product innovation effect) and when they operate more efficiently too (due to either new products or processes) they can expand output and jobs at the expense of competitors. Conversely, at the industry level the overall potential for job creation is constrained by increasing industry demand and by the dynamics of labour productivity (see in this regard Bogliacino, Lucchese and Pianta, 2011). In another study, Bogliacino (2010) found that the generally positive impact of R&D and innovation on employment – empirically confirmed in this study at firm level – varies according to how much the firm invests and also due to its size in terms of sales. Hence, the positive job creation effect increases when the R&D intensity of the firm (and thus implicitly the affinity to innovative activities) increases.

The existing empirical evidence on year-to-year growth patterns at firm-level and the corresponding determinants is subject to a controversial discussion given the lack of coherence among the empirical results on firms' growth autocorrelation (Coad, 2009, 2007). While early empirical studies concerning the growth of firms (Ijiri and Simon, 1967; Singh and Whittington 1975; Kumar 1985; and Dunne and Hughes 1994) found positive autocorrelation ranging from 30% to 33%, more recent studies relying on longer times series unveil more diverse annual autocorrelation patterns (Coad, 2007)[6].

There are several reasons why these mixed results may emerge (see e.g. Coad, 2009, 2007). Evidence suggests that serial correlation changes mainly with two characteristics of the firm, its size and its growth rate. This implies that there is not a "one size fits all" serial coefficient that applies to all firms (Coad, 2009, 2007). Stated simply, the differences in autocorrelation coefficients as emerged in the literature can be explained by the different firm-size compositions of the correspondingly different datasets. Following Coad's hypothesis, Ciriaci *et al.* (2012) found that among those innovative firms experiencing high organic employment growth, the smaller and younger grow faster than larger firms, but the jobs they create are not persistent over time. In addition, the results of the mentioned study suggested that, while being a smaller and younger firm helps growth in terms of employment and sales, it is not an advantage when innovative sales growth is considered. In fact, in the latter case larger firms experience faster growth. Therefore, among the fastest growing (Spanish) firms, the smaller and younger innovative companies clearly encounter difficulties when it comes to innovating at a later business phase, affecting their ability to base their sales on successive waves of innovations. [7]

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6 Chesher (1979) and Geroski et al. (1997), Wagner (1992) and Weiss (1998), Bottazzi et al. (2001) and Bottazzi and Secchi (2003) found a positive serial correlation for UK quoted firms, German manufacturing firms, Austrian firms, for the worldwide pharmaceutical industry and for US manufacturing, respectively. Negative serial correlation has been observed, instead, for German firms by Boeri and Cramer (1992), by Goddard et al. (2002) in the case of quoted Japanese firms, by Bottazzi et al. (2007) and by Bottazzi et al. (2005) for Italian and French manufacturing firms. Finally, a number of studies did not find any significant autocorrelation in firms' growth rates at all (e.g. Almus and Nerlinger (2000) analysing German start-ups, Bottazzi et al. (2002) for selected Italian manufacturing sectors, Geroski and Mazzucato (2002) for the US automobile industry, and Lotti et al. (2003) for Italian manufacturing firms).

7 As firm size matters in this regard, it is worth recalling that company size at a certain point in time (if measured by number of employees) is nothing else than the accumulated past growth in terms of employment; i.e. it refers in particular to the sustained – or in other words 'persistent' – jobs that have been created by the corresponding company. Analysing whether or to what extent the latter differs between innovative and non-innovative companies is the main subject of this study. Hence, the link between innovativeness and employment creation is of interest (and thus implicitly the link to company size and its trajectory too). Empirical studies, however, often fail to confirm a clear relation between innovation and size (labour force); some find a positive link, where large-scale firm research has become the prevailing form of organisation of innovation because it is most effective in exploiting and internalising the tacit and cumulative features of technological knowledge (Pavitt, 1986; Scherer, 1992; Scherer and Ross, 1990; Love et al., 1996; Cohen and Klepper, 1996; among others), but this significant (positive) influence is not confirmed by others (e.g. Mansfield, 1964; Griliches, Hall and Pakes, 1986; Acs et al., 1991) who report that small firms have an innovative advantage in highly innovative industries and in highly competitive markets or find that 'the pattern of R&D investment within a firm is essentially a random walk'. Ortega-Argilés and Voigt (2009) concluded in this regard that the advantages of large-scale companies, in general, tend to be physical whereas smaller companies can capitalise more on flexibility.

The question of whether there are systematic differences in the persistence of the jobs created by innovating vs. non-innovating firms has been only partially answered in recent literature.

3 Methodology

3.1 Database

This research draws on a balanced panel of 3,304 Spanish firms over the period 2002 – 2009 (comprising a total of 26,432 observations), obtained from matching eight waves of the annual Spanish Community Innovation Survey (*Encuesta sobre Innovación en las Empresas*)[8].

Firms that had undergone significant structural modifications were excluded, i.e. we dropped those firms that in any year declared an increase in turnover of 10% (or more) due to a merger with another enterprise or part of it (this is the only information provided by the survey on this point). Similarly, we also dropped any firm that declared a significant decrease in turnover (10% or more) due to sale or closure of part of the enterprise. Consequently, by nature of the resulting data set, the study captures organic growth only and not the any fast-growth by acquisition and/or fast decline due to sale or closure of a firm.[9] In addition, following Hall and Mairesse (1995), the dataset was 'cleaned' by removing all observations for which employment and/or sales were stated to be zero or missing. As a result, the total number of observations decreased from 26,432 (3,304 firms) to 25,426 (3,178 firms).

