GROWINPRO

Growth Welfare Innovation Productivity

Working Paper

An empirical assessment of the role of SMEs in shaping sectoral productivity growth and innovation patterns

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Task 3.5 SMEs and industry dynamics

DE3.7: **An empirical assessment of the role of SMEs in shaping sectoral productivity growth and innovation patterns**

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Abstract

Historically, SMEs have been seen as playing an essential role in facilitating industrial dynamics and contributing to employment creation and generation of value-adding across advanced economies but also increasingly in emerging and developing countries. However, post-2008 European economies have experienced a notable slowdown in productivity growth. To better understand the reasons behind the stagnant growth in Europe in the past decade, this study aims to explore industrial dynamics across all firms' classes and ages in Europe, and their association with innovation and labour productivity. Our findings suggest that over the past decade, we observe slow business entry and exit dynamics across Europe except for ICT and professional services sectors which show a high degree of turbulence, especially in recent years. EU *de-novo* firms are on average larger, but they grow at a slower rate and take longer time to exit that signifies a 'prolonged creative destruction process'. Our results also reveal that large firms still appear to play a more critical role in the value generation process, showing a clear premium gain in labour productivity as compared to their SMEs' counterparts. Finally, we also observe some differences along the North-periphery (South-East) divide, reflected in industry dynamics figures.

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1. Introduction

This working paper is a part of Task 3.5 of the GROWINPRO project. It focuses on the role of small-medium firms (SMEs) in shaping sectoral productivity growth and innovation patterns within the overall business dynamics. Our research aims to study the role of SMEs in business dynamics in the EU, and to explore differences in firm productivity growth across firms of different sizes, utilizing the uniquely assembled firm-industry-cross EU countries longitudinal dataset. This also includes exploration of the industrial (e.g. concentration) and technological patterns of SMEs contribution to productivity growth, especially from the perspective of advanced and converging EU economies.

This work builds on our previous work within the GROWINPRO project where we explored determinants of productivity gap in Europe from a multi-level perspective (see Bruno et al., 2019[1]). In this task, we aim to build on this work and explore: a) industrial dynamics across the EU27 and the UK, and b) the role of SMEs in industrial dynamics; and (c) study the role of SMEs in shaping innovation and productivity patterns in the region. The basis for exploration is the Amadeus database provided by the BvD[2] , which is the major commercial source of internationally comparable data on firms. Our focus is on the European economies covering the period from 2010-2016.

As SMEs have often been interchangeably associated with entrepreneurs, a lot of focus has been placed by European officials on designing policies to promote SMEs and address various constraints they face to facilitate their contribution to employment creation and growth. As our study reveals, the role of SMEs in shaping productivity growth and innovation patterns in Europe maybe, to some extent, exaggerated. Indeed, historically, they have been an essential vehicle in shaping industrial dynamics and growth in the region, and they do account for the dominant majority of the business population in Europe, and they do explain growing employment in the region. However, a few notable patterns of industrial dynamics in the region we reveal confirm (a) a sluggish business dynamics in the region with a few exceptions like ICT and professional services sectors; (b) a stagnant growth over their life span signifying higher presence of 'life-style businesses' with little ambition to expand, bearing no resemblance to Schumpeterian entrepreneurs underlying the process of creative destruction; (c) SMEs' positioning behind large firms in contributing to labour productivity levels.

In the next section, we review the literature that underlies our exploration of industry dynamics and the role of SMEs in Europe. Section three explores the methodological issues that arise from using the Amadeus database as the most prominent commercial

[1] Bruno, Douarin, Korosteleva Radosevic (2019) "Determinants of Productivity in the EU: A Multilevel Perspective", GROWINPRO Working Paper

[2] https://www.bvdinfo.com/en-gb

internationally comparable source of data on enterprises. Section four provides a brief outline of business demography landscape in the EU based on the Amadeus database. Section five presents stylized facts of industry dynamics based on the Amadeus database. Section six presents the role of SMEs in industry dynamics, and part seven explores econometrically the role of SMEs vs large firms in productivity dynamics. Conclusions summarise the key findings of this study and outline issues for further research.

2. Literature review

Small and medium-sized enterprises (SMEs) are often associated with entrepreneurship advocated by Schumpeter (1934) as the principal cause of economic growth. The underlying model is that SMEs introduce new products and services, disrupt the economy, displacing old products and production processes, followed by rapid imitation by new competitors. However, this highly stylized picture of the process of 'creative destruction' which is seen as essential to the dynamic capitalist economy does not necessarily correspond to the reality of contemporary economies. SMEs population is fairly heterogeneous in terms of growth ambitions and value-adding potential, and not all of them reflect stylized picture of entrepreneurial activity envisaged by Schumpeter (see, for example, Parker 2018[3], for a good overview of literature). Nevertheless, historically, SMEs have been playing an essential role in underlying a shift from a 'managerial economy' relying on large firms during the 1950-70s when size, product standardization and massive production mattered the most for economic development, to 'entrepreneurial economy' dominated by smaller-sized firms (Carree and Thurik, 2006)[4]. The turbulence of the 1970s/1980s has led to the emergence of smaller firms driven by intensified competition from multinationals that put pressures on larger firms triggering their deconstruction into smaller-sized units, outsourcing of some activities overseas, and structural shift from manufacturing to services. With response to fluctuation in demand during the period of economic instability, there is a trade-off between efficiency and flexibility. SMEs may be, on average, less efficient than larger firms, but they have lower marginal adjustment costs over time (Carree and Thurik, 2006).

Since then, SMEs have become the backbone of advanced economies worldwide. Across the OECD countries, SMEs account for 70% of the enterprise population. They generate between 50-60% of value-added. In emerging and developing economies, SMEs contribute

[3] Parker, S. (2018) The Economics of Entrepreneurship. Cambridge University Press: Cambridge, second edition.

[4] Carree, M. and R., Thurik (2006) *Entrepreneurship and Economic Growth,* Cheltenham, UK, and Northampton, MA: Edward Elgar.

to 33% of GDP and account for 34% and 52% of total employment respectively (Cusmano, L., Koreen, M. and Pissareva, L., 2018)[5].

While SMEs are seen as intrinsic to the process of creative destruction as discussed above, 'creative destruction' is not the only process taking place in a market economy but also 'creative accumulation'(Bergek et al., 2013[6]). This notion emphasizes the vital role played by incumbents via incremental innovation in the process of R&D activities which was also implicit in Schumpeter's later work labelled as 'Schumpeter Mark II'(1942[7]). 'Creative accumulation' is strongly present in industries where incumbents can withstand technological pressures from entrants as no single breakthrough is likely to change the basis for competition Also, data on firms' demography show quite important role of incumbents in driving industry dynamics.

Literature suggests that these two mechanisms are not alternatives but possibly complements. For an incumbent firm positioned closer to the technology frontier, more intense competition may lower its post-innovation rents through 'knowledge leakage' or spillovers. However, it would reduce the rents of a non-innovating incumbent even more. Therefore, it is in the interest of an incumbent to continue engaging in incremental innovation, underlying the process of 'creative accumulation', to escape a neck-to-neck competition from a new entrant (Aghion and Akcigit, 2015[8]). Respectively, 'creative destruction' may reinforce 'creative accumulation'.

A good example of the interaction and dynamics of the relationships between incumbents and entrants is Brown, J. David and Earle, John S., (2010[9]). They explore the relationship between so-called 'Superior entrants' vs 'Superior incumbents' hypotheses on the example of the US and transition economies. Superior entrants are new firms that embody technology and methods at the frontier, which is assumed to be continuously advancing. On the other hand, superior incumbents may dominate due to ex-ante uncertainty among entrants and investment by incumbents can represent an alternative source of growth. The empirical research by Brown and Earle (2010) shows support for both hypotheses. Their conclusion is

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[5] Cusmano, L., Koreen, M. and Pissareva, L., 2018. 2018 OECD Ministerial Conference on SMEs.

[6] Bergek, A., et al., (2013) Technological discontinuities and the challenge for incumbent firms: Destruction, disruption or creative accumulation? *Res. Policy* (2013), http://dx.doi.org/10.1016/j.respol.2013.02.009

[7] Schumpeter, J. A. 1942. Capitalism, socialism, and democracy. New York: Harper and Brothers.

[8] Aghion, P. and Akcigit (2015) Innovation and Growth: The Schumpeterian Perspective, http://www.coeure.eu/wp-content/uploads/Innovation-and-Growth.pdf.

[9] Brown, J. David and Earle, John S., Entry, Growth, and the Business Environment: A Comparative Analysis of Enterprise Data from the U.S. and Transition Economies (September 1, 2010). GMU School of Public Policy Research Paper No. 2011-07; US Census Bureau Center for Economic Studies Paper No. CES-WP- 10-20. Available at SSRN: http://ssrn.com/abstract=1687786

that: '*The superior entrants model, therefore, seems to apply only to the early stages of the reform process, while experimentation including substantial adaptation by incumbents, is a more appropriate characterization for more mature transition as well as for the US economy (as)…incumbents do have significant possibilities to differentiate themselves and to improve their performance, when conditions improve sufficiently*' (ibid).

The relationship between incumbents and entrants is part of the complex dynamics of shifts in the composition of the population of firms through the entry, exit, expansion and contraction in developing and creating new processes, products and markets. This complexity defies simple generalizations about the 'creative destruction' as the primary driver of growth. Several results from the literature illustrate well the issue (Bartelsman, Haltiwanger, Scarpetta, 2009). First, firm turnover rates are not directly related to GDP levels and rates. Second, relatively high firm turnover rates are observed both in countries with high-income levels and/or high growth rates as well as in poorer and/or slow-growth countries (and vice versa). Third, it is not clear whether there is a definite relationship between firm turnover and economic performance, but also because there could be measurement problems that affect the cross-country comparisons of firm turnover. Finally, simple cross country comparisons on specific dimensions may be misleading or inadequate (ibid).

What underlie these features are stylized facts of industry dynamics which are characterized by the following (Dosi et al., 1997)[10]:

a) *Microeconomic heterogeneity* which is present within industries and is characterized by significant differences in firms' characteristics, behaviour and performance. Heterogeneity emerges at any level of aggregation, and not only in cross-section but also over time: during any time-interval observed changes among firms in the same industry are uneven and often quirky. Moreover, diversity is not merely associated with traditional 'explanatory variables' like location, industry, size, age or capital. Instead, it appears to be associated with a much larger degree with the unobserved firm- or business unit-specific factors (Dosi, 2005).

b) *Persistence*: microeconomic diversities appear to be persistent. For example, as far as innovation is concerned, high (low) innovators at time t have – all else equal – a higher probability of remaining high (low) innovators at time t+1. Profits do not seem to converge on a common rate of return. The persistence of diversity corresponds to an evolutionary notion of idiosyncratic learning, innovation (or lack of it) and adaptation which are firm-specific

[10] Dosi, G., F. Malerba, O. Marsili and L. Orsenigo (1997) Industrial Structures and Dynamics: Evidence, Interpretation and Puzzles, *Industrial and Corporate Change*, 1997.

(Dosi, 2005[11]). Dosi et al. (2019) using an extensive integrated database on Italian companies and exploring several performance indicators is an excellent example of a dynamics of substantial polarization of firm performances within industries.

c) *Turbulence*: Most industries are characterized by high degrees of turbulence, due to entry, exit and changes in market shares. Exit rates tend to be high too, however, resulting in high turbulence and smaller net entry as compared to gross entry. In general, a positive correlation is observed between rates of entry and rates of exit across industries. Industry profitability does not seem to have any significant effect on entry and exit, which are instead positively correlated with industry growth.

d) *Mechanism of productivity growth*: An overwhelming amount of evidence converges on the description of the typical dynamic pattern of industries as involving continuous (albeit not time-invariant) entry, exit and expansion/contraction of incumbents.

e) *Invariant structural patterns*: Jointly with heterogeneity and turbulence there are also some striking regularities. One of them is undoubtedly the persistence over time of a skewed distribution of both firms and plant size – approximating a Pareto distribution – that is somewhat similar in the manufacturing industry over time and across advanced countries.

f) *Industry-specific features*: Significant industry-specific differences emerge from the data. Capital intensity, advertising intensity, R&D intensity and ultimately innovation propensity– along with structural measures like concentration and performance measures like profitability – differ widely across sectors. Entry, exit and survival, persistence in firms' attributes and performances, and innovative activities and the firm's growth also exhibit significant inter-industry variability.

g) *Patterns of technical change and industry dynamics tend to be remarkably similar across countries in the same technological classes*. Also, highly concentrated sectors tend to be the same in all developed countries. These observations suggest that some 'structural' factors exist that are rather invariant across countries within the same industries and shape in similar ways the patterns of industry dynamics (Dosi et al., 1997).

In summary, empirical evidence '*suggests that entry is a risky proposition, most likely to result in exit, and that entry and exit act more as a screening mechanism selecting firms efficient enough to survive in an industry's oligopolistic core than an automatic adjustment mechanism that drives the economic product of incumbent firms to zero*' (Martin, 2001[12]). Most entrants, it appears, do not pass the test and withdraw from the market after a

[11] Dosi Giovanni (2005) Statistical Regularities in the Evolution of Industries. A guide through some evidence and challenges for the theory, LEM Working Paper 17, June, Sant'Anna School of Advanced Studies, Pisa

[12] Stephen Martin Industrial Organization: a European perspective, Oxford University Press, 2001.

relatively short period. Established incumbents compete oligopolistically among themselves, while an ever-changing group of small firms circle precariously on the edge of the market. As established firms are concerned, the nature of the fringe group as a whole does not change very often. The cost of moving from the fringe to the inner core of established oligopolistic firms depends on barriers to mobility[13] (Martin, ibid).

International comparisons of industrial dynamics suggest that a high degree of turbulence/ churning (entry + exit) exist in all countries. Also, in all countries, net entry (entry minus exit) is far less important than the gross flows of entry and exit that generate it (Bartelsman, Haltiwanger and Scarpetta, 2004).

Given the importance of entry in relation to SMEs, it is worth referring here to Geroski (1995[14]) summary of stylized facts regarding entry. First, entry is common. Large numbers of firms enter most markets in most years, but entry rates are far higher than market penetration rates. Second, entry and exit rates are highly positively correlated, and net entry rates and penetration are modest fractions of gross entry rates and penetration. Third, the survival rate of most entrants is low, and even successful entrants may take more than a decade to achieve a size comparable to the average incumbent. Fourth, *de novo* entry is more common but less successful than entry by diversification. Fifth, entry rates vary over time, coming in waves which often peak early in the life of many markets. Different waves tend to contain different types of entrants. Sixth, entry seems to be slow to react to high profits, and it has only modest effects on average industry price-cost margins. Finally, high rates of entry are often associated with high rates of innovation and efficiency increases. There is also evidence that the entry has a more positive effect on productivity growth in industries that are close to the technological frontier than in those that are not (Aghion et al., 2009[15]).

An area of significant interests in the literature is a pattern of growth of firms which is also promoted by the so-called Gibrat law (GL). It states that 'the probability of a given percentage change in the size of a firm over a given period for firms in an industry is independent of the firms' initial size. For example, if a company with sales of £10m doubles in size over some time, it is likely the same will happen for a company beginning with sales of only £1m. This type of firm growth has attractive property that over time it produces a

[13] For critique of the conventional approach to barriers to entry see Dennis W. Carlton, (2005) Barriers To Entry, NBER Working Paper No. 11645, September 2005

[14] Geroski (1995) "What Do We Know About Entry?" International Journal of Industrial Organisation, 13, 421-440

[15] Philippe Aghion, Richard Blundell, Rachel Griffith, Peter Howitt, Susanne Prantl, "The Effects of Entry on Incumbent Innovation and Productivity". Review of Economics and Statistics, February 2009.

highly skewed distribution of firms' sizes which are commonly observed in a wide variety of industries'. Formally Gibrat's law is stated as:

$$z_{t,i} = \beta z_{t-1,i} + \varepsilon_{t,i},$$

where t is an index for time, i is an index for the firms, and $z_{t,i}$ is the size of company i at time t ($z_{t-1,i}$ is analogously defined).

If Gibrat's Law is valid, and firm growth rates are distributed independently of firm size, the parameter β should be equal to unity.

If β>1 large firms are expected to grow more rapidly than their smaller counterparts and hence a tendency to concentration and monopoly

If β<1 small firms are expected to grow faster than larger enterprises denoting a 'reversion to the mean'.

Despite an extensive literature on Gibrat Law, the evidence '*shows that the law cannot adequately describe the growth dynamics across firms, essentially because the average and volatility of the growth rates depend on a multitude of factors like firm size, age, life cycle, or numerous sectoral specificities. (…) Essentially, the basic assumption of a common growth rate distribution that is invariant across firms of different sizes or industries seems questionable both from an empirical and theoretical point of view'*. (Mund et al., 2015[16]). The empirical literature suggests that there a few measurable factors that influence growth, but by far the largest source of variation in enterprise growth rates remain unaccounted for (Parker, 2009:310).

The availability of internationally comparable data on firm demography has enabled us for the first time to depict international differences in the 'creative destruction' processes across countries. The early research of this nature was Bartelsman, Haltiwanger and Scarpetta (2004[17], 2009[18]). Empirical evidence on creative destruction in 22 developed and developing countries shows that:

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[16] Philipp Mund, Simone Alfarano and Mishael Milakovic (2015) Gibrat's Law Redux: think profitability instead of growth Industrial and Corporate Change, 2016, Vol. 25, No. 4, 549–571

[17] Bartelsman, Haltiwanger and Scarpetta (2004), Microeconomic Evidence of Creative Destruction in Industrial and Developing Countries, Discussion Paper No. 1374, October 2004, IZA . Available at http://ftp.iza.org/dp1374.pdf

[18] A slightly different version of this paper is available as chapter in: Eric Bartelsman, John Haltiwanger, Stefano Scarpetta (2009) Measuring and Analyzing Cross-country Differences in Firm Dynamics, In Timothy Dunne, J. Bradford Jensen, and Mark J. Roberts, editors, Producer Dynamics: New Evidence from Micro Data, University of Chicago Press, chapter URL: http://www.nber.org/chapters/c0480

- *Firm churning is large: gross firm turnover involves 10-20 per cent of all firms in industrial countries, and even more in transition and other emerging economies. Entering, but also exiting, firms tend to be small and thus firm flows affect only about 5-10 per cent of total employment. (…).*

- *Entry and exit rates are part of the same process. In most countries, entry and exit rates are correlated across industries. (…)*

- *Market selection is pretty harsh: about 20 to 40 per cent of entering firms fail within the first two years of life.(…).*

- *Successful entrants expand rapidly. Surviving firms are not only relatively larger but also tend to grow rapidly (…).*

- *Creative destruction is important for promoting productivity growth. While the continuous process of restructuring and upgrading by incumbents is essential to boost aggregate productivity, the entry of new firms and the exit of obsolete units also play an important role (.….).*

- *Creative destruction also promotes market contestability (and) productivity-enhancing strategies of incumbents".(p46-47)*

The majority of evidence on industry dynamics is based on individual country data, especially the US. However, among the catching-up economies, the CEE economies have been quite prominent regarding the availability of comparable data but also due to specific features during the transition period. The period of post-socialist transition has been an exceptional natural experiment to explore the characteristics of industry dynamics with the establishment of fully-fledged markets. Coupled with the lack of governmental regulations and reforms that led to greater flexibility in prices, wages and production decisions, the imbalances inherited from the planned economy created profitable opportunities for entrepreneurs (Welter and Smallbone, 2011)[19]. 'Creative destruction' framed as firm churning has been quite intensive during the transition period in the five Central and Eastern European countries in transition (Bartelsmann et al., 2004). The magnitude of firm creation and destruction was generally larger than that observed in industrial countries: many new smaller firms have been replacing obsolete larger units inherited from the centrally plan period.