The resulting sample – compared to the data used in similar studies – has four main advantages:

(1) The data set includes innovative firms from both the manufacturing[10] and the services sector[11] (overall 10 main sectors; see Table A1, Appendix). Almost 77% of the sample firms (2,438 vs. 739) are innovative firms, i.e. firms that introduced over the period 2002 to 2009 either products/processes new to the market and/or new to the firm and declared that they do invest in intramural R&D. It is worth mentioning that – among the innovative firms – (for instance in 2002) about 2.5% were young innovative companies (YICs), i.e. companies less than six year old, with less than 250 employees, and with an R&D intensity (in terms of turnover) of at least 15%. The sectoral breakdown is as follows: 45.7% manufacturing, 12.4% scientific and technical R&D, 11.1% retail trade, 5.3% construction, 4.8% finance and insurance, 3.4% transport, 2.8% water supply, and about 1% mining and quarrying[12].

8 This survey is conducted every year by the Spanish National Statistics Institute (*Instituto Nacional de Estadística*, INE) and it is the source of data that is then provided to EUROSTAT for the different waves of the Community Innovation Survey (CIS).

9 Such cases of non-organic growth should be better analysed based on different data. In the given panel, growth by acquisition plays a role, but a fairly limited one. We excluded these cases in order to avoid mixed / biased results. In this regard, a recent paper by Spearot (2012) points out that especially those firms follow a strategy of acquisitions which are anyway more productive and successful. However, the findings of this paper can not be easily generalised to our case as Spearot looks at 'Compustat' firms (commercial database), which essentially – although not exactly - correspond to large US firms, mostly listed at the stock exchange. In fact, when looking at such large firms, taking into account the growth effects due to M&A might be more relevant.

10 Manufacture of food products and beverages; manufacture of chemicals and chemical products; basic pharmaceutical products and preparations; computer, electronic and optical products; electronic equipment; machinery and equipment; motor vehicles, trailers and semi-trailers; manufacture of computer, electronic and optical products.

11 Public Administration and Defence as well as Education were excluded (zero and only four firms in the dataset, respectively). The Agriculture, Forestry and Fisheries sector had to be dropped because there was no information about R&D expenditure for 2002, 2003, 2004, and 2005.

12 The INE, and in particular the Sub-directorate General for Company Statistics (*Subdirección General de Estadísticas de Empresas)*, kindly gave us access to the data and collaborated closely with us in the data processing and in matching the

(2) The sample includes large companies, small as well as micro firms (the latter are frequently neglected in other studies due to problems with data availability). All in all, 41.4% of the sample firms are relatively large companies. The remaining 58.6% are SMEs (of which 43.2% are medium size enterprises, 49% small firms, and about 7.8% micro firms).[13]

(3) Thanks to the merging of annual survey waves we had yearly data which, compared to other studies (e.g. relying on CIS data), is a relatively high frequency allowing considerations of year-to-year employment growth / company level changes.

(4) Finally, the data set includes some additional company characteristics, such as e.g. company age, which allows taking this kind of information into account for the empirical analyses (usually impossible when relying on anonymised company data such as CIS).

Unfortunately, due to its nature of being a balanced panel, working with this dataset also had some drawbacks as it does not contain firms entering or exiting the market at any time during the period of interest. In fact, by only considering firms which were already in the market at the beginning of the observed period and survived until the end, a certain bias was introduced as the negative growth rates of those firms which left the market and the high-growth rates of new born firms were both left out. However, over the analysed period the Spanish economy was characterised by a relatively low-exit rate[14] which limits the corresponding bias to a certain extent[15]. Moreover, according to Lopez-Garcia et al. (2009), in general, Spanish start-ups tend to have a first year employment growth higher than that of subsequent years. In the empirical analysis, we controlled for the age of each firm which may has partially corrected the bias introduced due to the latter shortcoming. In addition, controlling for firm's age may have further compensated for the balanced nature of the panel because, for any given size of firm, the probability of exit is a decreasing function of firm's age as older firms are likely to have more precise estimates about their innate efficiency, thereby reducing the likelihood of failure (Farinas and Moreno, 2000).

3.2 Descriptive statistics

Table 1 illustrates the evolution of innovative companies in Spain over the period 2002-2009. It is interesting to note that after a positive trend from 2002 to 2007, a downturn occurred in 2009 in four out of the seven reported parameters (i.e. total expenses in innovation, number of innovative enterprises, percentage of innovative enterprises, and the percentage of turnover due to new and improved products.

Table 1: Business sector innovation trends in Spain (2002-2009)

	2002	**2005**	**2007**	**2009**
Total expenses in innovation (M €)	11,089	13,636	18,095	17,636

two different industrial classifications in use during the investigated period (i.e. NACE93 from 2002 to 2007, NACE2009 in 2009). In cases where a one-to-one matching between NACE93 and NACE2009 classification was not possible, a probabilistic matching was used (associating to the most similar category).

13 Please note that firm size here corresponds to the number of employees and firms' growth is approximated correspondingly by changes in the number of employees.

14 See, for instance, Lopez-Garcia et al., 2009; Lopez-Garcia and Puente, 2007a/b; Nunez, 2004; and Ruano, 2000.

15 We also ran a robustness check limiting the time period analysed (2002-2007), i.e. excluding the two crisis years (2008-09). *See* section 4 and Table A3 in the Appendix.

Number of innovative enterprises (a)	32,339	47,529	46,877	39,043
Percentage of innovative enterprises (a)	20.6	27.0	23.5	20.5
Innovation intensity in the overall business sector	0.8	0.8	0.9	1.1
Innovation intensity of innovative enterprises	1.8	1.7	1.9	2.2
Percentage of turnover concerning new and improved products in the business sector	8.6	15.6	13.5	14.9
Number of innovative enterprises with R&D activities	9,247	9,738	12,386	11,200

Note: (a) Data refers to the preceding three years

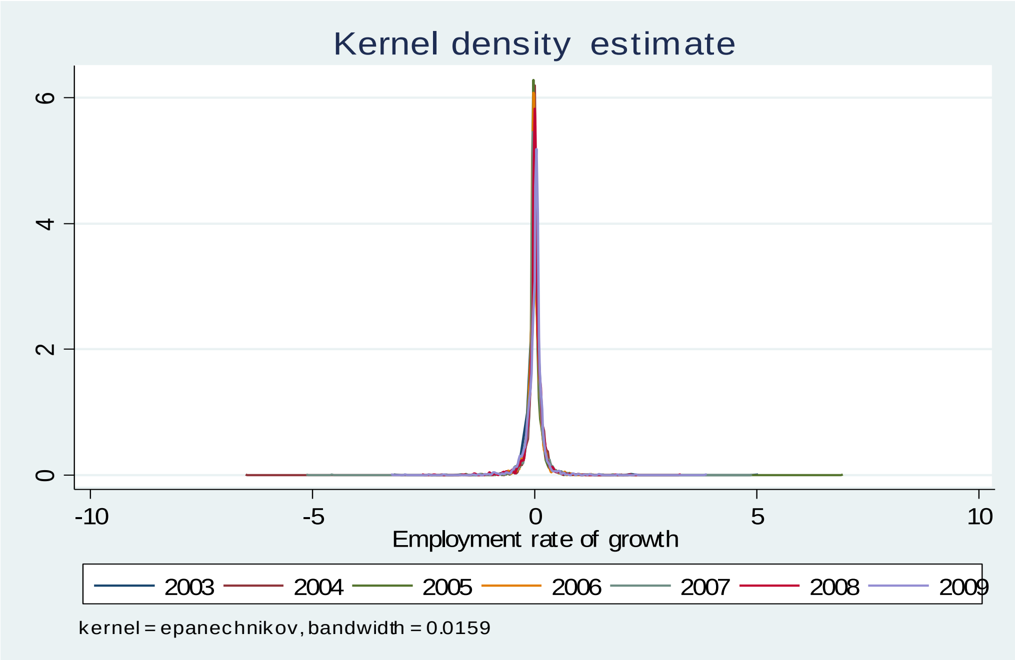
Source: "*Encuesta sobre Innovación Tecnológica en las Empresas*", Spanish National Statistics Institute (*Instituto Nacional de Estadística*) – INE, and EUROSTAT

Figure 1 (below) presents the univariate distribution of firms' employment growth rates which have been cleaned of size dependence, serial correlation and heteroskedasticity following Bottazzi et al. (2005) and Coad and Rao, 2008. Irrespective of the year considered, the figure shows that the distribution of firms' employment growth rates –– is tent-shaped, i.e. characterized by fat-tails. Stated simply, it suggests that there is – compared to a normally distributed variable – a higher probability of finding growth rates near the mean and also a higher probability (compared to a normally distributed variable) of rather extreme values.

Empirically, Figure 1 suggests that there is a minority of firms which experiences very rapid growth or very rapid decline, while the average firm does not grow at all. These findings point to the Laplace distribution and virtually appear the same as the empirical growth rate distribution commonly find for Community Innovation Survey data (see in this regard e.g. Hölzl and Friesenbichler, 2008).

Figure 1: Distribution of the growth rates of employment, 2003-2009[16].

[16] A similar figure (Figure 2) which reports the Distribution of the growth rates of sales, 2003-2009 is provided In Appendix



In addition, the descriptive analysis confirms that the density distribution of employment growth rates for innovative and non-innovative firms differs significantly. This difference implies diverse growth dynamics. In fact, the observed yearly growth rate distributions for non-innovative firms have longer tails, i.e. the number of extreme events – rapid growth or rapid decline – is higher than in the case of innovative firms,[17] whereas the peak of the Laplace distribution is significantly higher for innovative firms.[18] Moreover, the left hand side tail for non-innovative firms is slightly 'fatter' than the right hand side. This has a theoretical and an empirical implication. Firstly, it confirms that the Laplace distribution is somehow less appropriate to approximate non-innovative firms' growth rate distribution, which appears not symmetric, while it seems to be a fairly good approximation of the employment growth rate distribution for innovative firms. Secondly, it suggests that for non-innovative firms rapid decline is more likely to occur than rapid growth. All in all, these findings underline that growth rate distributions appear to be quite stable over time and are likely always display fat tails where outperformers and underperformers are concentrated.

From a methodological point of view, these descriptive statistics imply that regression estimates based on the assumption of normally distributed standard errors may perform poorly mainly due to the presence of (significant numbers of) 'outliers' (Coad, 2007). In addition, given the aim of this study, we should rather focus on those firms that grow largely more (or largely less) than the average as understanding the reasons behind these growth patterns appear to be of outmost policy relevance. In fact, an econometric analysis focusing on the average firm, in this particular respect, would be of fairly limited interest. That is why the following analysis is based on the use of quantile regression techniques, which are robust to outliers and allow investigating the autocorrelation structure across the entire distribution of employment growth rates.