Moreover, new firms have filled in new market niches enjoying, especially in the early years of transition, less competition and higher survival rates. This process was especially intensive in Poland after 1990. The number of entrants per industry grew from 4.26 in 1989–

[19] Welter, F. and D. Smallbone, 2011. Institutional Perspective on Entrepreneurial Behaviour in Challenging Environments. *Journal of Small Business Management,* 49(1): 107-125.

1990 to 10.88 in the following year and 31.94 in the peak year of 1991–1992. Over the same three years, the gross entry rate increased from under 22% to over 99%. However, most of the new post-transition entrants were very small relative to their industry counterparts (Roberts and Thompson, 2003[20]). However, market forces have quickly strengthened, and entry and exit rates stabilized and balanced, while failure rates among new firms increased (Bartelsmann et al., 2004). World Bank (2008: 16-34[21]) summarises stylized facts of creative destruction in transition economies. First, entrants tend to exhibit high survival rates at the beginning of the transition. Second, as Transition Proceeds, Productivity Growth is Driven Mainly by Efficiency Gains within existing Firms. Productivity gains within existing firms account for more than 80% of total manufacturing productivity growth in 'early reformers' and 30-60% in 'late reformers'. Third, net entry and reallocation are declining, converging toward advanced market pattern. This is a natural trend in line with Geroski's observations (1995) that decline is to be expected as business entry peaks early in the life of a market and declines once a market matures. As economies of scale emerge as a result of the market maturing, individuals may prefer income stability, while being employed by larger firms, over risky business initiatives.

The last ten years have seen an increasing focus on the phenomenon of the decelerating pattern of business dynamics in the US and Europe. It seems that this shift in the pattern of 'creative destruction' took place around the year of 2000 when the decline in dynamism and entrepreneurship has been accompanied by a decline in high-growth young firms (Decker et al., 2016[22]). However, other research suggests that this has been a long-term phenomenon. For example, the ratio of new firms (being less than one year old) to total firms in the US, has declined by around 50 per cent between 1978 and 2011 (Hopenhayn et al., 2018[23]). The declining share of young firms and the declining propensity for young firms to be high-growth firms has reduced expected skewness of firm growth rate distribution which indicate a deceleration in the 'creative destruction' processes. Data on the US show that the process of creative destruction is driven by innovation which leads to the large dispersion in productivity across firms within narrowly defined sectors and by high rates of entry and reallocations. With some lag, this leads to increased productivity. However, data also show that post-2000

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[20] Barbara M. Roberts and Steve Thompson (2003) Entry and Exit in a Transition Economy: The Case of Poland, Review of Industrial Organization 22: 225–243, 2003

[21] World Bank (2008) Unleashing prosperity. Productivity Growth in Eastern Europe and the Former Soviet Union, The World Bank, Washington, Available from: http://go.worldbank.org/NS2LJ69070

[22] Ryan A. Decker, John Haltiwanger, Ron S. Jarmin, Javier Miranda (2016) Where has all the skewness gone? The decline in high-growth (young) firms in the U.S., Working Paper 21776, http://www.nber.org/papers/w21776

[23] Hopenhayn, H., Neira, J., and Singhania, R. (2018). From Population Growth to Firm Demographics: Implications from Concentration, Entrepreneurship and the Labor Share. NBER Working Paper no. 25382.

these patterns have been changing (Foster et al., 2018[24]). It seems that the declining responsiveness is due to impediments to reallocations which then reduces aggregate (sectoral level) productivity growth (Haltiwanger, 2019[25]).

A critical phenomenon recognized in studies is the co-existence of a group of dynamic firms with much less technologically advanced firms' which nonetheless survive quite comfortably, possibly exploiting local markets niches' (Dosi et al., 2010, 2019 [26]). Dosi et al. (2010 and 2019) who noted this phenomenon in the case of Italy had labelled this the tendency toward *neo-dualism* as it involves the steady co-existence of the two types of firms. The explanations for this heterogeneity are to be found in firm-specific organizational capabilities though this is difficult to quantify. Dosi et al. (2010, 2019) also show the apparent weaknesses of markets in selecting more efficient firms despite external shocks like the 1999 introduction of Euro.

It seems that the phenomenon of declining 'creative destruction' proxied by declining entry rates and the share of young and small firms has become a feature of the most advanced economies. However, the evidence for developing countries suggests the opposite (Cusolito and Maloney, 2018[27]). Explanations for deceleration of entrepreneurship in advanced countries are the slowing of population growth, decreasing technological opportunities, growing market concentration, zombie-firm congestion, slower diffusion of knowledge, burdensome business regulations, increasing complexity of economies which deter entry and growth of small firms (Naude's, 2019[28]) or more delayed response to unchanged technological opportunities (Decker et al., 2015).

Summary

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[24] Lucia Foster, Cheryl Grim, John C. Haltiwanger, Zoltan Wolf (2018) Innovation, Productivity Dispersion, And Productivity Growth, Working Paper 24420, http://www.nber.org/papers/w24420

[25] John Haltiwanger (2019) Synthesizing Micro and Macro Evidence on the US Economy, NBER Reporter 2019:3

[26] Giovanni Dosi, Marco Grazzi, Chiara Tomasi, and Alessandro Zeli (2010) Turbulence underneath the big calm? Exploring the micro-evidence behind the flat trend of manufacturing productivity in Italy, LEM 2020/10 working paper, Scuola Superiore Sant'Anna, Pisa. Dosi, G., Guarascio, D., Ricci, A., & Virgillito, M. E. (2019). Neodualism in the Italian business firms: training, organizational capabilities, and productivity distributions. Small Business Economics, 1-23.

[27] Ana Paula Cusolito and William F. Maloney (2018) Productivity Revisited. Shifting Paradigms in Analysis and Policy, World Bank, Washington

[28] Wim Naudé (2019) The Decline in Entrepreneurship in the West: Is Complexity Ossifying the Economy? IZA Discussion Paper No. 12602, September

The aim of this literature review was not to be an exhaustive survey but to familiarise the reader with the context within which we want to explore the role of SMEs in business dynamics in Europe. Our conclusions are the following:

First, stylized facts of industry dynamics provide a more realistic view of the industry, then traditional equilibrium based theoretical models.

Second, creative destruction or firm churning plays an essential role in determining productivity growth. In most countries, entry rates tend to decline with firm size, consistent with the view that firms tend to enter small, test the market, and, if successful, expand to reach the minimum efficiency scale.

Third, while the continuous process of restructuring and upgrading by incumbents is essential to boost aggregate productivity, the entry of new firms and the exit of obsolete units also play an important role. The net entry process contributes positively to productivity growth.

Fourth, there has been declining business dynamics in the US, and Europe causes of which are not entirely clear but subject to an increasing number of studies based on higher firm-level quality data. This stands in contrast to developing countries where business dynamics have remained unchanged. In the European context, the magnitude of firm creation and destruction was generally more significant in the transition period for the CEE economies than that observed in advanced economies. However, this has been a temporary phenomenon as business dynamics in these countries has converged to advanced countries.

Fifth, within this context, our understanding of business dynamics in Europe is quite sketchy. Compared to the US, there is a dearth of comparative studies, and this is where this paper fills a specific gap. Also, a mixture of advanced and catching up economies in Europe is in itself quite a relevant feature whose business dynamics, especially in the post-2008 period has not been explored.

3. Methodology

The Orbis database (of which Amadeus is the European part) is very advantageous for examining the performance of large firms, for mean trends and within-firm responses. However, as well documented by Bajgar et al. (2020[29]) due to uneven coverage of Orbis it has to be analyzed with caution when it comes to inter-country comparisons, for example for

[29] Matej Bajgar, Giuseppe Berlingieri, Sara Calligaris, Chiara Criscuolo and Jonathan Timmis (2020) Coverage and representativeness of Orbis data, OECD Science, Technology and Industry Working Papers, No. 2020/06

examining properties of the entire firm distributions like productivity dispersions, and for the study of entry and exit.

In using Amadeus extensively for this project, we have become fully aware of its advantages and limitations. We think that its use for international comparisons of average trends is relatively reliable as well as for exploring intra-sectoral and intra-country distributions. Its use is indeed limited in the case of some countries, and for that reason, we have excluded Dutch data entirely and Danish data for 2010, 2011 and 2012.

We fully agree with Bajgar et al. (2020) that Orbis exit data are quite unreliable due to high attrition of companies, i.e. virtual exit of companies due to non-reporting rather than real death. Also, we fully agree that the coverage of micro-enterprises is quite poor across countries, but that does not undermine the use of entry rates. To minimize these biases of the database, we do not use data for the years 2017 and 2018, and thus we restrict the analysis to 2010-2016 period.

Also, Amadeus data on productivity is unbalanced and in some sectors and countries quite unreliable. So, database use requires careful cleaning for outliers which can be found in any sector, country, year. However, even with these caveats, which can significantly reduce the availability of valid data Amadeus still has coverage in the order of millions of firms which is unparalleled to other sources of firm-level information.

Our initial analysis was undertaken in a few stages to reveal outliers at different levels for variables of interest. The levels of analysis are comprised of the following steps: (I) country-year where all firm-level series were aggregated at country-year with visual and also descriptive statistics part helping to identify country-year outliers; (ii) country-sector; (III) sector-year; (IV) and country and sector averages.

We base the analysis on three distinct databases: the main database, trimmed and value-added database. We generate a separate database for value-added due to its importance in exploring different productivity issues (see section 7) but for which the number of observations goes significantly down.

For the **Main database**, we filter annual data for firms that have *both* turnover and employment data. We then trim the top and bottom 1% of the log(turnover/employment) distribution at the country-sector level. In this way, we trim 2% of the firms in each sector in each country, based on the log(turnover/employment) distribution in that country-sector. This eliminates outliers when we measure productivity as turnover/employment. This results in 3,515,161 firm-year observations and 842,612 firms.

For the **Trimmed database**, we take the main database, and we trim the top and bottom 1% of the log(turnover/employment) distribution at the country-sector level. In this way, we

eliminate from sample 2% of the firms in each sector in each country, based on the log(turnover/employment) distribution in that country-sector. In this way, we get rid of outliers. However, we are fully aware that the main feature of firms' distributions are huge differences in performance which generate highly skewed Pareto type distributions. This results in 3,485,254 firm-year observations and 584,729 firms.

For the **Value Added database**, we filter annual data for firms that have data for turnover, employment, and value-added. This gives us 1,338,392 firm-year observations and 206,785 firms. This significantly shrinks the size of the same when compared to the Mina database, but it enables us to use value-added as much more appropriate proxy for productivity. We also eliminate a few clear outlier firms in terms of value-added per employee based productivity.

The most substantial concern in the use of Amadeus (Orbis) emerges around the quality of **exit rates data**. We take the last year in which a firm has a number for either turnover or employment as the death year. However, if data on the firm are not regularly updated, we may be declaring as dead firms that are still operating. For example, firm whose information for 2017 and 2018 are not entered in Amadeus because they are not yet processed due to delay in data feed between the original data source (national statistical office) and Amadeus will be treated as exited in 2016. Respectively, we have high exit rate statistics occurring naturally in 2016-2018 due to delay in firm records' updating by data providers which make these years not reliable for further analysis. However, after addressing this issue and also a problem of the country and sector outliers, exit rates for a reduced period of 2010-2015 become more trustworthy (see Annex and stylized facts below about this issue). Also, all outliers identified at different levels of analysis are reported below.

Given endemic issues with exit data, net entry rates are not reliable and cannot be used unless some estimate is done for exit rates. Accordingly, survival rates are not reliable due to the high attrition rate of firms. For example, based on Eurostat data, the average 2-year survival rate in the EU between 2011-2017 is 70.7%. On average survival rates in Amadeus are higher than in Eurostat but not systematically. This may reflect the bias of Amadeus towards larger firms, as explained above.

Because of these issues, we have paid particular attention to the selection of countries, sectors, years and treatment of outliers. We have confined analysis mainly (though not only) on 19 sectors grouped into four broadly defined sectors: manufacturing (except coke and petroleum industries, and other manufacturing), utilities industries, ICT services, and professional services industries. We have excluded from analysis quite many sectors which are dominantly non-market sectors and where the issues of entry and exit and growth are strongly shaped by their institutional and other country-specific regulatory features. Alternatively, these are sectors which have highly concentrated market structure and where

the issue of creative destruction and SMEs is not central to their business dynamics. (see Annex Table A1). Annexe 3 describes the details of the treatment of outliers.

Additional issues with the database is cleaning of observations as many observations have negative or zero turnover values, or employment or observations for the firm are reported before the year of their reported incorporation or firms do not have specific NACE2 sector affiliation. A reader should trust us that we did our best to resolve these issues.

We present results across countries and sectors, and in some cases, we group EU countries into three groups. EU 'North' comprises of all advanced EU economies (Austria, Belgium, Germany, Denmark, Finland, France, Ireland, and Sweden) plus Great Britain; EU South includes (Italy, Spain, Greece and Portugal, and the EU East includes 'new member states' from Central and Eastern Europe. We exclude from the analysis small island states (Cyprus, Malta) and Luxembourg. Due to sparse data coverage, we had to exclude the Netherlands from the analysis altogether.

4. Key features of business demography landscape in the EU based on Amadeus database

Amadeus database contains data on over 17mln firms. However, as pointed out earlier, its coverage is quite uneven across firm sizes and countries — this caution against using it for longitudinal and for detailed inter-country analyses. Table 4.1 serves as a useful characterisation of business demography landscape that emerges from the database. The data are compiled by interpolating missing values for turnover and employment, filtering data based on firm-year observations that have both turnover and employment data, eliminating firms with negative turnover and with zero employment, and are restricted on 19 sectors listed in Annexe Table A 1.

Table 1 shows countries distribution by the average number of employees per firm; by the average size of firms classified as micro (1), small (2), medium (3) and large (4); by average age, by the number of patents and trademarks by firms, and by share of foreign subsidiaries in all subsidiaries per firm.

A careful reading of these indicators shows that the database reflects business demography of Europe only at the macro-regional level and that it is much less reliable for detailed comparisons among different countries. Some country examples are obvious discrepancies with the evidence-based on business registries. For instance, GB and DK have the biggest average enterprise or Greece has bigger average enterprise compared to Sweden. We

believe that this feature of the database is then reflected in other indicators like age, patents and trademarks. However, if we ignore distortions in the case of specific countries database well reflects broad differences among three EU regions: North, South and East. As broad tendency data show that on average North firms have bigger enterprises while EU East has the smallest with South being broadly in an intermediate position. These differences seem to be reflected in different patent, trademark intensities. Finally, a robust macro-regional feature is that share of foreign subsidiaries is much higher in the EU East and Ireland reflecting foreign-led modernisation of this region as well as weak organisational capabilities of local firms.

Table 4.1: Some key features of business demography landscape in the EU based on Amadeus database 2015

country	numberofemployees	avg_firm_size_category	avg_firm_age	avg_patents_per_firm	avg_trademarks_per_firm	% foreign subsidiaries
GB	250.58	2.28	19.19	6.23	1.28	0.46
DK	235.09	2.38	18.5	7.32	2.18	0.30
IE	168.28	1.71	12.26	0.34	0.38	**0.86**
FR	142.13	1.66	18.82	3.45	0.57	0.65
PL	93.01	1.81	15.02	1.14	0.19	0.24
DE	89.77	1.51	20.51	6.63	0.47	0.07
BE	86.24	1.84	21.2	2.3	0.62	0.51
AT	59.54	1.54	18.81	1.21	0.38	0.12
GR	43.42	1.8	20.28	0.09	0.19	0.24
SE	29.01	1.13	13.37	0.99	0.15	0.18
FI	26.14	1.15	14.69	0.7	0.19	0.48
IT	26.06	1.42	15.09	0.6	0.27	0.07
ES	20.58	1.25	14.71	0.21	0.17	0.47
CZ	18.66	1.26	12.65	0.2	0.03	0.12
LT	15.34	1.29	9.75	0.02	0.02	0.21
SK	12.29	1.15	8.76	0.03	0.01	0.54
RO	10.88	1.13	8.91	0.01	0.01	0.17
PT	10.16	1.15	11.81	0.02	0.06	**0.77**
SI	9.83	1.15	12.48	0.08	0.06	**0.77**
HU	8.71	1.11	11.1	0.06	0.01	**0.83**
HR	8.29	1.13	10.68	0.01	0.01	**0.70**
BG	7.01	1.1	8.21	0.01	0.01	0.05
EE	5.1	1.08	8.67	0.01	0.02	**0.96**
LV	4.68	1.06	6.9	0.01	0.01	0.29

Source: Authors' calculations based on Amadeus data 2015. Cells coloured in red show the bottom 20% of distribution, and cells highlighted in green – the top 20% of the distribution.

This initial insight into database suggest that the stylized facts that follow in the next section should be considered as what they are – stylized facts – which point to broad tendencies but where variability in data is often too large and thus may not satisfy a reader that looks for methodological rigour. However, we consider this necessary first step in the analysis. A second step and econometric testing of some of the relationships of interests would require 'weighting' or 'normalization' of Amadeus distributions to distributions which may be expected based on business registry data. This seems to us as the best way to exploit all advantages of Amadeus while also ensuring methodological rigour. With that in mind, we turn to stylized facts of industry dynamics based on the Amadeus database.

5. Selected stylized facts (SF) of industry dynamics based on the Amadeus database

In this section, we provide the main stylized facts of business dynamics using data on entry, exit, the average size of entrants, average and total market share of entrants, turnover, employment, productivity, the ratio of productivity between the top and bottom deciles of firms' distribution, and relative size of entrants after 2 and 5 years.