3.3 The quantile regression approach

17 Results are available upon request.

18 These results are in line with the empirical evidence on high-growth firms or gazelles (Moreno and Casillas, 2007).

The quantile regression model is a semi-parametric technique firstly introduced by Koenker and Bassett (1978) and has been used since by many authors (e.g. Coad and Rao, 2008). The technique has several useful features which make its application especially appropriate when dealing with very heterogeneous observations whose heterogeneity, however, is of interest. Basically, when analysing firms' growth rates, outliers are carriers of fundamental information that one wants to preserve, not eliminate. As such, the quantile regression model can be used to exploit and characterise the entire conditional distribution of a dependent variable (i.e. a firm's employment growth rate) given a set of regressors and control variables (Buchinsky, 1998).

This methodological approach allows taking into account the fact that different solutions at distinct quantiles may reflect differences in the response of the dependent variable to changes in the regressors at various points in the conditional distribution of the dependent variable itself (Buchinsky, 1998). In other words, by applying this technique we account for the fact that the autocorrelation between a firm's growth rates is not the same for all firms regardless of their size (or sector; see Coad and Rao, 2008 and the Appendix for details).[19]

The regression model to be estimated for this study is specified as follows:[20]

$$\begin{aligned} Growth_{i,t} = \; & \alpha_0 + \alpha_1 \log(size_{i,t-1}) + \alpha_2 INNO^*Growth_{i,\,t-1} + \alpha_3\, INNO^*Growth_{i,\,t-2} \\ & + \alpha_4 non\; INNO^*Growth_{i,\,t-1} + \alpha_5 nonINNO^*Growth_{i,\,t-2} + a_6 INNO \\ & + \alpha_7 year + \alpha_8 age_i + \alpha_9 sector_i + a_{10} YICs + \varepsilon_{i,t} \end{aligned} \tag{1}$$

where $size_i$ is the logarithm of the number of employees at t-1, *year* is a vector of yearly dummies accounting for common to all firms' macroeconomic phenomena (such as inflation, market cycles, etc.), age_i is the age of the firm (controlling for the degree of establishment of a firm), $sector_i$ a vector of industry dummies, YICs is a dummy identifying the so-called *young innovative companies* (which is a firm specific attribute[21]), and $\varepsilon_{i,t}$ a vector of residuals.[22] Finally, $INNO^*Growth_{i,t-1}$, $INNO^*Growth_{it-2}$, $non\text{-}INNO^*Growth_{i,t-1}$, and $non\text{-}INNO^*Growth_{i,t-2}$ are four interaction terms introduced to disentangle differences in the first and second order autocorrelation of growth rates of innovative[23] and non-innovative firms, and INNO is a dummy identifying innovative firms. Additional information about the quantile regression approach is provided in the appendix.

4 Empirical Results

Five quantile regressions were computed (.10, .25, .50, .75 and .90 quantile), using the same set of independent variables in each regression and allowing two lags in serial correlation (see Table

19 In addition, in case of quantile regressions the error terms do not need to satisfy the restrictive assumption according to which they must be identically distributed at all points of the conditional distribution.

20 See Annex for further methodological details.

21 Using data over the time period 2002 to 2009 this choice implies that the YIC status change over time. In fact, if the YIC status would have been a time attribute and the YICs were oversized from an employment point of view at the beginning, they might have much more potential in terms of sales than employment growth.

22 We did not insert an interaction term year*sector because of the loss of degree of freedom that would have implied.

23 According to the CIS definition, innovative firms are those that have answered positively to at least one of the following four questions: (1) During the period 1998-2000, has your enterprise introduced on the market any new or substantially improved products?; (2) During the period 1998-2000, has your enterprise introduced any new or substantially improved production processes?; (3) By the end of 2000, did your enterprise have any ongoing innovation activities?; (4) During the period 1998-2000, did your enterprise have any innovation activities that were abandoned?.

2, Appendix). The coefficients can be interpreted as the partial derivative of the conditional quantile of the dependent variable with regard to the particular explanatory variable.

We start with commenting briefly on the results calculated for the median of the employment growth distribution (Q50) and then reflect whether (and how) these results may change along the growth distribution and whether being an innovative firm plays a role in this regard. The results obtained for the median firm (column "Q50" of Table 2, Appendix) suggest a random growth path for both innovative and non-innovative firms. Besides, they indicate that employment growth is not systematically determined by firm size, i.e. growth appears to be independent of a firm's size. At the first glance, these two results would support Gilbrat's law (1931), which implies the absence of any structure in growth process since a firm's growth does not depend on its size and follows a random path.

Furthermore, firms' age was found to affect negatively firms' growth performance (although with a very low elasticity). This result is in line with the corresponding literature (see Coad and Tamvada, 2011). However, all these results regard firms which are just at or around the median of the growth rate distribution and are therefore here of minor interest given the fact that the majority of these firms is not growing at all.

Noteworthy differences emerged regarding the impact of firm size and age on employment growth at the extreme quantiles. For declining firms, both size and age entered the equation with a positive algebraic sign, whereas for growing and fast growing firms both variables are significant and affect firms' growth performance negatively. In other words, among firms declining in terms of employment figures, higher company age tends to limit the losses in employment growth, i.e. older firms tend to decline less (set off employees less drastically), whereas among growing firms the smallest and youngest tend to experience a faster growth. These results are in line with findings made in previous studies according to which smaller firms tend to generally grow faster than larger firms (Ciriaci et al., 2012; Coad, 2009).