SF1: The EU business dynamics measured by entry and exit are low and stagnant

- **Entry rates in the EU are relatively low with a country-year mean (median) being equal to 2.7% (1.9%) and standard deviation of 2.1 that indicates little variation across country-years with a few exceptions.** No entry (0%) is observed in Greece in 2010 which may have been expected in light of Greece being hit the most by debt crisis around this time, and a maximum of 10.7% - in Latvia in 2011. (see table A 2.1). There is little variation across years though 2010 recorded the minimum average rate of 2.5%, which may be a reflection of the post-2008/9 global financial and Eurozone crisis. Overall, the average country-year entry rates in the EU remain relatively low which possibly reflects not only lower business dynamics in the EU but also post-2008 crisis period which presumably has stifled entrepreneurial activity, as particularly evidenced in Greece throughout 2010-2014.

SF2: Business entry is still more prevalent in Southern and Eastern EU economies

- The top 20th centile of distribution (entry rate 4.6% and higher) includes Bulgaria, Croatia, Latvia, Romania and Portugal. This is quite surprising as we would have expected that by 2010 business dynamics of the CEE has converged fully to business

dynamics of other EU economies. The latter is the case for Poland, whereas in case of Slovakia has one of the lowest entry rates not only among ex-transition economies but also across Europe. Slovakia is joined by other European countries that fall within the bottom 20th centile of distribution (with an entry rate of 0.63% and lower) (see Table A 2.1). This pattern is also observed at a country-sectoral level. A high rate of entry (eq. to 4.1% and higher) is present in Latvia, Romania, Croatia and Bulgaria across almost all sectors. Estonia exhibits higher entry rates across many manufacturing sectors (pharmaceuticals, basic metals and fabrics, and electronic equipment), but also IT and other information services, and other professional services (see Table A 2.2). The latter sector shows high entry rates across many EU countries, but primarily CEE economies, and also across time.

- Belgium's entry rates remain the lowest ones consistently across all sectors. Slovakia is an exception from CEE economies where entry rates are particularly low, closely following Belgium (Table A 2.2).

SF3: Exit rates progressively increase over time, but overall remain low.

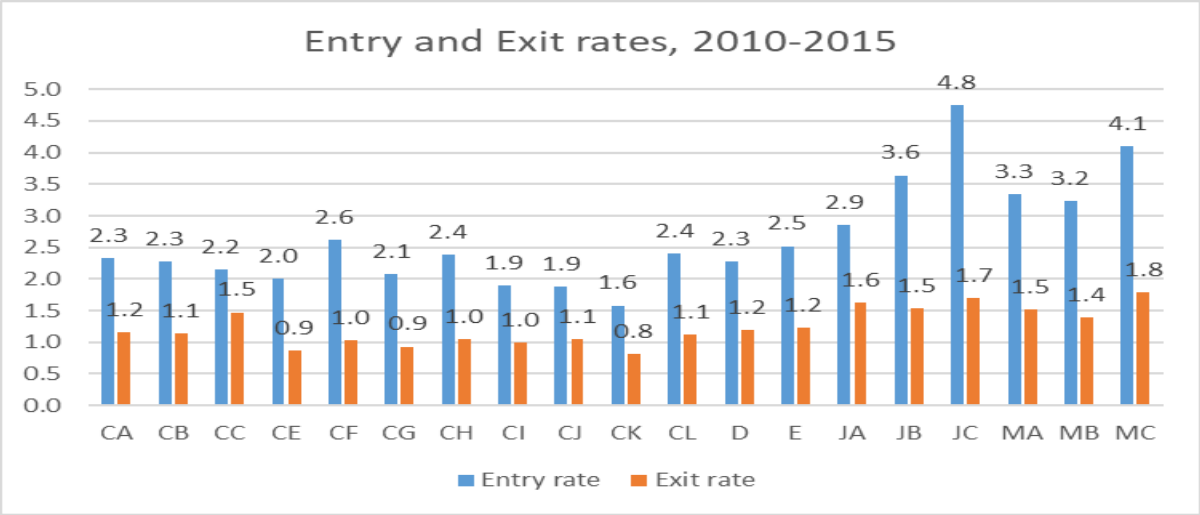
- After removing some outliers as described in Appendix 1, exit rates generally remain low, especially when contrasted with entry rates. The country-year mean (median) is 1.25 (0.6%) and standard deviation equal to 1.6%.
- While entry rates remain relatively steady over time, exit rates progressively (but not consistently across all countries) increase over time (see Table A 2.3). However, we consider this to be a quirk of the database due to delay in recording data on companies in the last several years. For this reason, we do not explore the dynamics of exit rates to the extent that we explore other variables.
- The unusually high exit rates in some countries (Bulgaria, Spain, France) seem to be the result of accelerated attrition rate of firms in the database. If we discount for this feature of the database, it appears that only Great Britain and Ireland have continuously higher than average exit rates.

SF4: ICT services sector exhibits higher turbulence

Dynamics of competition process is driven by a variety of factors among which industry-specific barriers to entry play an essential role. Sectors with lower fixed investments and more significant market and technological opportunities are expected to have a more dynamic creative destruction process. Data for the EU confirm this stylized fact (Figure 5.1).

- Entry rates across sectors are much more varied when compared to exit rates which may reflect peculiarities of Orbis database but also may reflect the interaction among much more diversified entry opportunities and slower process of market selection which work more similarly across sectors. Below we refer to this feature as 'prolonged creative destruction process'.
- Entry rates are particularly high in ICT services sectors and together with sector average exit rates generate high churning effect or market turbulence. Churning is also high in professional services, reflecting lower barriers to entry and exit. On the other hand, manufacturing and utilities is much less dynamic in terms of entry and more similar but still smaller in terms of exit (Table 5.1).

Figure 5.1: Entry and Exit rates across sectors (average 2010-2015)



Source: Authors' calculations based on Amadeus data

Table 5.1: Entry, exit and churning rates across five major sectors 2010-2015

	Entry	Exit	Churning (entry + exit)
ICT Services	2.52	1.46	3.98
Professional services	2.45	1.39	3.84
Manufacturing	2.15	1.06	3.21
Utilities	1.76	1.16	2.92

Source: Authors' calculations based on Amadeus data

SF5: Positively correlated entry and exit rates: confirmed stylized fact from industry dynamics literature

- A positive and significant correlation between entry and exit sector-year rates adds more confidence in data cleaned of outliers. Figure 5.2 is based on sector averages over time and countries, and its correlation is high 85% (p-value 0.000). This reduces the problem the rising attrition rates for recent years.

Figure 5.2. Scatter diagram of entry and exit rates based on Amadeus (2010-2015)

SF6: Net entry rates are the highest in ICT services and the lowest in manufacturing

Given limited reliability of entry rates data over time, we consider net entry (entry-exit) data only as period average and across sectors. We assume that the attrition of exiting firms is

similar across all sectors and thus does not disturb the relative net entry rates across sectors.

- The net entry is the highest in ICT services (30% above average), followed by Professional Services (+25%) and is the lowest in manufacturing (-15%). This may be expected given low barriers to entry in services and significantly higher role of physical assets in manufacturing (Table 5.2).
- Within manufacturing, net entry is the highest in traditional sectors (food, textiles, wood) and the lowest in the manufacture of machinery and equipment n.e.c. and resource-based sectors (chemicals, rubber). Technology intensive sectors are around the average of manufacturing. This also seems to reflect differences in physical assets loadings across sectors.

Table 5.2 Sectoral dynamics of net entry in relation to economy average (2010-16)

Sector	**Sector/(Total=1)**
JA	1.31
JB	1.24
JC	1.37
ICT services	**1.30**
MA	1.22
MB	1.11
MC	1.44
Professional services	**1.25**
D	0.96
E	0.98
Utilities	**0.97**
CC	1.18
CA	0.93
CB	0.92
CL	0.90
CJ	0.85
CF	0.83
CH	0.83
CI	0.80

CG	0.75
CE	0.70
CK	0.65
Manufacturing	**0.85**

Source: Authors' calculations based on Amadeus data

SF7: Lower entry rates across EU 'North' member states are counterbalanced by higher average employment size of *de novo* firms. EU 'East' and 'South' entrants (except Italy) are significantly smaller compared to EU 'North'.

The average size of entrant firms is an important factor in entrepreneurial dynamics. Smaller entrants are in a more favourable position to 'test the market' and withdraw if markets do not look promising compared to large entrants. However, the size of entrants maybe also the results of other factors like income levels and the size of local markets. Here we show data on the average size of entrants expressed as the average number of employees of firms in sector *s* in the year in which they were established (see Table A 2.4). Also, data for Great Britain, Denmark and Ireland are quite deficient across the sector which should be considered in the interpretation of data.

- The mean size of entrant firm for country-sectors for the EU is 32 employees (median is five employees which is far below the mean, implying a right-skewed distribution). Overall, an average entrant in the EU is in between micro and small firm in terms of employment. Still, there is a significant variation across EU countries, given a standard deviation of 224 employees.
- Great Britain and Ireland stand out as clear outliers from the whole sample with an average size of entrants in the countries being respectively 126 employees (Ireland) and 411 (Great Britain). In section 4 of this report, we focus only on small and medium-sized firms, excluding large firms (>249 employees) from the analysis.
- The average size of entrants is significantly higher in the EU 'North' and much smaller in the EU 'East' and 'South'. For example, the EU North range (if we exclude GB and IE) is from 5 (Sweden) to 33 employees (Germany). The South/East range (except Italy and Greece) is from 2 (Estonia and Latvia respectively) to 16 employees (Poland).
- As expected, the biggest entrants are in manufacturing with services entrants being below the total average, except for Legal, accounting, management, architecture,

engineering, technical testing and analysis activities (MA) which appears to be an outlier being driven by sizable entrants in Ireland (see Table A 2.4).

SF8: Exiting firms are most often smaller than entrants in line with the industrial dynamics literature with a few country-specific paths.

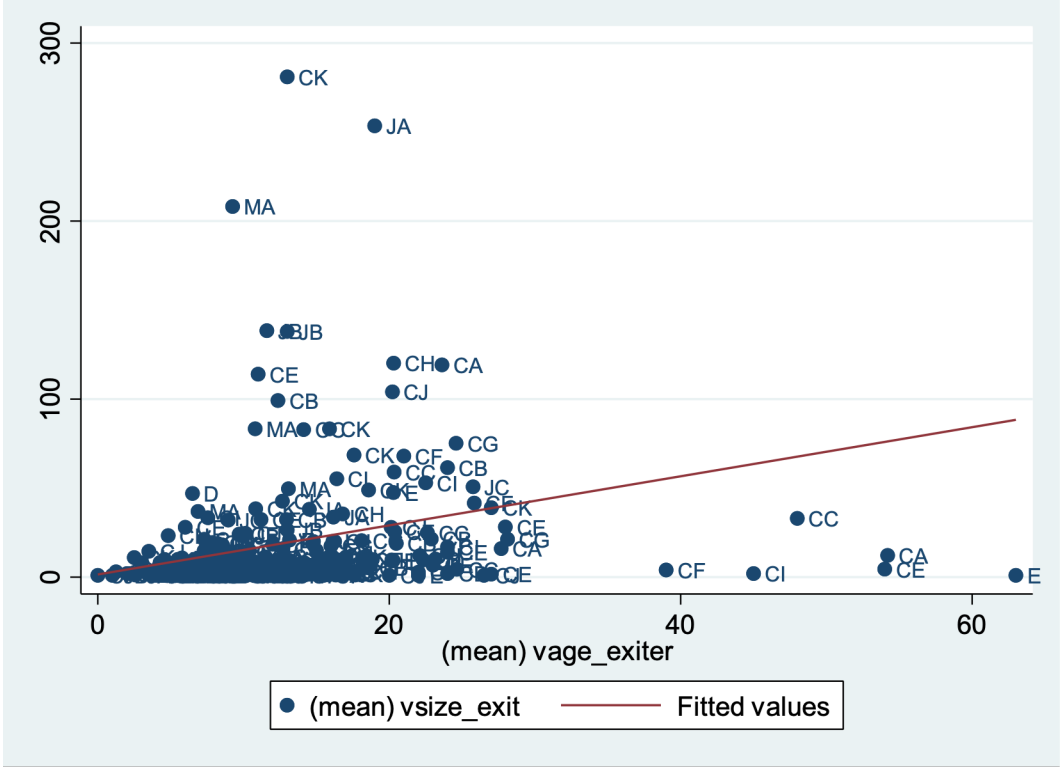
The exit is essential to creative destruction processes as it ensures that unviable business experiments get filtered out of the market race. Similar to entrants here we show data on the average size of the exiting firm expressed as an average number of employees of firms in sector *s* in a year in which they exited the market. Data presented in Table A2.5. have been cleaned of outliers across countries and sectors.

- The average size of an exiting firm has seventeen employees (the median is four employees (standard deviation 57), and the average employment at 80th percentile of distribution is 14 employees. The average entrant has 32 employees, while exiting firms has 17. This is expected and confirms stylized fact from industrial dynamics that exiters usually shrunk.
- However, heterogeneity across sector-countries is also significant. The average exiting firm in Bulgaria is less than two employees across all but one sector. On the other hand, exiting German firm is on average with 33 employees which is equal to the average size of the entrant. The exit rates in Germany across the Manufacture of electrical equipment and Transport equipment by far outweigh the entry rates in these industries.
- Great Britain and Greece have the biggest exiters, equal respectively to 97 and 115 employees. The exit in all ex-transition economies except for Poland, Slovakia and Slovenia, is dominated by micro firms.
- Manufacturing of machinery and transport equipment are among the two sectors where the size of the average exiter is within the top 20% of the distribution. Scientific research and development activities have the most sizable exiting firms among the services sector (see Table A2.5).

SF9: EU exiting firms are comparatively old pointing to 'prolonged creative destruction process' correlated to their size

- The average size of the exiting firm in the EU is 11 years which is comparatively quite old. This points to a much less dynamic process of creative destruction in the EU which resembles the prolonged process of filtering of viable firms.
- The age of exiting firms seems to be positively correlated to their size which conforms to a picture of creative destruction in the EU characterized by larger entrants compared to the US and thus lower period of 'testing' their viability before they exit[30]. For example, countries with larger exiting firms are also those with older exiting firms. On the other hand, Bulgaria, Lithuania, Latvia and Romania all have smaller exiting firms, but they are also much younger (5-6 years on average) compared to large entrants/exiters countries. (see table A2.6).

Figure 5.3: Scatter plot of Average Size and Age of exiting firm (sector-country averages), 2010-2015



Note: removed outlier sectors MB and CL

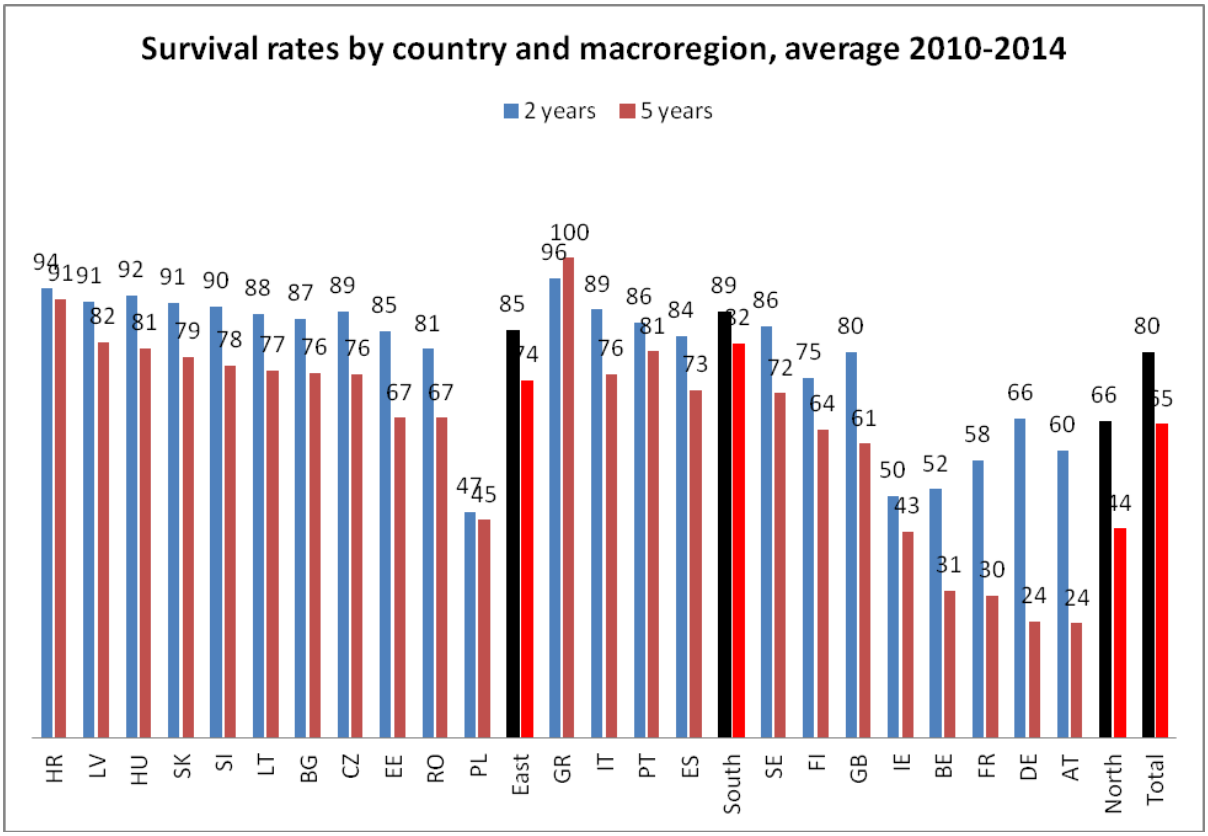
[30] Correlation coefficient improves is 21% at 1 % sig level.

SF10: Survival rates are macro-region specific: on average higher on 'periphery' (East/South) and lower in 'North.'

One of the key features of 'creative destruction' is the survival of firms. A firm born in year x is considered to have survived in year x+1 if it is active in terms of turnover and/or employment in any part of year x+1 (= survival without changes). It is expected that the survival rates in the early years of firms' activity will be much lower when compared to later years as the firm matures and consolidate its position on the market. Survival data indicate two critical features of the EU firms.

- EU 'periphery' (South and East) have on average higher survival rates compared to average survival rates of 'North' firms. This may indicate their lack of growth ambition, softer markets which enable the survival of inefficient entrants. The only exception in the case of 'periphery' economies is Poland, where survival rates do not change but are comparatively much lower compared to the 'North' average (figure 5.4).
- Competition reduces survival rates which on the average drop from 80% of active firms in year 2 to 60% in year 5. However, 'North' firms in several countries (Ireland, Belgium, France Germany and Austria) are facing somewhat harsher conditions as their survival rates disproportionally drop in between 2 and 5 years when compared to all other economies. A very high survival rate of Greek firms is due to quite biased and very small sample of around 300 larger firms while German data are based on only 23,000 firms

Figure 5.4: Survival rates by country and macro-region, average 2010-2014



S11: Survival rates are relatively uniform across sectors unlike much more varied country rates

- Unlike different survival rates between EU North and Periphery and significant differences in survival rates within the 'North' economies, these rates are fairly homogenous across various sectors.
- Survival rates are somewhat higher in manufacturing when compared to services. This reflects differences in initial size and difficult exit for firms which operate with physical assets.