Both innovative and non-innovative declining firms show a random growth pattern (no first order or second order growth autocorrelation in Q10 was found). If in turn the extreme opposite quantile is considered (Q90), a positive first-order autocorrelation for high-growth innovative firms and negative autocorrelation for non-innovative firms emerges. This suggests that being active in innovation tends to stabilise a firm's (high) growth pattern, i.e. a positive high-growth episode of an innovative firm is rather likely followed by another positive high-growth period. On the other side, for non-innovative firms, negative autocorrelation of employment growth was found, i.e. these companies appear to be unable to repeat a positive growth achieved in one year in the following year again and, therefore, do not experience stable growth pattern (sustainable growth process with persistence of the created jobs). In addition, the dummy inserted for innovative firms was found to always be positive and significant, which confirms that being active in innovation and investing in R&D positively affects employment growth. This finding is a strong toehold for policies seeking to stimulate R&D and innovation activities as well as for those aiming at enforcing job creation in Europe. In fact, the results of this study suggest a stronger integration of the two policy fields since the individual effects (due to targeting only one of the two) might well be mutually reinforcing.

Looking at the dummy for young innovative companies (YICs), a clear cut between declining/low growth on the one hand and high-growth firms on the other emerged again. Being a YIC was found to have a positive effect in periods of decline (for actually declining firms), i.e. being young, small and investing intensively in R&D apparently helps such firms and they tend to decline more slowly. On the other side, just being small and/or young seems to be a "sufficient precondition" for potentially experiencing high-growth episodes: the control inserted for YICs is not significant for high-growth firms, while age and size enter the equation with a negative significant coefficient, and the aforementioned dummy for innovative firms with a positive sign. These findings are in line with previous empirical evidence on Spanish firms which suggests in the case of YICs less persistent and more erratic innovation behaviour (García-Quevedo *et al.*, 2011). Perhaps the lacking experience of such firms is reflected in this result.

In a nutshell, our findings suggest that, among the high-growth firms, small and young firms grow more in terms of employment. Being innovative stabilises a firm's growth pattern while not being an innovator has a negative effect on firms' ability to repeat a positive growth performance. Moreover, innovating actively and invest in R&D stimulates employment growth.[24] On the other side, while being small, young and R&D intensive (i.e. being a YIC) was found to have a positive effect for declining and low-growth firms (such firms are declining slower), belonging to this group of companies is not a significant explanatory variable for episodes of high employment growth.

All in all, these results suggest that returns to innovation are highly skewed and that spending on innovation provides remarkable chances of growing sustainably, thus creating persistent jobs and being commercially successful. However, as we all know, even substantial R&D expenditures do not ensure high growth for a firm (Scherer, 1999), or said in other words, stimulating R&D and innovation does not necessary lead to observable growth in the short term, particularly not in terms of employment. In fact, technological advancement is often even labour-saving (Harrison et al., 2008; Dachs and Peters, 2011; Bogliacino *et al.,* 2011). Therefore, a company might grow considerably in terms of sales while no employment growth is occurring. Accordingly, in the case of YICs it might be reasonable to expect a higher sales growth due to the successful introduction of new products in the market (Czarnitzki and Delanote, 2012) rather than substantial employment growth.

In order to test whether this is the case, we repeated the quantile regression presented above (made for employment growth) and conducted a separate regression for sales growth (see Table 3, Appendix). Equivalent as above, i.e. also with regard to sales growth, the empirical results suggest a clear distinction between declining/low-growth firms on the one hand and high-growth firms on the other. Among declining firms, innovative firms show a random growth path (which is confirmed also for low-growth and high-growth firms), while for non-innovative firms a negative first-order autocorrelation was found, which turns to be non-significant if growing and high-growth firms are considered. In other words, being a non-innovative firm increases the pace of decline (accelerates downturns), while it does not influence a positive growth pattern. In contrast to the results obtained for employment growth, the control inserted for YICs is significant only for high-growth firms and enters the equation with a positive sign. This result suggests that young, small and R&D intensive companies are likely to experience higher / faster sales growth[25] (whereas they do not show high employment growth, *c.p.*).

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[24] The latter result is in line with Calvo (2006) who, while analyzing a panel of Spanish manufacturing firms, has shown that any activity leading to both process and product innovations is a strong positive factor in the firm's survival and its employment growth. See in this regard also Ciriaci *et al*., 2012.

[25] As pointed out by Ciriaci, *et al.* (2012), size matters a lot in terms of sales growth, but the sign of its influence changes along the distribution of company growth rates. The variable has a positive impact on extreme negative growth episodes (column "Q10") and a negative impact on extreme positive growth episodes (and was found to be significant in all quantiles). That is to say, larger firms are less likely to experience decline, i.e. as bigger a firm is the lower the rate at which sales growth is declining. Smaller firms, in turn, are more likely to experience positive and high sales growth. A positive effect of size on lower quantiles (declining firms) combined with a negative effect on upper quantiles (high-growth firms) indicate that larger firms experience a lower variance in growth rates, i.e. are less likely to either experience fast decline or fast growth in the following years. The latter may provide a toehold for corresponding policy making which aims at accelerating the EU's overall growth patterns by targeting smaller firms.

5 Conclusions

This study has analysed the organic employment growth patterns of a panel of Spanish firms over the years 2002-09 to verify whether changes in employment are persistent over time or not, whether such persistence (if any) differs between innovative and non-innovative firms, and to which extent (if any) it is affected by firm's size, age, and R&D intensity.

Overall, the main message of the paper is that employment creation is persistent over time in the case of innovative firms and it is not in the case of non-innovative firms. More specifically, a number of stylised facts emerged from the empirical analyses:

- Innovative firms are more likely to experience high employment growth episodes compared to non-innovative firms.
- Performing intramural innovation activities apparently helps to stabilise a firm's growth pattern over time; i.e. for innovative firms a positive high-growth episode is more likely to be followed by another period of high growth (which overall allows such firms to embark on a higher growth path than without performing innovative activities; see point above).
- In turn, non-innovative firms which were found to have high employment growth in one period appear to be widely unable to keep this pace of job creation in the next period. In fact, a negative autocorrelation of employment growth was found pointing to a rather unstable growth pattern over time.
- Being a relatively small and/or young firm seems to be "sufficient" for increasing the probability of experiencing high employment growth. In other words, such firms can achieve high employment growth even without innovation activities and significant R&D spending (c.p.).
- Larger and older firms have a bigger buffer in times of declining growth, likely because they typically have a more diversified portfolio and the ability to benefit from economies of scale.
- Finally, firms that fall into the category of YICs appear to decline slower during downturn periods but they do not necessarily grow faster / create more jobs than others in times of growth. However, they were found to be more likely to experience (persistently) high sales growth.

All these findings confirm the important role that innovative companies can play in helping the economies to accelerate job creation at the exit of the economic crisis and to ensure more stable levels of employment in the longer run. Putting innovation at the core of the Europe 2020 strategy for smart, sustainable and inclusive growth has reflected the recognition of the mutually reinforcing role of the research and innovation and employment policy agendas. In this context, the Innovation Union and the Industrial Policy initiatives in particular have outlined a number of policy measures that would favour the growth of innovative companies in Europe.

The empirical evidence provided in this study reinforces in particular the urgent need to put in place relevant support instruments targeting the growth of innovative companies in Europe, as well as those aiming at broadening the number of existing companies that undertake innovative activities in order to remain competitive. These instruments include also a dedicated SME instrument that, within the next financial support framework for research and innovation (2014-2020) – Horizon 2020 –, will address the needs of innovative SMEs. Extending the analysis of this paper to broader datasets, to cover companies located in other Member states, and deepening it for key sectors could reinforce the evidence base necessary to a proper design of this kind of support instruments.

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APPENDIX

Table A1: Sample composition (by NACE 2009 sector classification codes) - Panel data of innovative firms 2002-2009, and total firms population in 2009

Sector of activities / name	Number of firms in the sample	Size	Turnover	R&D Expenditure intramural	Innovation expenditure	R&D performing firms	Total number of Spanish firms in 2009	Share of firms in the sample (2002-2009) to the total Spanish firms in 2009
	Total in the sample	Total No. of employees	€ (x 1000)	€ (x 1000)	€ (x 1000)	Share over total (%)	Total	Share over total (%)
B Mining & Quarring	**32**	**7,062**	**1,091,742**	**4,644**	**4,289,730**	**0.97**	**2,916**	**1.10**
C Manufacturing	**1,509**	**347,760**	**122,997,602**	**1,370,893**	**2,843,496**	**45.67**	**50,943**	**2.96**
(only activities' sub-sectors specified below)								
C10 Food products	244	67,124	25,157,017	71,311	264,291	*n/a*	25,689	0.95
C11 Manufacture of beverage	47	17,681	8,804'335	10,640	52,599	*n/a*	5,216	0.90
C20 Chemicals & Chemical products	307	40,560	14,862,231	139,667	231,262	*n/a*	3,997	7.68
C21 Basic pharmaceuticals products and preparations	115	35,202	17,700,935	554,271	938,272	*n/a*	416	27.64
C26 Computer, electronic and optical products	169	17,560	3,707,637	137,436	203,844	*n/a*	3,283	5.15
C27 Electronic equipment	151	40,308	9,662,792	120,504	203,457.	*n/a*	2,984	5.06
C28 Machinery and equipment	306	33,262	5876,098	109,427	156,797		7,071	4.33
C29 Motor vehicules, trailers and semi-trailers	170	96,063	37,226,557	227,637	996,431	*n/a*	2,287	7.43
E Water supply	**92**	**80,484**	**6,664,142**	**25,077**	**41,922**	**2.78**	**5,945**	**1.55**
F Construction	**176**	**131,099**	**30,491,773**	**75,983**	**97,987**	**5.33**	**557,110**	**0.03**
G Retail	**367**	**494,714**	**132,721,519**	**118,367**	**236,692**	**11.11**	**809,290**	**0.45**
H Transport & Storage	**112**	**117,673**	**18,645,373**	**44,410**	**185,042**	**3.39**	**234,798**	**0.05**
J Information & communication	**341**	**142,329**	**42,837,605**	**437,634**	**2,319,112**	**10.32**	**51,110**	**6.67**
K Financial & Insurance	**157**	**269,159**	**122,749,085**	**137,260**	**611,406**	**4.75**	**68,306**	**0.23**
M Scientific and technical	**408**	**99,378**	**11,807,028**	**862,495**	**1,009,943**	**12.35**	**409,641**	**0.10**
Q Health	**110**	**61,301**	**3,748,580**	**10,639**	**24,383**	**3.33**	**126,986**	**0.09**
TOTAL	***3,304***	***1,437,975***	***493,754,449***	***1,553,006***	***8,816,217***	***100.00***	***2,488,473***	***0.13***

Data sources: *Instituto Nacional de Estadística* (the Spanish National Statistics Institute) – INE (2011); Unpublished anoninized micro-data and INE's *Directorio central de empresas* (2012) available at www.ine.es/

Table 2 Quantile regression estimation of Eq. 4 for employment growth, innovative & non innovative firms, 10%, 25%, 59% 75% and 90% quantiles, years 2002-2009