Table 5.4: Survival rate after 2 and 5 years by sector, average 2010-2014

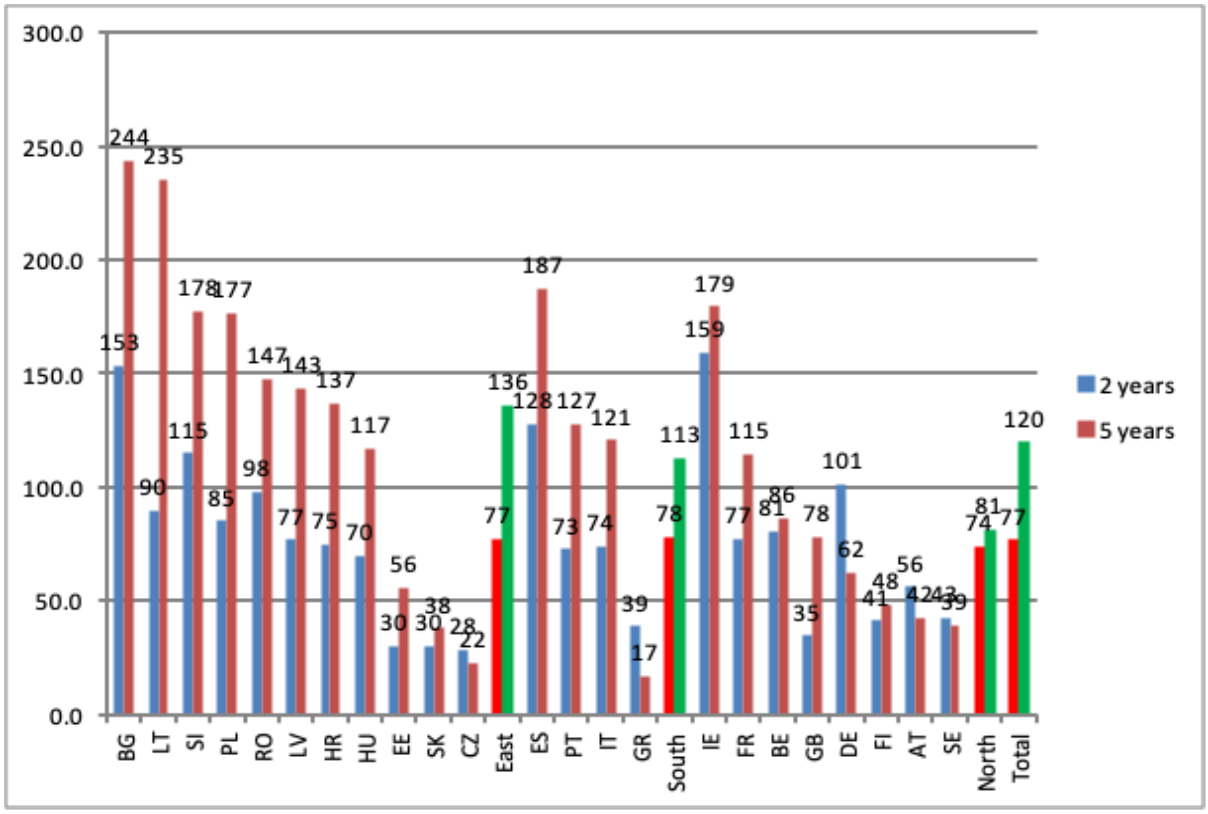
Sector	2 years	5 years	Difference 5-2
CE	87.4	77.9	-9.4
CJ	79.9	70.4	-9.4
CF	86.4	70.3	-16.1
CL	80.1	70.2	-9.9
CC	82.3	69.2	-13.1
CG	84.4	68.4	-16.0
CI	86.6	66.4	-20.1
CK	83.3	66.1	-17.2
CA	79.1	65.4	-13.7
CH	85.8	65.2	-20.6
CB	78.1	61.7	-16.3
Manufacturing	**83.0**	**68.3**	**-14.7**
E	80.7	69.6	-11.1
D	73.3	58.2	-15.1
Utilities	**77.0**	**63.9**	**-13.1**
MB	79.1	64.5	-14.6
MA	76.8	61.6	-15.2
MC	76.6	60.5	-16.1
Professional services	**77.5**	**62.2**	**-15.3**
JA	76.4	62.8	-13.6
JC	75.4	61.1	-14.3
JB	80.0	60.2	-19.8
ICT services	**77.3**	**61.3**	**-15.9**
Total	80.32	65.38	**-14.9**

SF12: In the majority of the EU countries and sectors growth of enterprise employment follows the U shaped curve

- Growth of enterprises follows the non-linear path. In the majority of countries (except Bulgaria, Slovenia, Spain, Ireland and Germany) after two years, entrants have shrunk. By year five they grew in all but five countries (Czechia, Greece, Germany, Austria and Sweden). So, in 17 EU countries and GB growth of enterprises seem to follow the U shaped curve as on average enterprises shrink by 23% in their second year and by year five recover to 20% higher of their initial size. This probably reflects initial optimistic estimates of founders who are facing market realities as well as country-specific institutional conditions and market conditions but also biases of samples of the Amadeus database.

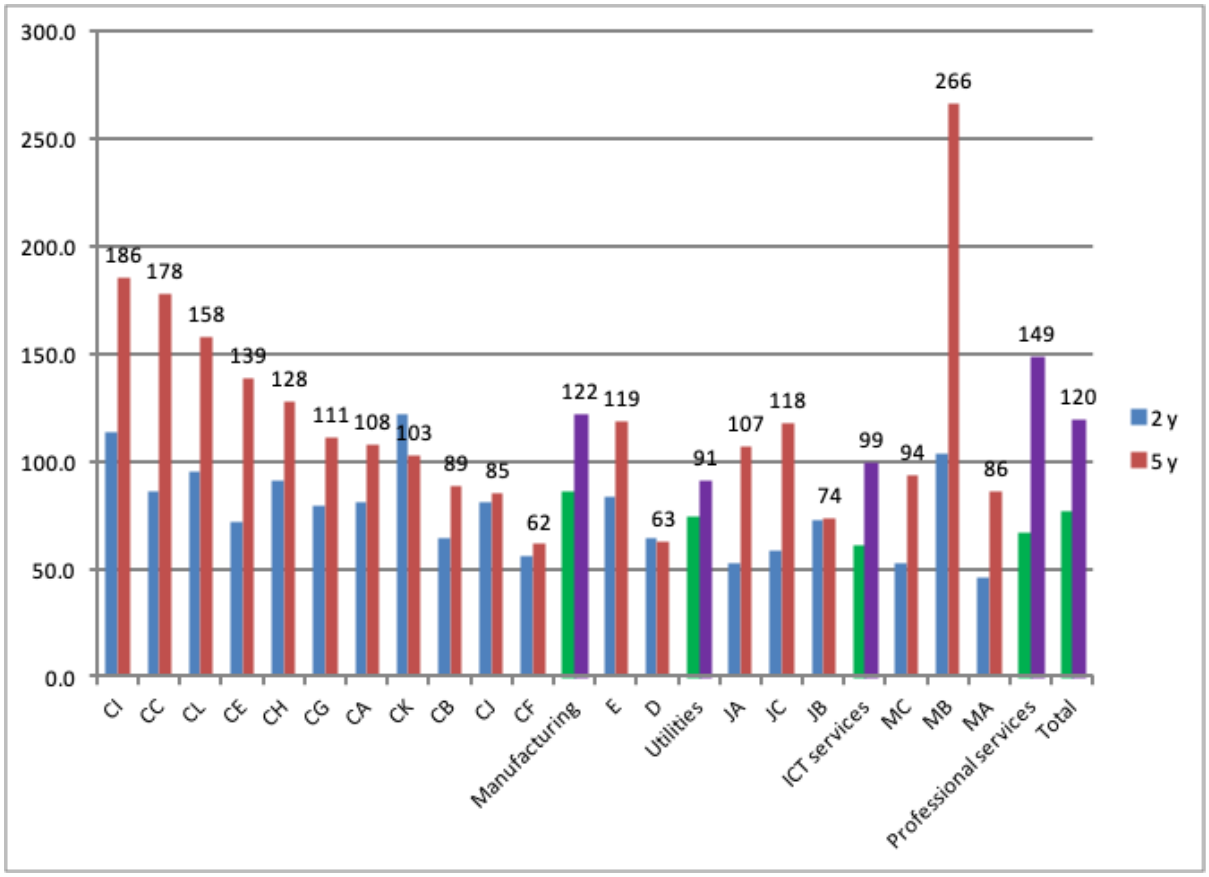
- Within this broadly correct stylized fact of the U shaped employment growth curve, there are very different dynamics which are partly a reflection of real differences and probably partly a reflection of uneven coverage of firms within Amadeus database.
- By year two shrinking of firms is extremely pronounced in three CEE economies (Estonia, Slovakia and the Czech Republic), Greece, GB, Finland, Austria and Sweden. By year five in twelve economies enterprises have recovered and grew above their initial size. However, they do not grow further in the group of five economies where firms have shrunk by year two. Moreover, they are now joined by Germany and Belgium in a group where firms by year five have not reached their entry-level employment (Figure 5.5).
- The decline by year five is party due to possibly tight market competition but also may reflect uneven representativeness of samples within the Amadeus database. Namely, in our preliminary exploration, we used data for all sectors in the Amadeus database (not just 19 sectors selected for our current analysis) these country-specific trends have not been confirmed. However, the stylized fact about the U shaped growth of enterprises has been confirmed on the full database.

Figure 5.5: The relative size of entrants (employment) after 2 and 5 years by countries



- U shaped the growth of firms is also present in 15 out of 19 sectors (figure 5.6). Growth of firms based on employment is much more common in manufacturing and much less in services (except for Scientific research and development (MB) and IT and other information services (JC). Within manufacturing, entrants grow the most in Manufacture of computer, electronic and optical products (CI), Manufacture of wood and paper products, and printing (CC) and Manufacture of transport equipment (CL).

Figure 5.6: The relative size of entrants (employment) after 2 and 5 years by sectors



SF13: Market shares of both entrants and exiting firms remain consistently low across all sector-countries

- One of the stylized facts of industrial dynamics is that entrants and exiting firms are small, and they have small market shares. Total market share of entrants is meagre of 0.78% with a standard deviation of 3.4% across sectors-countries. Denmark stands out across Europe with entrants having higher total market shares in Manufacturing of food products (CA) (4.5%), Manufacturing of machinery and equipment (CK) (3.2%) and Scientific R&D (MB) (7.1%). *De novo* firms in services on average have higher total market shares. However, in the manufacturing of pharmaceuticals sector, Slovenia emerges as an outlier with a total share of entrants being equal to 6.9% (see Table A2.7)
- For existing firms, as expected total market shares are lower compared to entrants (a mean is equal to 0.29% and ST DEV of 0.78%). Ireland is an outlier with the

manufacturing of wood (CC) and transport equipment (CL) having a higher rate of exiting firms with more sizable shares. Germany, Finland, France, Great Britain, Ireland and Spain have exiting firms with total market share being in top 20th centile of distribution. There is no significant correlation between age and market turnover share of exiting firms observed (see Table A2.8).

SF14: Intra-countries dispersions of sectoral productivities (top decile vs bottom decile) are significant and country-specific

Given highly skewed firm distributions in productivities, we explore inter-country differences in dispersions between top vs bottom 10% of the firms. We would expect that these dispersions would be greater in converging economies and visibly smaller in economically more advanced whose firms operate closer to the technology frontier. In converging economies, we would expect these differences to be more significant given differences in technological lags among sectors working at quite different distances to the technology frontier. In Annex Figure A2.1. we show results of productivities computed as the natural logarithm of top decile productivity on bottom decile productivity by country.

We do not discern systematic pattern which would reflect distances to technology frontier but patterns which are very much country-specific. There is a “compressed” patterns - where there is a relatively small distance between the top and bottom performers which are typical of Austria, Estonia, Spain, Latvia and Slovenia. On the other hand, “dispersed” patterns which indicate the relatively higher distance between top and bottom performers within the same country are typical for Denmark, Great Britain, Greece, Ireland, Latvia and Poland[31].

SF15: Inter-sectoral productivity differences at the extremes of distributions are more significant than inter-country differences

Firm distributions are skewed, and here we compare the distribution of Top/bottom decile ratios for Sales-based productivity and how it relates to sectoral as well as country variability. The ANOVA table below shows the results of the analysis of the variance for the dependent variable Top/bottom decile productivity ratio. The dispersion of the ratio is well explained by the sectoral breakdown (one-way ANOVA F stats 4.85, Prob>F 0.000***) as well as country breakdown (one-way ANOVA F stats 4.25, Prob>F 0.000***). However, the inter-sectoral breakdown has somewhat better explanatory power than the inter-country breakdown. To further corroborate these findings, we perform a two-way ANOVA: both breakdowns are

[31] The data on Romania and Sweden are truncated and therefore cannot be directly compared with the other countries.

highly significant in explaining the ratio variability, but the sectoral breakdown is still statistically more significant.

Table 5.5 Analysis of Variance (ANOVA): Dependent Variable Top Decile Productivity on Bottom decile productivity, independent variables: sector dummies, country dummies

	Observations	Adj-R2	Degrees of freedom	F stats	Prob>F
One-way sectoral ANOVA: explaining productivity dispersion across sectors	11,794	0.0058	18 (19 sectors -1)	4.85	0.000***
One-way country ANOVA: explaining productivity dispersion across countries	11,794	0.0063	23 (24 countries -1)	4.25	0.000***
Two-way sectoral and country ANOVA: explaining productivity dispersion across sectors and countries	11,794	0.012	18 (19 sectors -1) 23 (24 countries -1)	4.90 4.28	0.000*** 0.000***

SF16: There seems to be convergence in manufacturing productivity of 5 -year-old entrants of the EU periphery (East and South) in relation to EU North

In the case of manufacturing, changes in relative productivities of 5-year-old entrants show on the average higher increase in the Periphery than in the EU North. For both 2011 and 2014 average productivity of 5-year-old entrants has increased more in the EU South and East than in the Core EU (North). This is quite a preliminary hypothesis which bodes well with Rodrik (2011a[32], 2011b[33]) hypothesis on unconditional convergence in manufacturing at a global level

Table 5.6. Relative productivity of 5 y old entrants (compared to their entry year)

	Mfg avg 2011	Mfg avg 2014
GB	245	398
FI	177	254
DE	173	386

[32] Rodrik, D., 2011a. The Future of Economic Convergence. NBER Working Paper Number 17400.

[33] Rodrik, D., 2011b. Unconditional Convergence. NBER Working Paper Number 17546

AT	150	-13
FR	124	69
SE	91	121
avg North	**160**	**203**
IT	259	613
PT	217	398
ES	131	182
avg South	**202**	**397**
HU	696	231
LT	683	202
HR	660	365
PL	262	
BG	236	543
EE	173	280
RO	169	249
SK	140	
SI	99	166
LV	60	175
avg East	**318**	**276**

Note: Data are based on the untrimmed database and include all manufacturing sectors

6. SMEs in industry dynamics

In this section, we explore industry dynamics from the perspective of the size of firms, and in particular, the role of SMEs. We explore the role of SMEs in the entry, exit as well size of entrants and their sectoral and R&D distribution, market shares, productivity differences and growth over time. In defining SMEs, we follow Eurostat convention. We include in this category micro firms, small firms and medium-sized firms up to 250 employees and an annual turnover of EUR50mn or annual balance sheet total of EUR43mn. For classification criteria for each of three subcategories see Annex 4 table A4.1

SF1: Entry is driven by micro firms and is dominant in the EU 'Periphery'. Micro firms' entry dominates in all sectors across the EU except in low R&D intensive sectors

- Across all countries, we observe higher entry among micro firms. There is some variation in smaller and medium-sized firm entry with some countries showing higher rates of smaller businesses (Bulgaria, Denmark, Finland, Romania), and others – medium-sized (Czech Republic, Slovenia).
- The entry rate of SMEs is consistently smaller in EU 'North' countries, but higher in 'South' and 'East'. While Poland demonstrates more convergence to EU entry rates post-2010 (see Table A 2.1), in 2010, it still exhibited high entry rates, which are driven by the entry of micro-firms (see table 6.1).
- Entry rates over time and across SMEs groups do not exhibit a discernible trend, and thus we do not report it here

Table 6.1: Country entry rates distribution by size, 2010-2016

Country	All	Micro	Small	Medium
AT	1.13	1.71	0.41	0.54
BE	0.55	0.98	0.12	0.15
BG	5.49	6.45	1.81	0.98
CZ	1.56	2.03	0.48	1.85
DE	1.53	2.94	0.65	0.25
DK	1.62	2.93	4.98	0.64
EE	3.08	3.64	0.62	0.11
ES	1.57	2.01	0.49	0.48
FI	2.94	3.49	1.27	0.85
FR	0.88	1.38	0.31	0.32
GB	1.08	2.02	0.71	0.74
GR	1.68	2.54	1.23	0.42
HR	4.61	5.51	1.36	1.52
HU	2.3	2.59	1.12	0.62
IE	1.38	1.75	1.54	0.51
IT	2.54	3.44	1.2	0.55

LT	3.28	5.11	0.83	0.34
LV	7.34	8.08	1.16	0.27
PL	2.87	10.71	0.42	0.09
PT	5.57	6.81	1.07	0.63
RO	5.62	6.38	2.78	1.86
SE	1.42	1.68	0.33	0.29
SI	2.56	2.96	0.78	1.11
SK	0.63	0.77	0.22	0.13
Total	2.66	3.69	0.96	0.64

Source: Amadeus (authors' calculations). Note: the category 'All' refers to the whole sample, including large firms discussed in section 5. Cells highlighted in green show countries with the highest entry rates.