Explanatory variables	(1) Q10	(2) Q25	(3) Q50	(4) Q75	(5) Q90
Lagged size	**0.00695*****	0.00157	0.000557	**-0.00429*****	**-0.00939*****
	(0.00228)	(0.00112)	(0.000585)	(0.00116)	(0.00206)
Innovative; 1st order lag	-0.0881	-0.0225	0.0183	**0.0434***	**0.0672****
	(0.0741)	(0.0294)	(0.0221)	(0.0211)	(0.0381)
Non-innovative; 1st order lag	0.0708	0.0343	-0.000732	-0.0169	**-0.0864*****
	(0.0687)	(0.0316)	(0.0209)	(0.0197)	(0.0303)
Innovative; 2nd order lag	-0.0143	-0.0101	0.0132	-0.00169	-0.00423
	(0.0342)	(0.0227)	(0.0164)	(0.0218)	(0.0503)
Non-innovative; 2nd order lag	0.0319	0.0394*	0.0178	0.0333	0.0208
	(0.0354)	(0.0216)	(0.0162)	(0.0215)	(0.0491)
Dummy for innovative firms	**0.0559*****	**0.0222*****	**0.00910*****	**0.0143*****	**0.0215*****
	(0.00919)	(0.00277)	(0.00226)	(0.00446)	(0.00708)
YICs	**0.317*****	**0.208*****	**0.153*****	0.0758	-0.00535
	(0.0488)	(0.0422)	(0.0389)	(0.0496)	(0.0557)
Age	**0.0301*****	**0.00737*****	**-0.00253****	**-0.0190*****	**-0.0428*****
	(0.00627)	(0.00223)	(0.00107)	(0.00186)	(0.00435)
Manufacturing	**0.0377*****	-0.00546	-0.00446	**-0.0233*****	**-0.0596*****
	(0.0133)	(0.00817)	(0.00291)	(0.00648)	(0.0132)
Mining	-0.00300	-0.0139	-0.0154	-0.0256	**-0.0783*****
	(0.0411)	(0.0262)	(0.0102)	(0.0200)	(0.0248)
Water	**0.0584****	**0.0331*****	**0.0206*****	0.00267	-0.0336
	(0.0262)	(0.00875)	(0.00459)	(0.0103)	(0.0290)
Construct	-0.0476	**-0.0361*****	**0.00865***	**0.0379*****	0.0330
	(0.0298)	(0.0106)	(0.00506)	(0.00985)	(0.0221)
Retail	**0.0362****	0.0100	**0.0111*****	**0.0137***	-0.00113
	(0.0175)	(0.00785)	(0.00338)	(0.00814)	(0.0179)
Transport	**0.0724*****	**0.0214****	**0.0100****	-0.00316	-0.0328
	(0.0215)	(0.00833)	(0.00506)	(0.00986)	(0.0205)
R&D	0.0217	**0.0163***	**0.0284*****	**0.0428*****	**0.0488*****
	(0.0153)	(0.00890)	(0.00489)	(0.00712)	(0.0130)
Finance & insurance	**0.0713*****	**0.0309*****	**0.0181*****	0.0109	-0.0203
	(0.0175)	(0.00886)	(0.00449)	(0.00861)	(0.0144)
Health	**0.0970*****	**0.0391*****	**0.0309*****	0.0155	0.00284
	(0.0195)	(0.00914)	(0.00739)	(0.0111)	(0.0258)
Observations	11,512	11,512	11,512	11,512	11,512

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Other controls: yearly dummies.

Table 3 Quantile regression estimation of Eq. 4 for sales growth for innovative and non innovative firms, 10%, 25%, 59% 75% and 90% quantiles, years 2002-2009

Variables	(1) Q10	(2) Q25	(3) Q50	(4) Q75	(5) Q90
Lagged size	**0.0345*** **	**0.0163*** **	0.00261	**-0.00924*** **	**-0.0221*** **
	(0.00293)	(0.00166)	(0.00160)	(0.00150)	(0.00276)
Innovative; 1st order lag	-0.00694	0.00998	0.0436	0.0540	0.164
	(0.0615)	(0.0356)	(0.0310)	(0.0570)	(0.154)
Non-innovative 1st order lag	**-0.114***	**-0.0568***	**-0.0559***	-0.0729	-0.206
	(0.0604)	(0.0345)	(0.0292)	(0.0560)	(0.157)
Innovative; 2nd order lag	-0.0301	-0.0157	-0.00716	0.00246	-0.00400
	(0.0197)	(0.00962)	(0.0125)	(0.0280)	(0.0552)
Non-innovative; 2nd order lag	0.0123	0.00521	0.00205	-0.00617	-0.00376
	(0.0207)	(0.00955)	(0.0106)	(0.0257)	(0.0503)
Dummy for innovative firms	**0.0252***	**0.0158****	**0.0175*** **	**0.0229*** **	0.0260
	(0.0144)	(0.00655)	(0.00373)	(0.00698)	(0.0232)
YICs	-0.315	-0.467	0.0601	0.193	**0.456***
	(0.263)	(0.322)	(0.321)	(0.411)	**(0.242)**
Age	0.00886	0.00220	**-0.00839*** **	**-0.0277*** **	**-0.0598*** **
	(0.00787)	(0.00342)	(0.00239)	(0.00325)	(0.00897)
Manufacturing	0.0286	-0.00500	-0.00977	**-0.0233****	-0.0353
	(0.0227)	(0.0122)	(0.00601)	(0.0105)	(0.0231)
Mining	0.0112	**-0.0431*** **	**-0.0492*** **	-0.0431	-0.0300
	(0.0332)	(0.0166)	(0.0157)	(0.0263)	(0.0455)
Water	0.0331	0.0338	**0.0321*** **	0.0169	**0.0483****
	(0.0556)	(0.0226)	(0.0104)	(0.0110)	(0.0222)
Construct	-0.0419	-0.0134	0.0200	**0.0737*** **	**0.117*** **
	(0.0381)	(0.0194)	(0.0133)	(0.0159)	(0.0292)
Retail	0.0410	0.00609	0.000347	-0.00241	-0.0251
	(0.0312)	(0.0125)	(0.00533)	(0.0101)	(0.0251)
Transport	**0.0904*** **	**0.0336****	**0.0135****	-0.00164	0.00775
	(0.0197)	(0.0136)	(0.00573)	(0.0127)	(0.0278)
R&D	0.00321	**0.0291***	**0.0356*** **	**0.0612*** **	**0.132*** **
	(0.0341)	(0.0157)	(0.00798)	(0.0108)	(0.0288)
Finance & insurance	**0.0493***	**0.0290***	**0.0530*** **	**0.0925*** **	**0.144*** **
	(0.0298)	(0.0151)	(0.00734)	(0.0150)	(0.0369)
Health	**0.116*** **	**0.0628*** **	**0.0432*** **	**0.0250***	0.0121
	(0.0207)	(0.0124)	(0.00485)	(0.0152)	(0.0363)
Observations	11,512	11,512	11,512	11,512	11,512

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Other controls: yearly dummies.

Excursus: The quantile regression approach

The general model applied in this study can be written as (Buchinsky, 1998; Koenker and Hallock, 2001):

$$y_{it} = x_{it}^{'}\beta_{\mu} + u_{\mu it} \qquad with \qquad Quant_{\mu}(y_{it}/x_{it}) = x_{it}^{'}\beta_{\mu} \tag{2}$$

where y_{it} is the vector of employment or sales or innovative sales growth rates; x_{it} is a vector of regressors; β is a vector of parameters to be estimated, and $u_{\mu it}$ is a vector of residuals whose distribution is unspecified (equation (1) assumes that $u_{\mu it}$ satisfies the quantile restriction Quant ($u_{\mu it}$ /x_{it}) = 0 only; (see Buchinsky, 1998). In this way, Quant (y_{it}/x_{it}) refers to the μ^{th} conditional quantile of y_{it} given x_{it}. The μ^{th} regression quantile, $0 < \mu < 1$, solves the following problem:

$$\min_{\mu}\left\{\sum_{i,t:y_{it}\geq x_{it}^{'}} \mu\left|y_{it} - x_{it}^{'}\mu\right| + \sum_{i,t:y_{it}<x_{it}^{'}} (1-\mu)\left|y_{it} - x_{it}^{'}\mu\right|\right\} = \min_{\mu}\frac{1}{n}\sum_{i=1}^{n}\rho_{\mu}(u_{\mu it}) \tag{3}$$

where $\rho_{\theta}(u_{\theta it})$ is the so-called 'check function', which is defined as follows:

$$\rho_{\mu}(u_{\mu it}) = \begin{Bmatrix} \mu u_{\mu it} & if & u_{\mu it} \geq 0 \\ (\mu - 1)u_{\mu it} & if & u_{\mu it} < 0 \end{Bmatrix} \tag{4}$$

Equation (2) is then solved by linear programming methods.

By increasing μ continuously from 0 to 1, one traces the entire conditional distribution of y, conditional on x (Buchinsky, 1998).

Given that any data set has a finite number of observations, the previous statement implies that only a finite number of quantiles will be identified and numerically distinct. As shown by equation (3), $\rho_{\theta}(.)$ is a weighted sum of absolute deviations, which gives a robust measure of location, so that the estimated coefficient vector is not sensitive to outlier observations on the dependent variable (in other words, the parameter vector estimate is robust to outliers; Coad, 2006). Therefore, when the error-term is non-normal, quantile regression estimators may be more efficient that OLS estimators (Buchinsky, 1998). In addition, in case of quantile regressions the error terms do not need to satisfy the restrictive assumption according to which they must be identically distributed at all points of the conditional distribution.

European Commission
EUR 25807 – Joint Research Centre – Institute for Prospective Technological Studies

Title: Innovation and Job Creation. A sustainable relation?

Authors: Daria Ciriaci, Pietro Moncada-Paternò-Castello and Peter Voigt

Luxembourg: Publications Office of the European Union

2013– 23 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1831-9424

ISBN 978-92-79-28533-2

doi:10.2791/76791

Abstract

This study compares the growth patterns of innovative and non-innovative firms focusing on whether there are systematic differences in the persistence of the jobs created by these two categories of firms. Using data from a unique longitudinal dataset of 3,300 Spanish firms over the years 2002-2009, obtained by matching different waves of the "Encuesta sobre Innovación en las Empresas españolas" and adopting a semiparametric quantile regression approach, we examine employment serial correlation.
The empirical results of the study indicate that the jobs created by innovative firms generally appear to be rather persistent over time whereas those created by non-innovative firms do not. Among declining firms, non-innovators tend to deteriorate faster in terms of economic performance. In addition, among those firms experiencing high organic employment growth, smaller and younger innovative firms grow more on average than larger innovative firms. Overall, evidence suggests that being innovative supports and stabilises a firm's organic employment growth pattern and being smaller and younger seems to be a sufficient condition to experience high employment growth, i.e. – with regard to the latter – it is not necessary to have a comparably high R&D spending / being an R&D intensive company.

LF-NA-25807-EN-N

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ISBN 978-92-79-28533-2

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Publications Office