- Consistently across all sectors entry rates are higher among micro firms, and then subsequently fall across sizes.
- Entry rates are high among micro-firms across all but low-intensity R&D sectors. In a medium-low R&D intensity group, entry rates are high in Telecommunications (JB), Other professional services (MC). Among the medium-high and high-intense R&D sectors, the sectors with high entry rates are ICT (JC) and Scientific Research and Development (MB).
- A lower entry rate of micro firms in low R&D intensity sector may be an indication of better opportunities for entry of small and medium firms in traditional sectors

Table 6.2: Sector entry rates distribution by size

Sector	All	Micro	Small	Medium
Low R&D intensity				
CA	2.37	3.52	1.11	0.4
CB	2.28	3.06	1.05	0.6
CC	2.16	3.02	0.84	0.38
D	2.19	3.4	0.86	0.57
E	2.45	3.6	1.44	0.44
Total	2.29	3.32	1.06	0.48

Medium-low R&D intensity				
CG	2.15	3.05	0.61	0.46
CH	2.4	3.54	0.87	0.26
JA	2.82	3.52	0.89	1.49
JB	3.62	4.79	1.3	1.07
MA	3.32	3.89	0.93	1.12
MC	4.06	4.76	1.34	0.94
Total	3.06	3.92	0.99	0.89
Medium-high R&D intensity				
CE	2.09	3.03	0.48	0.34
CJ	1.82	3.05	0.78	0.27
CK	1.66	2.88	0.85	0.56
CL	2.44	4.1	1.67	0.32
JC	4.68	5.65	1.25	0.85
Total	2.54	3.74	1.01	0.47
High R&D intense				
CF	2.7	3.7	0.79	0.72
CI	1.91	2.99	0.6	0.61
MB	3.4	4.56	0.6	0.73
Total	2.67	3.75	0.66	0.69

Source: Amadeus (authors' calculations). Note: the category 'All' refers to the whole sample, including large firms discussed in section 5. Cells highlighted in green show sectors with the highest entry rates.

SF2: Exit rates are low compared to entry rates across countries and sectors and similar to entry micro-firms dominate

- Exit rates are overall low across all size groups and are lower than entry rates. This suggests that the population of SMEs is growing. Variation across countries, in particular among micro firms in France, Great Britain and the Czech Republic are the most likely reflection of different countries coverage rather than of market conditions

- On average, exit rates are higher among micro-firms which is consistent with industrial dynamics literature. It suggests that high entry and exit of micro firms represent experimentation and trial and error process which takes places at the fringes of markets

Table 6.3: Country exit rates distribution by size, 2010-2015

Exit	All	Micro	Small	Medium
AT	0.57	0.88	0.2	0.18
BE	1.37	2.86	0.11	0.33
BG	3.04	3.74	0.54	0.23
CZ	4.28	5.37	1.87	0.81
DE	1.52	2.31	0.83	0.68
DK	0.58	1.53	0	0.19
EE	1.63	1.81	1.24	0.03
ES	3.24	3.95	1.49	1.13
FI	1.76	1.98	1.46	0.85
FR	4.63	7.8	2.61	1.38
GB	3.21	7.47	2.94	1.82
GR	1.6	1.86	1.66	0.8
HR	0.34	0.37	0.16	0.01
HU	0.53	0.62	0.07	0.03
IE	3.02	4.31	1.52	1.73
IT	1.5	2.05	0.57	0.47
LT	0.6	0.79	0.48	0.24
LV	1.08	1.16	0.25	0.82
PL	1.18	2.35	0.61	0.21
PT	2.68	3.12	1.31	0.82
RO	1.06	1.25	0.4	0.13
SE	0.17	0.17	0.12	0.25
SI	0.77	0.82	0.59	0.6
SK	0.94	1.19	0.46	0.52
Total	1.75	2.52	0.92	0.6

Source: Amadeus (authors' calculations). Note: the category 'All' refers to the whole sample, including large firms discussed in section 5. Cells highlighted in green show countries with the highest exit rates.

- Similar to entry dynamics, exit rates are higher in services sectors rather than manufacturing. This reflects lower barriers to entry and exit and is expected
- Higher R&D intensity sectors on average show smaller exit rates which reflects the different nature of competition based on technology knowledge.
- Telecommunications (JB) ICT (JC), and other professional services (MC) sectors exhibit higher exit rates, especially among micro-firms which is overall consistent with also higher entry rates in these sectors, pointing towards higher turbulence. However, it seems that this turbulence takes places on fringes of the markets though with differences depending on the R&D intensity of sectors.

Table 6.4: Sector exit rates distribution by size

Sector	All	Micro	Small	Medium
Low R&D intense				
CA	1.16	1.75	0.65	0.68
CB	1.14	1.67	0.75	0.35
CC	1.47	2.02	0.76	0.68
D	1.19	1.82	0.49	0.3
E	1.22	1.81	0.8	0.28
Total	1.24	1.81	0.69	0.46
Medium-low R&D intense				
CG	0.93	1.63	0.45	0.22
CH	1.04	1.72	0.59	0.24
JA	1.63	2.26	0.6	0.46
JB	1.54	2.15	0.63	0.53
MA	1.52	1.91	0.71	0.38
MC	1.78	2.22	0.65	0.37
Total	1.41	1.98	0.61	0.37
Medium-high R&D intense				
CE	0.87	1.93	0.58	0.3
CJ	1.05	1.93	0.42	0.35
CK	0.81	1.42	0.49	0.44
CL	1.12	2.29	0.35	0.32
JC	1.69	2.29	0.62	0.45
Total	1.11	1.97	0.49	0.37
High R&D intense				
CF	1.03	1.56	1.02	0.23
CI	0.99	1.66	0.44	0.29
MB	1.39	1.94	0.65	0.13
Total	1.13	1.72	0.7	0.22

Source: Amadeus (authors' calculations). Note: the category 'All' refers to the whole sample, including large firms discussed in section 5. Cells highlighted in green show sectors with the highest exit rates.

SF3: Average micro, small and medium-sized entrants, have 2, 19 and 85 employees respectively. There is a trade-off between entry rates and size of entrants

- As expected in line with the literature on business demography, micro-firms are small in size with two employees on average, and small and medium-sized increase progressively in size with average employment size reaching 19 and 85 employees respectively.
- On average, 'North' EU economies are bigger in sizes compared to the EU 'East' economies which indicates that lower entry rates are counterbalanced by bigger sizes of entrants in the former group.

Table 6.5: Country average size of entrant distribution by size

Country	All	Micro	Small	Medium
AT	10.01	2.66	18.2	70.59
BE	11	2.12	17.36	75.75
BG	5.32	1.82	18.46	101.21
CZ	11.81	3.23	21.81	64.66
DE	33.42	2.48	17.7	94.38
DK	16.55	1.71	20.67	21.5
EE	2.07	1.62	17.8	81
ES	7.82	2.23	17.94	84.91
FI	17.8	2.23	19.65	88.79
FR	10.28	2.59	18.78	80.89
GB	373.73	2.83	19.78	86.08
GR	17.64	5.58	18.12	83.43
HR	3.98	1.82	19.13	64.07
HU	9.95	1.88	19.01	102.33
IE	274.35	2.41	19.75	59
IT	13.87	2.95	17.01	74.41
LT	13.61	2.83	18.72	105.08
LV	2.3	2.03	16.29	50.67
PL	16.64	5	27	148.11
PT	3.14	1.85	18.45	103.14
RO	15.72	2.11	17.95	78.15

SE	5.29	1.74	17.36	72.84
SI	5.76	1.99	18.17	71.75
SK	5.13	1.81	21.36	75
Total	31.78	2.39	18.75	84.52

Source: Amadeus (authors' own calculations). Note: the category 'All' refers to the whole sample, including large firms discussed in section 5.

- There is a not systematic relation between R&D intensity of sectors and the average size of entrants. While we observe some progression in an increase of the average size of entrants from low to medium-low and medium-high R&D intense group, the employment increase in the latter group is driven by the outlier – manufacture of transport equipment sector (CL) especially regarding large-size entrants (note, larger firms are not included here given the focus on SMEs).
- High-intense R&D sector has the lowest average employment among entrants across all sector groups suggesting that these start-ups are less labour intense firms.
- Similar to entry rates there is not consistent time trend across different firm size across different SMEs groups, and thus we do not report it here

Table 6.6: Sector average size of entrant distribution by size

Sector	All	Micro	Small	Medium
Low R & D intense				
CA	28.09	2.58	18.36	88.09
CB	21.45	2.48	19.54	87.02
CC	11.5	2.55	18.83	85.66
D	41.42	2.1	12.67	38.6
E	10.56	2.53	19.32	84.35

Total	22.04	2.46	18.49	82.67
Medium-low R&D intense				
CG	15.5	2.65	18.56	87.37
CH	34.12	2.76	19.81	94.63
JA	6.76	2.2	18.98	70.28
JB	8.68	2.39	17.82	75.88
MA	90.62	2.01	17.68	91.24
MC	37.49	2.1	17.7	80
Total	33.84	2.34	18.46	86.32
Medium-high R&D intense				
CE	17.08	2.47	22.17	48.76
CJ	16.55	2.43	20.06	84.15
CK	15.15	2.46	20.19	87.21
CL	204.64	2.53	20.96	96.19
JC	6.38	2.13	18.53	91.9
Total	49.28	2.38	19.85	85.11
High R&D intense				
CF	16.44	2.29	16.13	73.75
CI	15.47	2.65	17.55	85.67
MB	12.05	2.17	19.69	75.78
Total	14.48	2.37	17.66	79.91

Source: Amadeus (authors' calculations). Note: the category 'All' refers to the whole sample, including large firms discussed in section 5.

SF4: Average SMEs exit smaller compared to their size at entry across all three groups

- Exiting firms are on average small in sizes. For the whole sample, the average exiting firms has 17 employees compared to 32 at entry. However, this is mainly due to the exit of larger firms. Shrinking of exiting SMEs seems proportional to their size.
- Variations across countries also reflect different country coverage (cf. GB and GR). There are no clear patterns of country profiles of shrinking exiting firms as well as concerning their sectoral distribution and sectors by R&D intensity

Table 6.7: The country average size of exiting firms by size

Country	All	Micro	Small	Medium
AT	4.0	2.4	16.6	57.5
BE	20.1	1.4	23.2	78.8
BG	1.8	1.5	15.9	72.5
CZ	11.2	3.0	19.2	85.7
DE	32.0	2.9	15.1	74.9
DK	11.3	4.0		33.0
EE	2.2	1.4	16.2	
ES	4.6	2.2	18.1	53.5
FI	10.2	1.9	18.7	79.0
FR	8.2	3.3	17.0	64.1
GB	98.3	2.9	19.7	80.4
GR	129.5		6.0	32.7
HR	3.2	2.1	14.8	
HU	1.7	1.4	18.9	235.0
IE	35.5	2.4	13.7	69.9
IT	9.9	2.5	16.7	69.0
LT	4.3	2.0	15.9	120.5
LV	2.4	1.7	22.8	104.5
PL	16.9	5.0	31.1	130.6
PT	4.3	2.2	17.8	78.3
RO	3.3	2.1	18.1	93.3
SE	19.4	1.5	23.4	127.3
SI	12.8	2.6	22.1	70.6
SK	11.4	2.2	20.2	103.6
Total	17.6	2.3	18.4	77.6

Source: Amadeus (authors' calculations). Note: the category 'All' refers to the whole sample, including large firms discussed in section 5. Cells highlighted in 'red' shows the smallest average size of exiting firms across countries

SF5: Exiting SMEs in the EU is relatively old which reflects the dominance of 'lifestyle' business in the SMEs population

- The average exiting SME is 11 years old and they especially present in the EU North (Austria, Belgium, Denmark) and the UK. However, as with size variations across countries also reflect different country coverage (cf. GB and GR). As would be expected exiting firms are older proportionally to their size.
- The old exiting SMEs suggest a high share of 'life-style businesses' with no ambition to grow, and which remain small in size over a long period. As these firms are established for reasons which are not necessarily related to growth, the reason for exit is not necessarily a failure but often non-commercial issues. This issue should receive more attention from academic scholars.
- There is no systematic pattern of age differences of exiting firms across different sectors and their R&D intensity

Table 6.8: Average age of exiting firms by country and size

Country	All	Micro	Small	Medium
AT	14.1	12.3	28.8	17.5
BE	15.6	14.3	27.1	13.0
BG	6.2	6.2	5.9	8.4
CZ	7.7	7.0	14.1	17.2
DE	17.8	15.3	24.2	25.1
DK	15.5	4.7		48.0
EE	6.4	6.3	7.4	
ES	11.9	11.6	16.0	21.1
FI	12.0	11.5	22.2	16.5
FR	12.9	12.0	15.7	25.0
GB	17.4	12.8	18.9	21.7
GR	23.3		13.0	27.7
HR	11.8	11.5	14.1	
HU	10.6	10.5	12.5	15.0
IE	12.3	10.5	12.8	21.5
IT	8.9	8.3	9.0	18.8
LT	5.7	5.6	11.9	20.0
LV	5.6	5.6	8.3	14.8
PL	7.9	6.0	11.0	20.2
PT	9.6	8.8	15.3	28.9
RO	5.7	5.8	5.9	9.8

SE	12.9	12.7	14.9	17.6
SI	10.7	9.0	13.3	13.0
SK	9.5	9.0	14.2	16.0
Total	11.2	10.0	15.5	21.1

Source: Amadeus (authors' calculations). Note: the category 'All' refers to the whole sample, including large firms discussed in section 5.

SF6: On average, micro firms have the highest total market share compared to small and medium firms at both entry and exit. Market share of SMEs shrinks between entry and exit, especially for medium-sized firms.

Market share is calculated by dividing the total turnover of start-ups by the turnover of firms in the same sector-year-country.

- Market share of SMEs across Europe remains small and is around 0.54%. However, this ranges from 1.66% for the micro firm to 0.47 and 0.5 by small and medium firm respectively. Possibly, this reflects unfilled potential market niches which entrant exploits. However, while on the average total market for micro and small-sized businesses reduced marginally for exiting firms, for medium-sized firms the market share of exiting firms shrinks by almost half (from 0.5 to 0.3)
- Given significant country differences in the coverage of micro firms, we should not read too much from country differences within this general pattern. Across countries, the market share of an entrant is the lowest in France (0.05%) and the highest in Romania (1.45%) which may reflect opportunities in expanding 'lifestyle business' in these economies. The relatively high market shares of entrants in EU South and East (except Slovakia) is compatible with this proposition.
- Market share of exiting firm is small which corroborates data on shrinking size of exiting firms which shrinks from 32 to 11
- Market shares of entering and exiting SMEs based on sectoral affiliation or R&D intensity do not reveal clear pattern at the aggregate level

Table 6.9: Market share of entrants by size distribution (country averages)

Country	All	Micro	Small	Medium
AT	0.34	1.21	0.45	0.35
BE	0.15	0.75	0.1	0.17

BG	0.93	3.43	0.72	0.38
CZ	0.87	0.88	0.24	2.47
DE	0.44	1.31	0.38	0.17
DK	0.18	2.65	3.88	0.47
EE	0.45	1.55	0.28	0.16
ES	0.24	1.06	0.27	0.25
FI	1.04	1.68	0.99	0.44
FR	0.05	0.58	0.21	0.18
GB	0.95	1.1	0.42	0.55
GR	0.3	1.04	0.13	0.47
HR	0.64	1.7	0.38	1.02
HU	0.48	1.09	0.4	0.43
IE	0.71	1	0.58	0.4
IT	0.28	1.36	0.43	0.25
LT	0.63	2.05	0.32	0.12
LV	0.84	3.22	0.46	0.19
PL	0.09	4.84	0.27	0.06
PT	0.51	2.28	0.56	0.47
RO	1.45	3.25	1.62	1.74
SE	0.11	0.66	0.16	0.2
SI	0.9	1.33	0.32	0.87
SK	0.15	0.48	0.07	0.05
Total	0.54	1.66	0.47	0.5

Source: Amadeus (authors' calculations). Note: the category 'All' refers to the whole sample, including large firms discussed in section 5. Cells highlighted in green show countries with the highest total share of entrants, whereas cells highlighted in red, show the lowest total share of entrants.

6.10 Market share of exiting firms by size and country averages

Country	All	Micro	Small	Medium
AT	0.04	0.3	0.08	0.01
BE	0.12	1.14	0.09	0.17
BG	0.19	1.03	0.13	0.03
CZ	0.16	0.58	0.49	0.1

DE	0.52	1.74	0.58	0.28
DK	0.04	0.09	0	0.1
EE	0.15	0.3	0.6	0
ES	0.54	1.68	0.81	0.44
FI	0.71	1.01	1.36	0.57
FR	0.42	4.17	1.25	0.6
GB	0.84	5.23	2.18	1.17
GR	0.24	0	0.03	0.03
HR	0.03	0.1	0.08	0
HU	0.07	0.1	0.06	0.07
IE	1.29	1.75	0.86	1.36
IT	0.21	0.68	0.15	0.22
LT	0.09	0.24	0.01	0.09
LV	0.3	0.35	0.32	0.62
PL	0.05	1.05	0.18	0.07
PT	0.33	1.38	0.72	0.26
RO	0.1	0.45	0.13	0.1
SE	0.06	0.04	0.13	0.25
SI	0.4	0.47	0.5	0.26
SK	0.13	0.34	0.1	0.04
Total	**0.3**	**1.04**	**0.47**	**0.29**

Source: Amadeus (authors' calculations). Note: the category 'All' refers to the whole sample, including large firms discussed in section 5.

7. SMEs in productivity and innovation dynamics

Innovation is usually associated with "*new*" technology-based firms while the role of large firms is often ignored or analysed out of the wider economic context. The changing interaction between large and small firms is a relatively unexplored topic. For example, econometric evidence suggests that large firms -and not SMEs- exert an independent and robust effect on economic growth (Lee et al., 2013). Developed economies tend to have more significant numbers of large firms than predicted by their size. In contrast, many middle-income or non-members of the OECD countries tend to have negative 'residual numbers', i.e. a lesser number of large firms than predicted. Overall, the econometric evidence suggests that large firms play a more robust role in the economy than SMEs.

However, excessive relative dependence on large firms does not seem to be right either (Lee et al., 2013). In fact, SMEs alone are not sufficient as drivers of fast technology upgrading. These issues have not been explored in the European context, and they motivate our inquiry.

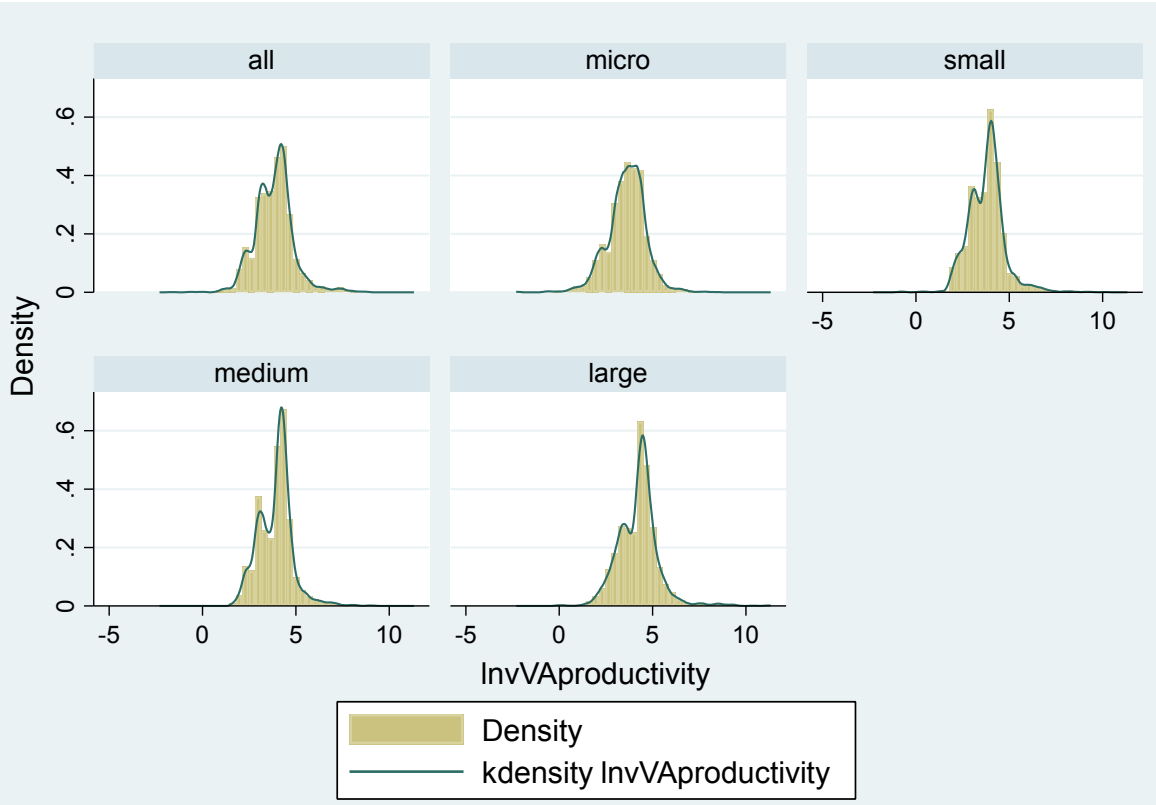
Firstly, we explore the role of SMEs in industry dynamics by looking at the relationship between sectoral productivity and the average size of the firm. Next, we pinpoint how the relationship differs for our four size-classes (micro, small, medium and large) by looking at their respective evolution of productivity levels/growth through time. Finally, we further explore how sectors with different degrees of R&D intensity (see Table A1) evolve in term of productivity within each size-class.

The database we exploit for this econometric assessment is the Amadeus data at the firm level for value-added per employment[34]. Individual firm-level data are aggregated in 19 sectors, 24 countries, seven years (2010-2016) and four size categories (micro, small medium and large) as explained in section 3.

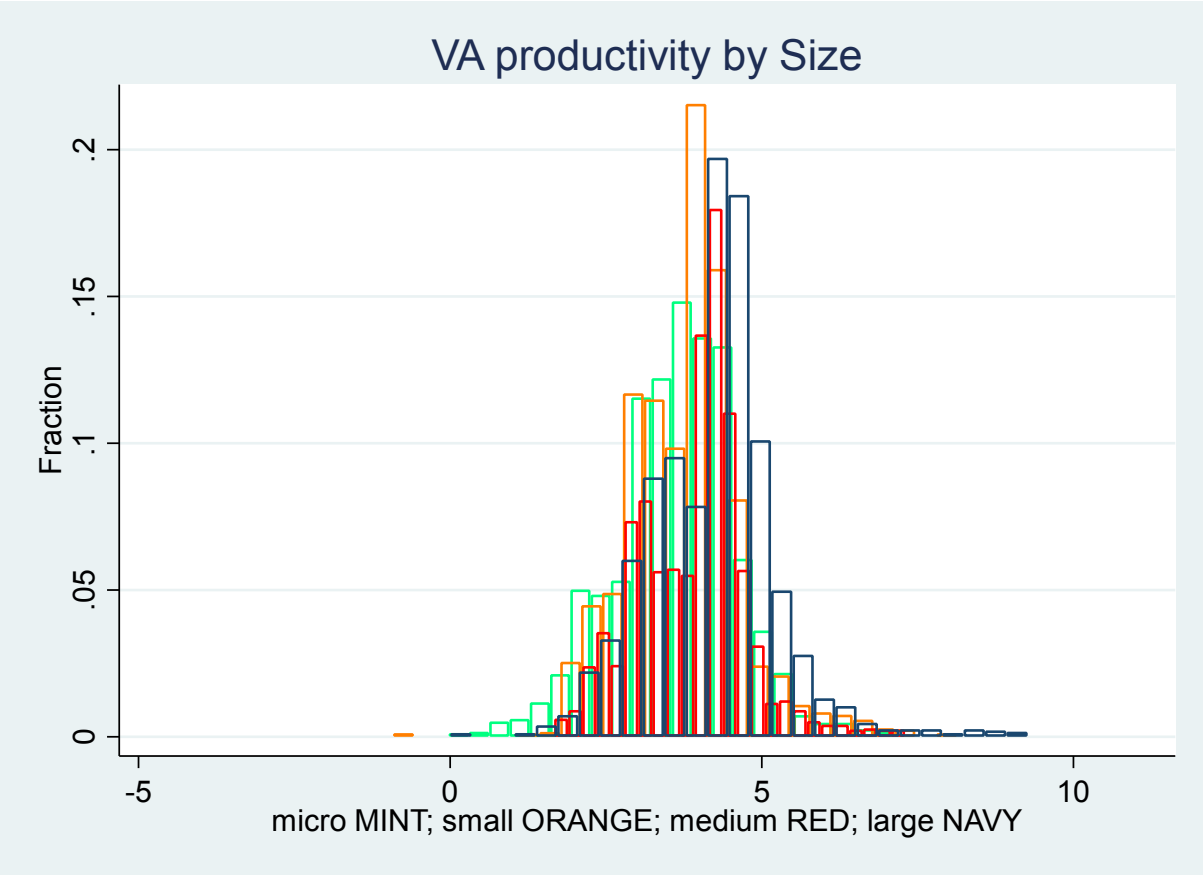
In the graph below, we report the log(VA/employment) distribution by size categories, alongside the distribution for "all" the sample, i.e. all size categories aggregated together. The VA productivity within each size category is indeed log-normal, the micro-firms' category has much longer tails and less compressed structure than the other three, and the kernel density seems to suggest a double-peaked curve behaviour. However, to gauge the relative position of each of the curve on the horizontal axis, we also present the four size categories into an "over-imposed" unique graph. It is possible to appreciate how the "Micro" (mint green) is shifted to the left, the "Small" (orange) is on the rightward side of micro, the "Medium" curve (red) goes even further right and finally the "Large" (blue navy) positioning itself on the far right side of the graph. This bird-eye-view seems to suggest the existence of a positive relationship between productivity and size. We also report a substantial temporal variability within each size classes.

7.1 VA on Employment Distributions by size-classes

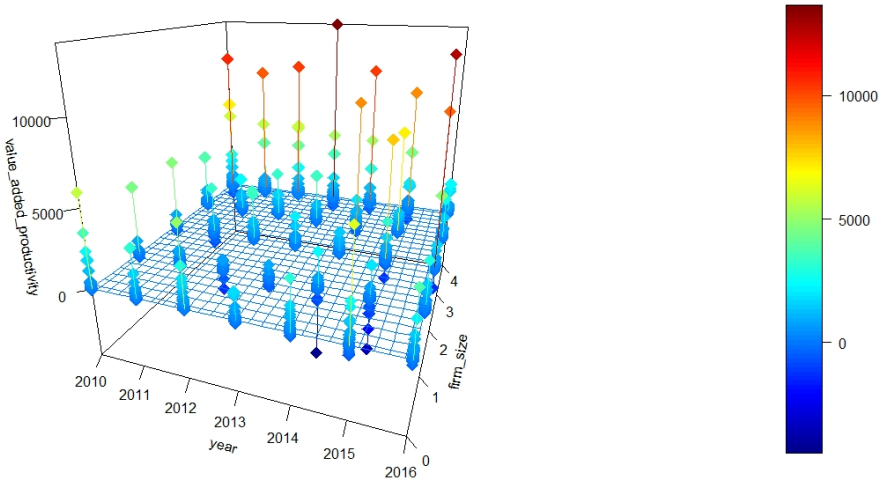
[34] The availability of the variable Value added is not on the same sample of sales per employees. In fact, in Amadeus value added is reported by a restricted sample of firms compared to the much more populated sample of firms reporting "operating revenue turnover". Value added is used for the value added based productivity, while "operating revenue turnover" is used for the Sales-based productivity measure. For this econometrics exercise we present the VA base productivity –being a more appropriate proxy of labour productivity- but we do find broadly consistent results also for sales-based productivity.


all
micro
small
medium
large
Density
0
.2
.4
.6
-5
0
5
10
lnvVAproductivity
Density
kdensity lnvVAproductivity
Graphs by size_category_0_to_4

7.2 VA on Employment Distributions, over-imposed picture



7.3 VA on Employment Distributions, temporal variability



However, we cannot read too much into these graphs, the reason being that these are "unconditional distributions", potentially driven by sectoral, country and time composition, for example. This is the reason why we move into an econometrics mapping exercise testing the size-productivity relationship within the following three specifications with clustered standard errors:

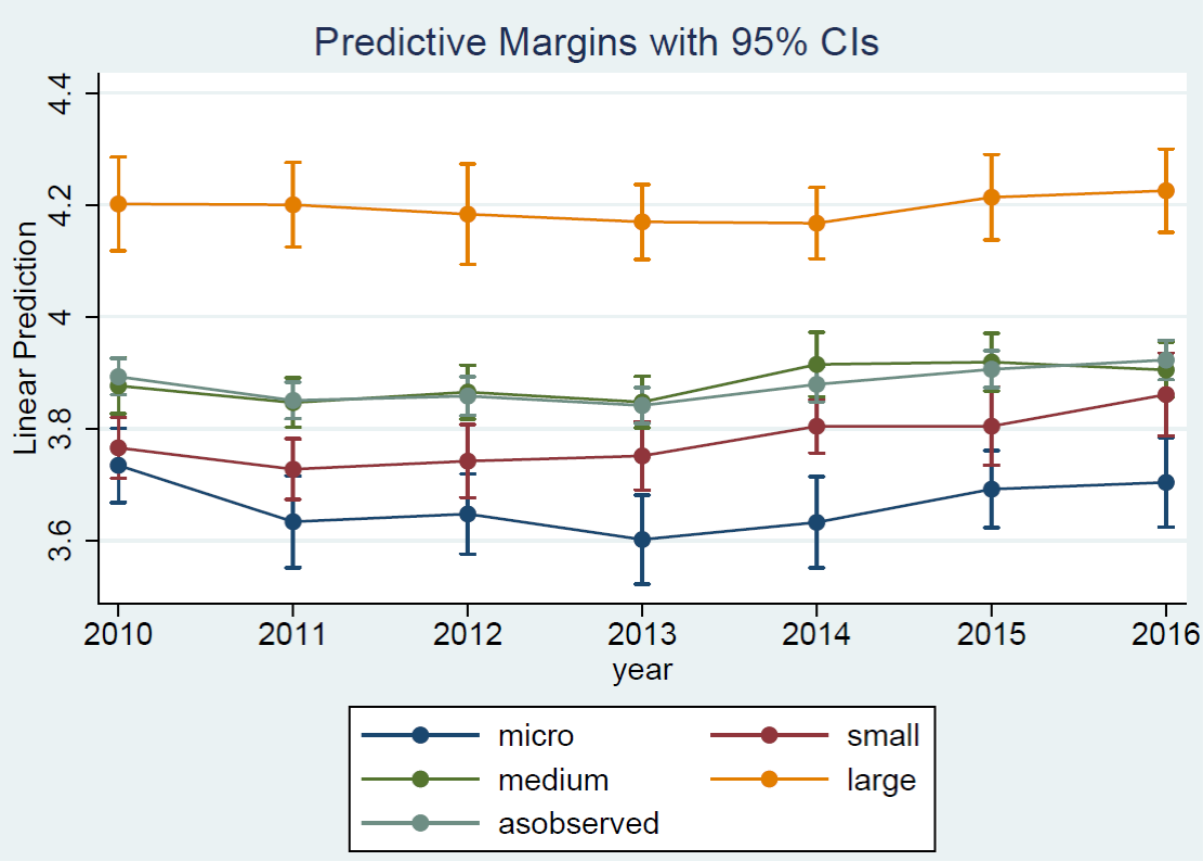
$$log\left(\frac{VA}{employment}\right) = \alpha + \beta Size + \gamma X + \varepsilon \quad (1)$$

$$log\left(\frac{VA}{employment}\right) = \alpha + \beta_1 Size * Time + \beta_2 Size + \beta_3 Time + \gamma X + \varepsilon \quad (2)$$

$$log\left(\frac{VA}{employment}\right) = \alpha + \beta_1 Size * Time * R\&D + \beta_2 Size + \beta_3 Time + \beta_4 R\&D + \gamma X + \varepsilon \quad (3)$$

For all equations, the dependent variable is VA on employment and the main independent variable is size (expressed in four categories dummies). X represents the granular set of Fixed Effects (country, sector time and their interactions). In equation 2) we "augment" equation 1) by the inclusion of the interaction of size*time (to capture sector-specific trends) and in equation 3) we further explore the triple interaction size*time*R&D (to capture sector/ technology-specific trends). The results are presented in the graphs below.

7.4 Predicted values of productivity levels by size category (see equation 2 in the text)

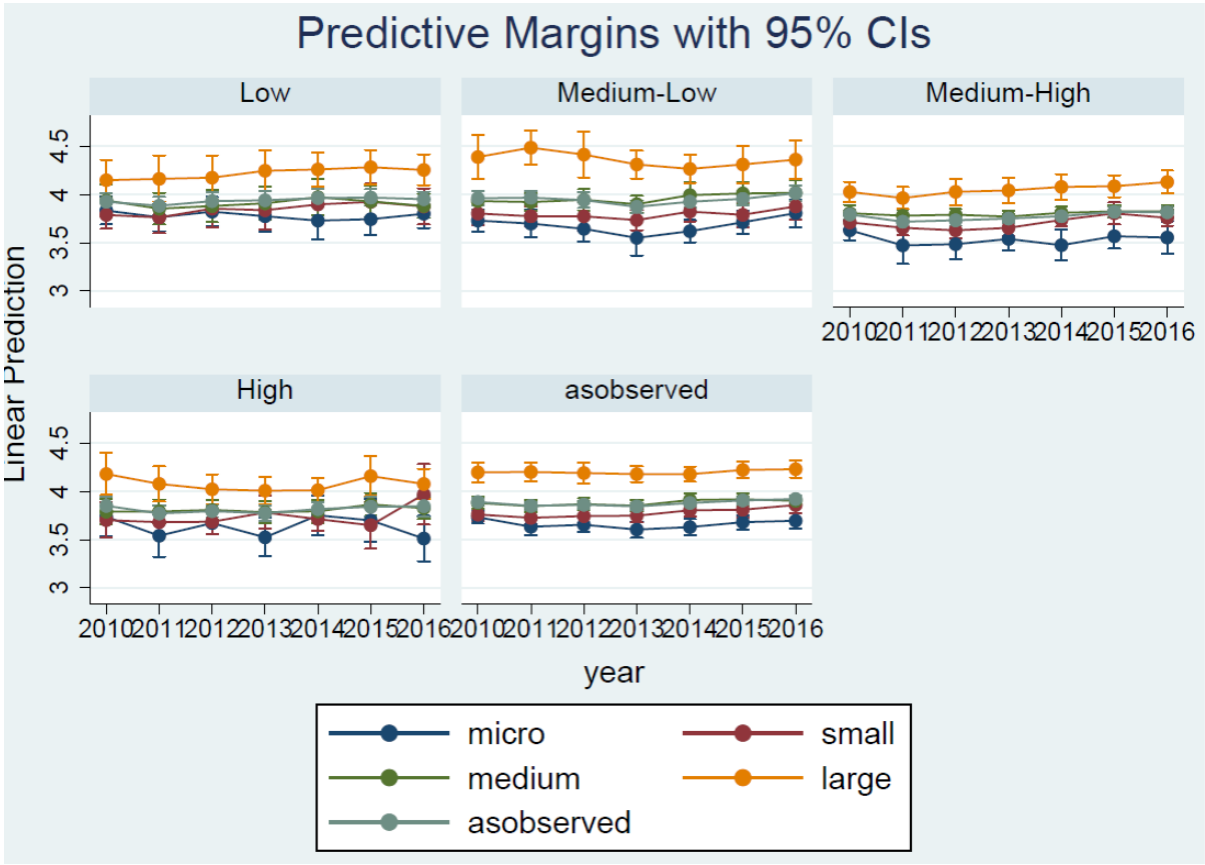


Our results suggest that there is a robust relationship between productivity and size of firms. The increase in productivity is less than proportional to the rise in employment, though (elasticises of the model between 0.19 and 0.09). We note that even if the increase of productivity is less than proportional to the rise in employment, the larger the size measure (being this expressed in categories or as a continuous variable), the higher the semi-elasticity[35] of the estimated coefficients.

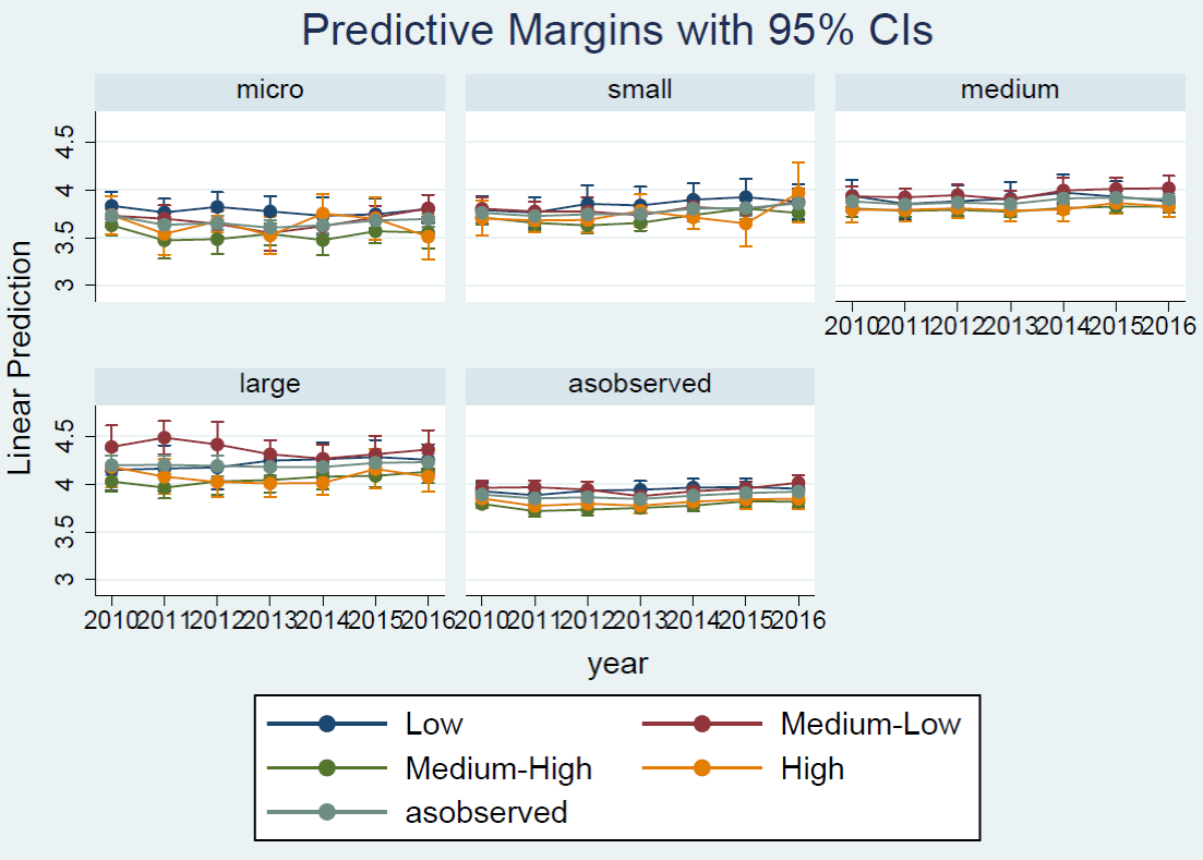
As far as the level of VA productivity is concerned, “Large firms” appears to be a “league” apart and there is a sluggish or no increase in the level of productivity for most size categories, except for “Small firms”, which register a slight upper trend from 2011 onwards. “Micro firms” experience a slump in productivity, especially in 2013, but in 2016 they are back to roughly 2010 levels.

[35] Semi-elasticity: the independent variable is a dummy and the depended variable is in logs.

7.5 Predicted values of productivity by technology (see equation 3) in the text): R&D intensity breakdown.



7.6 Predicted values of productivity by size category (see equation 3 in the text): Size categories breakdown.



We now turn to the results from equations 3), yet the most demanding specification. There is a quite stable ranking among size-classes: large first and micro last[36]. However, high tech "Small" firms seem to reach in 2016 level of productivity similar to "Large" ones. The variability in productivity between size classes (within the same level of technology) is higher than the variability between the level of R&D technology (within the same size-class), though. This signals that firm productivity is mainly determined by the size category they belong to, and less so by the level of technology intensity/adoption (low medium-low medium-high high) they adopt, a sort of "size-class trap".

Finally, we also estimate the same equations in growth (delta log) and otherwise exploit the same specification of controls[37]:

$$\Delta log\left(\frac{VA}{employment}\right) = \alpha + \beta Size + \gamma X + \varepsilon \quad (4)$$

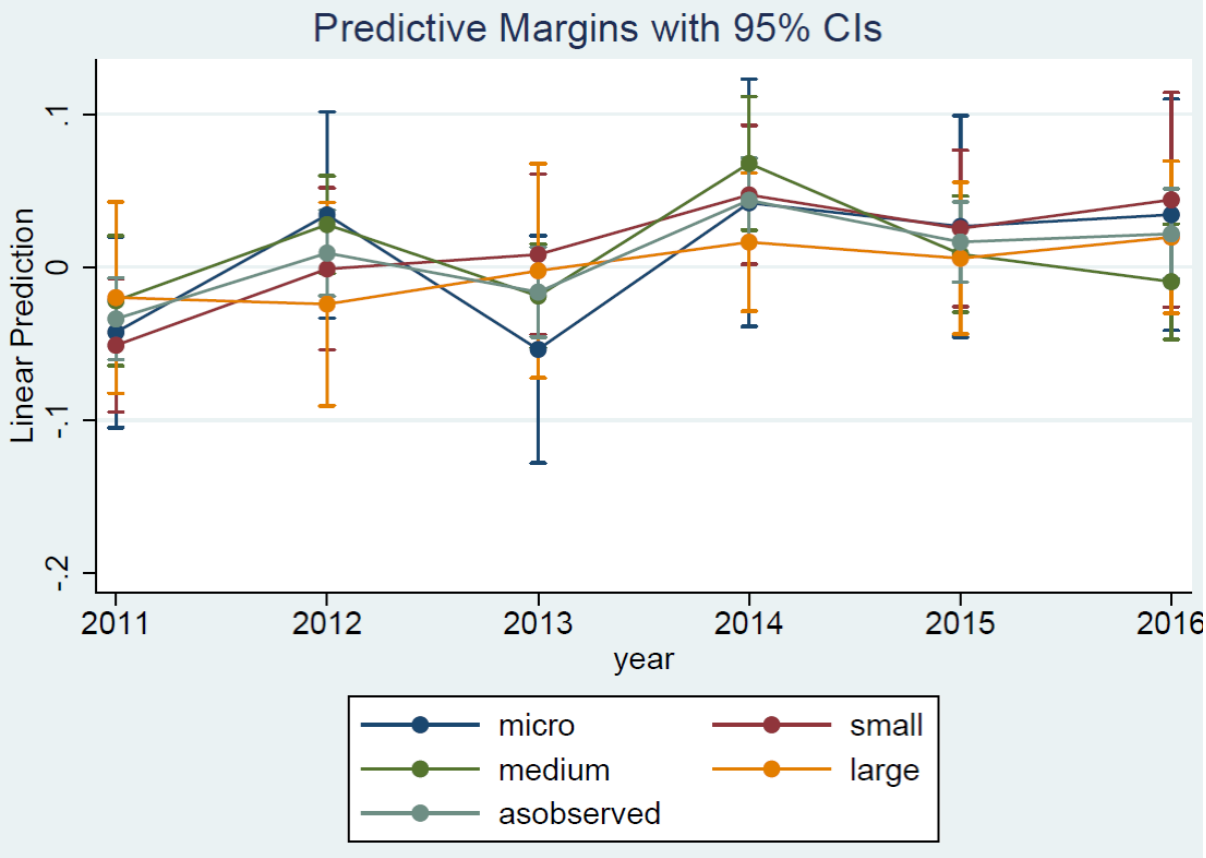
[36] The category "asobserved" is the unweighted mean of all four categories.

[37] An important caveat: the limited econometrics exercise of this section is only meant to map patterns of productivity evolution in the European countries when looking at different size classes. The extension to dynamic modelling and to a much more theory-driven specification is the natural way to develop crucial research questions by the means of a deeper investigation.

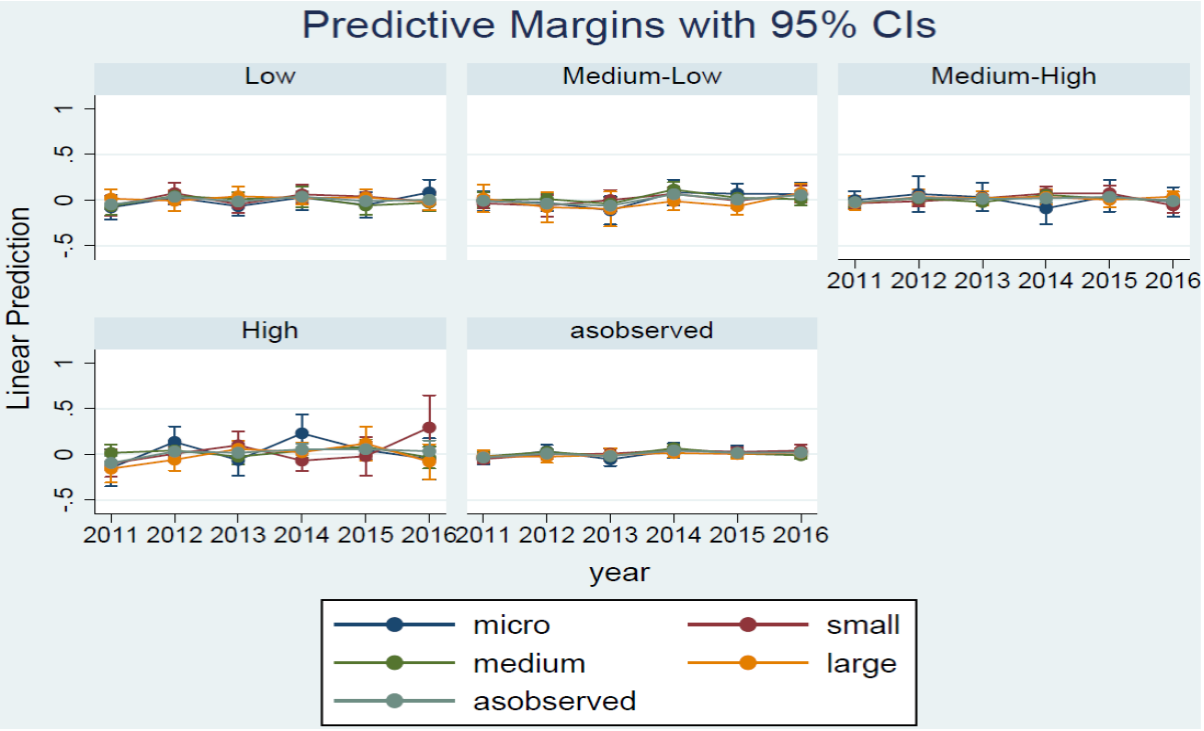
$$\Delta log\left(\frac{VA}{employment}\right) = \alpha + \beta_1 Size * Time + \beta_2 Size + \beta_3 Time + \gamma X + \varepsilon \quad (5)$$

$$\Delta log\left(\frac{VA}{employment}\right) = \alpha + \beta_1 Size * Time * R\&D + \beta_2 Size + \beta_3 Time + \beta_4 R\&D + \gamma X + \varepsilon \quad (6)$$

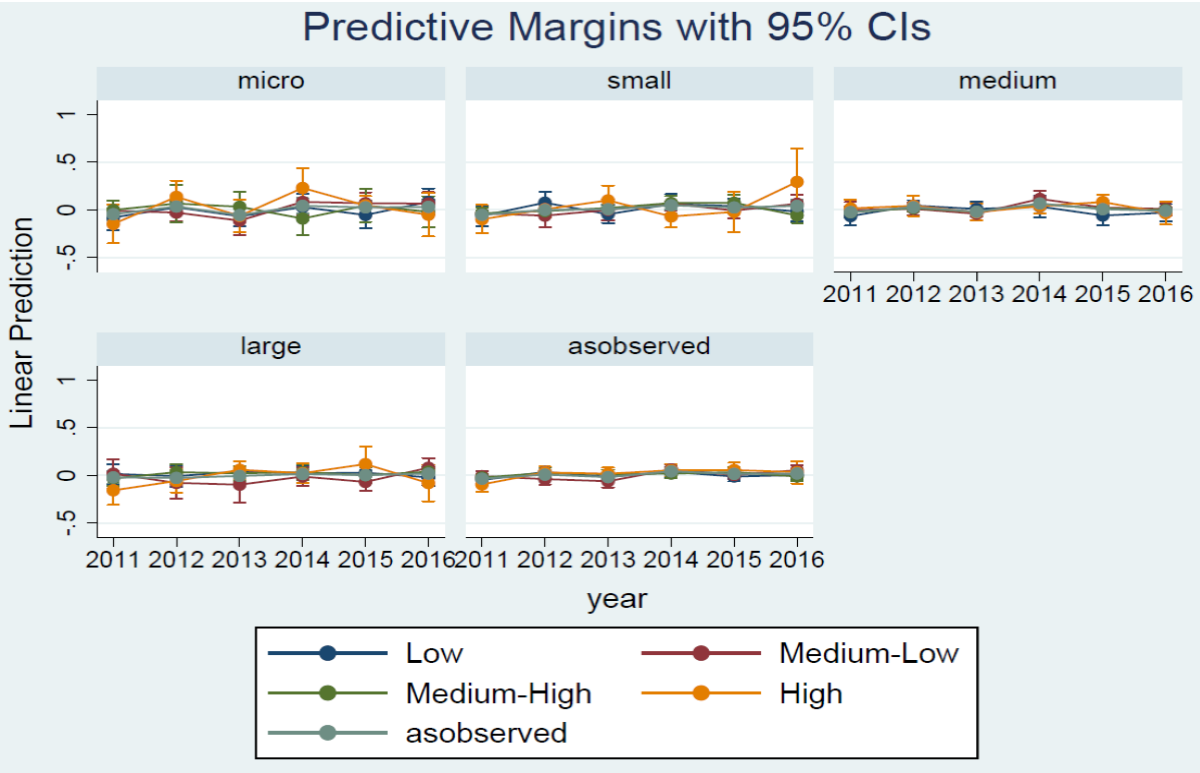
7.7 Predicted values of productivity (delta log) by size category (see equation 5) in the text)



7.8 Predicted values of productivity (delta log) by technology (see equation 6) in the text): R&D intensity breakdown.



7.9 Predicted values of productivity (delta log) by size (see equation 6) in the text): size categories breakdown.



As far as the interpretation of the results of the growth equation is concerned[38], there is no empirical evidence of statically significant productivity difference between four size categories nor between technological classes. As per the graphs, not only the lines are all much overlapping, but the confidence intervals are not far apart from each other for basically all breakdown. There is one notable exception: the growth rate of Small-Sized firms in High R&D intensity sectors spikes in 2016. Is this a sign a thriving growth of Service/IT-led small companies in recent years? It is too soon to say, but the data definitively point in that direction.

8. Conclusions

The paper aims to explore the role of SMEs in the EU in shaping productivity growth and innovation patterns. As the first step in the analysis, we have used a section of Orbis -Amadeus- database to explore features of the EU business demography and industry dynamics. Within that context, we have explored the role of SMEs and their contribution to productivity when compared to large firms.

In several respects, this is pioneering work as the issue of industry dynamics within the EU is sparsely explored primarily due to severe data limitations and numerous methodological problems related to data coverage and longitudinal comparability. The methodological issues are very challenging, and we have listed them in section 3, where we also explained how we tried to tackle it. In a nutshell, our conclusions are strongly conditional on the quality and suitability of the database. However, given that Amadeus is the biggest database at the firm level, we do not see better instrument to explore issue related to the EU firm demography. Based on this, our results can be summarised in 16 tentative stylized facts or tendencies which operate across the entire sample of countries and sectors but which are not necessarily valid for each EU country or even EU macro-region. Still, stylized facts are the first step in generating hypotheses for further econometric work. Moreover, in section 7, we report on first such exploration where we examine the role of different sizes of firms in productivity within the EU.

The evidence presented should be seen in the context of the post-2008 growth in the EU which is characterised by stagnant growth and slowing down or even breakup of the EU as ‘convergence machine’ but also in the context of deep structural change driven by diffusion of ICT and related organisational and institutional changes. Last but not least, this period is characterised by the debt crisis of the EU South and macroeconomic challenges strongly driven by the complexities of the European Monetary Union.

[38] See also footnote 37.

Within that context, the EU business dynamics measured by entry and exit are low and stagnant though business entry is still more prevalent in Southern and Eastern EU economies. Entry and exit rates are highly correlated which conform to this general stylized fact from industry dynamics literature. Within that context, it is significant that the ICT sector represents activity with a high degree of turbulence as reflected in quite dynamic entry and exit of firms. It is also significant that the ICT sector is expanding as net entry rates are the highest in ICT services.

Industry dynamics in Europe has its specific features as the EU is composed of economically and technologically advanced 'North' and Periphery (South/East) and this structural feature is reflected in industry dynamics figures. A significant, stylized fact is that entry rates are low in the EU North, but these are counterbalanced by higher average employment size of *de novo* firms in the North. EU 'East' and 'South' entrants (except Italy) are significantly smaller compared to EU 'North'. This reflects not only their levels of income but also organisational and entrepreneurial capabilities.

Data do confirm another stylized fact from industry dynamics which show that exiting firms are most often smaller than entrants. However, data also indicate a few country-specific paths which do not fully conform to this trend. However, a very strong and specific feature of the EU is that exiting firms are comparatively old pointing to 'prolonged creative destruction process'. This evidence is confirmation of the last literature which also indicates that the creative destruction process in the EU is quite specific compared to the US. EU entrants enter larger but then grow at a slower rate and take longer time to exit. On the other hand, US entrants enter smaller but than either quick exit or grow. Whether this latter feature still holds for the US is to be confirmed as the latest evidence on the US also points to significant slowing down of the 'creative destruction machine'.

It is important to recognise that this feature of 'creative destruction' in the EU is a continent-wide feature. Although, survival rates are macro-region specific: on average higher on 'periphery' (East/South) and lower in 'North' they are still high when compared to the US. Lower rates in the EU may also be a reflection of the economic structure of the EU, which has a lower share of ICT producing and suing sectors. Survival rates are fairly uniform across sectors, unlike much more varied country rates which further shows that intensity of 'creative destruction' is also strongly shaped by sector or industrial structure of the economy.

Another interesting feature of industry dynamics in the EU is that in the majority of the EU countries and sectors, the growth of enterprise employment follows the U shaped curve. Entrants shrink in the initial two years but then manage to grow again by year five. Whether this is an endemic feature of all SMEs which make the bulk of entrants and whether unrealistic expectations of optimistic founders can explain it is an issue which deserves further scrutiny. Although being relatively big at entry market shares of both entrants and

exiting firms remain consistently low across all sector-countries. However, we would need comparable international data to put this fact in the context. However, this fact just confirms another stylized fact of industry dynamics literature which suggest that the majority of SMEs operate on fringes of oligopolistic markets and their entry and exit are indications of the natural process of experimentation in the market economy. Also, many of SMEs are 'lifestyle' business whose primary aim is not to grow, but 'survival' and thus, their criteria for a successful business are not of conventional Schumpeterian 'heroic entrepreneur'.

A significant, stylized fact of industry dynamics literature is large and highly skewed inter-firm differences in productivity within countries and within sectors. Our evidence fully conforms to this stylized fact. Intra-countries dispersions of sectoral productivities (top decile vs bottom decile) are significant and country-specific. However, we find also tentative evidence that inter-sectoral productivity differences at the extremes of distributions are more significant than inter-country differences. This issue merits further research as its implications for policy are of major importance.

Finally, our very tentative stylized fact is that there seems to be convergence in manufacturing productivity of 5-year-old entrants of the EU periphery (East and South) in relation to EU North. In other words, there is some (possibly very slim but still possible) ground for hypothesis for intra-EU convergence in manufacturing. This hypothesis corroborates well with Rodrick's finding that there is unconditional convergence in manufacturing at a global level.

Business dynamics is to a large extent about entry/exit, growth of firms and the role of incumbents and newcomers in productivity, innovation and employment. However, the nature of our inquiry requires also a specific focus on a different type of entrants, i.e. on different types of SMEs. We use Eurostat classification and divide SMEs into micro, small and medium and based on a similar approach tried to distil several stylized facts which would be informative specifically about the role of SMEs.

Our evidence shows that micro firms drive entry and they are dominant entrants in the EU 'Periphery'. Micro firms' entry dominates in all sectors across the EU except in low R&D intensive sectors. As these are traditional sectors, we presume that in these sectors, the founder does not envisage such uncertainties and possibly capital and knowledge requirements for entry are lower, which enable entry of somewhat larger firms.

Entry/exit dynamics is similar to overall dynamics but is dominated by micro firms. This is expected as experimentation is the least costly for these firms. Average micro, small and medium-sized entrants in the EU based on Amadeus sample have 2, 19 and 85 employees respectively. As would be expected there is a trade-off between entry rates and size of entrants, i.e. entry rates are lower when the size of average entrant increases. Also, in line

with the overall trend average SMEs exit smaller compared to their size at entry across all three groups. These features of entrants and exiting firms are also reflected in market shares of SMEs which shrink between entry and exit, especially for medium-sized firms. However, the puzzling fact is that on average, micro firms have the highest market share compared to small and medium firms at both entry and exit, that may be attributed to their higher entry rates as compared to small and medium-sized firms underlined by faster pace of imitation of new ideas

Exiting SMEs in the EU is relatively old, which reflects the dominance of 'lifestyle' business in the SMEs population to which we pointed out earlier. This is the most intuitive explanation of why exiting firms would exit at a relatively old age. However, this should be treated as a relevant hypothesis which warrants further research.

Finally, we explored the relationship between large and small firms in contributing to levels and rates of productivity growth. Our results suggest that there is a robust positive relationship between productivity and size of firms. However, the increase in productivity is less than proportional to the increase in employment (elasticises of the linear model are between 0.19 and 0.09). Among sectors, Telecommunications and "Scientific research and development" register a premium in terms of productivity or their productivity increases relatively higher with increasing size of the enterprise. Among EU economies, Denmark is the leading in terms of Value-added on employment measure of productivity.

Issues for further research

Our research represents the first stage in the research process which helped us to generate several grounded hypotheses. However, to create a reliable basis for econometric investigation, our research will need to address two issues:

- Weighting sample to eliminate uneven coverage across countries and sectors.
- In the next stage of this research, we hope to be able to merge Amadeus data with different industry, regional & country-level data to investigate the determinants of productivity growth among different firms' size classes, and barriers constraining SMEs' contribution to innovation and growth.

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Annexes:

Annex 1: Sectors and indicators

Table A1: Sectors included into analysis

	Sectors included into analysis (C+D+E+J+M)	R&D intensity	
1	**Manufacturing (C')**		
1	CA.Manufacture of food products, beverages and tobacco products	Low	L
2	CB.Manufacture of textiles, apparel, leather and related products	Low	L
3	CC.Manufacture of wood and paper products, and printing	Low	L
4	CE.Manufacture of chemicals and chemical products	Medium-High	MH
5	CF.Manufacture of pharmaceuticals, medicinal chemical and botanical products	High	H
6	CG.Manufacture of rubber and plastic products, and other non-metallic mineral products	Medium-Low	ML
7	CH.Manufacture of basic metals and fabricated metal products, except machinery and equipment	Medium-Low	ML
8	CI.Manufacture of computer, electronic and optical products	High	H
9	CJ.Manufacture of electrical equipment	Medium-High	MH
10	CK.Manufacture of machinery and equipment n.e.c.	Medium-High	MH
11	CL.Manufacture of transport equipment	Medium-High	MH
		Medium-High	MH
2	**Utilities industries (D+E)**		
12	D.Electricity, gas, steam and air-conditioning supply	Low	L
13	E.Water supply, sewerage, waste management and remediation	Low	L
3	**ICT services (J)**		
14	JA.Publishing, audiovisual and broadcasting activities	Medium-Low	ML
15	JB.Telecommunications	Medium-Low	ML
16	JC.IT and other information services	Medium-High	MH
4	**Professional, scientific and technical activities (M)**		
17	MA.Legal, accounting, management, architecture, engineering, technical testing and analysis activities	Medium-Low	ML
18	MB.Scientific research and development	High	H
19	MC.Other professional, scientific and technical activities	Medium-Low	ML
	Adjusted based on		
	Source: Fernando GalindoRueda (2016)OECD Taxonomy of Economic Activities Based on R&D Intensity , OECD		
	https://www.oecd-ilibrary.org/docserver/5jlv73sqqp8r-en.pdf?expires=1591882716&id=id&accname=guest&checksum=EAFB5E36CA08BCA5DBD306CDA4F1FB82		

Table A2: Indicators and definitions

Indicators	Definition
entry_rate	firms in sector s in year t whose inc year is year t) / (all firms in sector s in year t
avg_size_entrant	average number of employees of firms in sector s in year t whose incorporation year is year t

tot_mkt_share_entrants	sum of all turnovers of firms in sector s in year t whose incorporation year is year t
exit_rate	(firms in sector s in year t for which year t is the last available year with data for either employment or turnover) / (all firms in sector s in year t)
avg_size_exiter	(avg number of employees of exiter firms in sector s in year t)
tot_mkt_share_exiters	(sum of all turnovers of exiter firms in sector s in year t)
avg_age_exiter	(avg age of exiter firms in sector s in year t)
avg_turnover	(average turnover of firms in sector s in year t)
tot_turnover	(sum of all turnovers of firms in sector s in year t)
avg_employment	(average number of employees of firms in sector s in year t)
tot_employment	(sum of all employees of firms in sector s in year t)
VA_avg_productivity	(avg of (value added per employee) of firms in sector s in year t)
TNV_avg_productivity	(avg of (turnover per employee) of firms in sector s in year t)
turnover_rate	(percentage of entrant firms + percentage of exiters firms) in sector s in year t
high_over_low_productivity	(average productivity of 10% most productive firms in sector s in year t)/(average productivity of 10% least productive firms in sector s in year t)
survival_rate_2y	% of entrant firms in sector s in year t-2 that are still alive in year t
survival_rate_5y	% of entrant firms in sector s in year t-5 that are still alive in year t
relative_size_to_entry_2y	{[(number of employees of firms in sector s in year t who where entrants 2 years ago)/(number of employees of firms in sector s in year t-2,their entrant year)]-1}*100
relative_size_to_entry_5y	{[(number of employees of firms in sector s in year t who where entrants 5 years ago)/(number of employees of firms in sector s in year t-5,their entrant year)]-1}*100
productivity_of_5y_old_entrants	average of the productivities of firms in sector s in year t that were entrants at t-5
productivity_of_entrants_5y_ago	average of the productivities of firms that were entrants in year t-5 in sector s in year t-5
relative_productivity_of_5y_old_entrants_vs_5y_ago	[(average of the productivities of firms in sector s in year t that were entrants at t-5)/(average of the productivities of firms that were entrants in year t-5 in sector s in year t-5)]-1

Annex 2:Tables and figures

Table A2.1 Cross-country-year entry rates, 2010-2016

Country	2010	2011	2012	2013	2014	2015	2016	Total
AT	1.34	1	1.83	0.89	0.89	0.86	1.13	1.13
BE	0.77	1.03	0.48	0.5	0.17	0.73	0.18	0.55
BG	4.16	5.57	7.12	5.41	5.65	5.15	5.37	5.49
CZ	1.36	1.41	1.39	1.31	1.69	1.85	1.93	1.56
DE	1.72	1.87	1.88	1.58	1.21	0.99	1.45	1.53
DK					1.91	0.99	1.97	1.62
EE	4.23	3.42	2.64	3.04	2.91	2.64	2.68	3.08
ES	1.37	1.46	1.37	1.92	1.61	1.59	1.71	1.57
FI	2.32	2.67	3.31	3.84	3.21	2.41	2.84	2.94
FR	1.3	0.96	0.78	0.95	0.97	0.58	0.61	0.88
GB	1.26	1.11	0.78	0.87	0.97	1.18	1.39	1.08
GR	0	0.02	0.02	0.05	3.04	2.14	6.38	1.66
HR	3.83	1.63	3.91	5.97	5.85	5.85	5.21	4.61
HU	1.11	3.89	2.44	2.11	2.31	1.82	2.41	2.3
IE	1.72	1.65	1.25	0.83	1.83	1.03	1.33	1.38
IT	0.87	2.35	1.93	2.46	2.91	4.2	3.03	2.54
LT	4.94	2.56	3.76	4.08	3.23	3.01	1.35	3.28
LV	5.17	10.72	7.36	9.51	7.33	6.15	5.11	7.34
PL	6.59	2.76	3.29	0.08	0.12	4.02	3.24	2.87
PT	4.64	6.17	5.34	6.08	5.53	6.02	5.24	5.57
RO	4	6.39	6.33	5.17	4.57	6.95	5.92	5.62
SE	1.11	1.65	1.47	1.58	1.59	1.13	1.37	1.42
SI	3.04	2.46	2.01	2.54	2.79	2.24	2.84	2.56
SK	0.35	0.56	0.29	0.54	1.13	0.67	0.85	0.63
Total	2.49	2.75	2.65	2.67	2.64	2.67	2.73	2.66

Source: Amadeus (authors' own calculations); cells highlighted in red show the bottom 20th centile of distribution, and cells highlighted in green show the top 20th centile of distribution.

Table A2.2 Country-sector entry rates, 2010-2016

Sector	AT	BE	BG	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LV	PL	PT	RO	SE	SI	SK	Total
CA	1.29	0.69	5.57	1.96	1.3	0.87	3.2	1.46	2.46	1	0.86	1.49	4.27	2.14	0.81	3.09	2.81	5	1.06	4.01	5.64	1.27	3.17	0.73	2.34
CB	1.7	0.46	7.37	0.99	1.3	0	3.2	1.49	2.1	0.64	0.44	1.03	4.11	1.86	2.39	3	2.01	4.87	1.11	4.91	5.96	1	0.93	0.47	2.22
CC	1.11	0.7	5.66	2.16	1.16	0	2.36	1.6	1.53	0.83	0.61	1.29	4.1	1.89	0	2.53	2.77	6.24	2.44	4.31	4.01	0.96	1.51	0.9	2.11
CE	1.14	0.16	5.16	1.1	1.07	6.07	2.69	1.1	2.2	0.04	0.47	1.03	6.47	1.94	0	1.1	2.56	6.39	1.77	1.87	4.9	0.59	2.41	0.14	2.18
CF	0.27	0.54	2.36	2.06	1.07	2.77	4.64	1.74	5.64	0.2	0.73	1.19	2.79	2.64	0.84	1.61	8.24	8.86	0.89	4.76	3.79	1.89	3.57	1.73	2.7
CG	0.94	0.51	5.7	1.11	0.81	0	3.26	1.17	1.71	0.46	0.54	0.36	4.74	2.41	1.24	1.9	3.5	7.44	0.87	3.24	5.53	0.74	1.89	0.37	2.1
CH	1.59	0.21	4.77	1.66	1.13	1.23	4.44	1.57	1.91	0.57	0.84	0.44	3.59	2.19	0.84	2.57	4.37	8.77	1.61	4.21	4.5	0.87	2.21	0.91	2.38
CI	0.46	0	3.86	1.39	0.94	0	1.13	2.03	3.09	0.44	0.64	0.6	2.39	1.4	0	1.34	3.21	7.17	1.89	5.69	3.03	0.9	2.86	0.33	1.87
CJ	0.36	0.29	3.79	0.93	1.43	0	5.51	1.11	1.87	0.51	0.69	0	3.54	1.04	1.59	1.73	1.96	5.99	1.46	2.87	3.66	0.61	1.1	0.53	1.77
CK	0.99	0.3	3.67	0.76	1.07	1.5	1.39	1.14	1.47	0.57	0.5	1.34	2.41	1.59	1.39	1.63	2.77	5.19	0.91	3.39	3.41	0.61	1.57	0.17	1.66
CL	0.74	0	3.97	1.34	1.06	0	3.39	1.11	2.44	0.61	0.73	1.3	4.7	2	0	2.97	2.9	9.64	1.54	4.39	7.54	0.61	3.66	0.6	2.39
D	0.43	1.74	3.24	0.23	1.96	2.37	0	0.63	2.77	1.21	2.1	1.71	6.74	2.97	0	1.77	2.8	2.06	1.63	3.13	8.73	0.73	3.61	0	2.19
E	1.51	0.13	5.53	1.79	1.11	0	1.87	1.37	1.96	0.74	1.1	1.49	3.41	2.06	3.04	1.97	3.01	4.99	0.79	5.09	8.33	1.6	3.87	0.66	2.39
JA	0.83	0.54	7.06	1.89	1.69	3	3.36	1.59	2.86	0.83	1.46	1.21	3.47	2.53	2.29	2.13	1.99	8	3.51	7.19	5.69	2.23	1.43	1	2.82
JB	1.3	0.29	4.76	2	2.39	3.17	1.86	3.04	3	1.9	1.41	4.91	6.89	3.21	1.97	4.97	1.91	8.37	5.1	14.1	5.51	1.97	2.59	0	3.61
JC	1.63	1.04	10.49	2.51	3.09	2.17	5.66	2.41	4.61	1.61	2.13	2.39	7.67	3.29	3.14	3.74	5.1	12.29	10.44	10.26	8.04	3.36	2.87	1.06	4.62
MA	1.69	1.09	5.41	1.54	2.31	1.8	2.96	1.4	3.57	1.41	2.54	3.19	5.1	2.23	2.76	2.83	3.29	9.46	7.81	6.07	4.79	2.57	2.06	0.89	3.28
MB	2.26	0.79	8.06	1.07	1.43	3.03	3.21	2.17	6.76	1.51	0.83	4.77	4.41	2.81	1.1	3.19	2.77	7.39	2.11	7.51	6.49	1.96	5.17	0.69	3.4
MC	1.33	1.01	7.9	3.23	2.76	2.9	4.36	1.77	3.91	1.6	1.9	2.56	6.69	3.43	2.73	4.11	4.26	11.27	7.6	8.87	7.21	2.44	2.16	0.77	4.03
Total	1.13	0.55	5.49	1.56	1.53	1.62	3.08	1.57	2.94	0.88	1.08	1.7	4.61	2.3	1.38	2.54	3.28	7.34	2.87	5.57	5.62	1.42	2.56	0.63	2.63

Source: Amadeus (authors' own calculations); cells highlighted in red show the bottom 20th centile of distribution, and cells highlighted in green show the top 20th centile of distribution.

Table A2.3 Cross-country-year exit rates, 2010-2015

Country	2010	2011	2012	2013	2014	2015	Total
AT	0.33	0.08	0.31	0.63	0.46	0.64	0.41
BE	0.8	1.65	1.18	1.42	0.66	1.88	1.27
BG	0.04	0.11	0.38	4.83	5.42	5.29	2.68
CZ	0	0	0	0.13	0.25	3.76	0.69
DE	1	1.58	0.92	1.45	1.55	1.84	1.39
DK					0.03	0.38	0.21
EE	0.21	0.12	0.24	0.49	1.94	1.39	0.73
ES	0.62	0.58	1.16	3.64	3.88	4.93	2.47
FI	0.2	0.24	0.09	0.75	1.15	5.59	1.34
FR	0.07	0.11	0.41	4.97	7.23	8.68	3.58
GB	3.44	2.57	2.44	2.46	1.99	3.61	2.75
GR	0	0	0	0	0.14	0.18	0.05
HR	0	0	0	0.49	0.33	0.46	0.21
HU	0.03	0.01	0.51	0.41	0.54	0.77	0.38
IE	2.45	2.25	2.93	2.03	2.52	4.96	2.86
IT	0	0	0	1.83	1.92	2.52	1.05
LT	0	0	0	0.63	0.46	1.23	0.39
LV	0	0	0	0.63	1.47	2.53	0.77
PL	0.23	0	0.28	2.25	1.11	3.45	1.22
PT	0.67	0.67	1.08	3.98	3.82	3.68	2.32
RO	0	0	0	1.46	1.39	2.13	0.83
SE	0.02	0	0.01	0.1	0.13	0.39	0.11
SI	0.06	0.03	0.18	1.5	1.14	0.74	0.61
SK	0	0	0	1.24	1.86	1.49	0.76
Total	0.44	0.44	0.53	1.62	1.72	2.61	1.24

Source: Amadeus (authors' own calculations); cells highlighted in red show the bottom 20th centile of distribution.

Table A2.4 Country-sector distribution of average size of entrants, 2010-2016

Sector	AT	BE	BG	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LV	PL	PT	RO	SE	SI	SK	Total
CA	38	26	3	6	49	43	1	5	14	7	356	11	5	4	2	8	8	2	44	3	4	5	5	9	27
CB	8	1	6	5	295		2	4	2	4	32	9	4	4	3	20	6	2	34	5	7	2	8	6	20
CC	5	36	3	5	8		3	5	34	6	95	22	4	4		8	6	3	9	4	3	3	3	2	12
CE	7	42	3	3	12	64	1	12	15	3	236	29	1	4		8	4	2	6	5	4	2	1	3	20
CF	3	1	71	3	2	12	1	54	11	1	134	7	2	3	30	15	7	2	5	3	2	2	72	2	19
CG	21	5	8	9	28		2	7	51	8	89	10	3	4	4	11	6	2	41	3	4	6	26	12	16
CH	12	6	3	6	20	2	2	6	72	10	501	13	4	4	2	9	6	3	38	3	5	3	5	5	31
CI	5		4	3	33		3	7	48	8	106	15	2	6		22	5	3	5	6	5	2	2	2	14
CJ	7	2	3	10	16		4	3	3	5	178		3	11	16	11	4	2	5	3	6	2	9	16	15
CK	7	48	5	13	19	20	7	4	22	13	57	46	2	12	2	14	16	2	12	2	31	19	8	26	17
CL	11		2	77	40		1	8	11	55	4233	26	4	111		12	92	3	7	4	99	2	4	3	229
D	1	3	2	35	4	65		2	9	3	528	6	2	8		60	8	2	8	1	93	10	2		41
E	10	1	3	5	6		2	4	2	10	32	12	22	10	13	13	10	3	57	5	13	11	2	6	11
JA	10	3	2	5	3	5	1	4	4	9	56	18	5	3	9	4	3	2	6	2	3	2	4	2	7
JB	2	1	5	9	3	6	2	4	4	8	41	85	4	7	28	3	3	2	6	2	4	13	3		11
JC	8	5	2	4	3	2	1	4	4	9	59	11	2	2	11	4	5	2	5	2	2	2	1	2	6
MA	3	11	2	5	56	9	1	9	14	9	262	6	2	2	1635	30	4	2	6	3	2	6	2	2	87
MB	4	1	2	43	22	1	4	3	2	7	52	6	2	2	2	7	104	2	5	2	9	5	5	1	12
MC	4	7	2	4	4	4	1	4	3	4	765	6	2	2	12	3	3	2	5	1	2	2	2	2	35
Total	9	12	7	13	33	19	2	8	17	9	411	19	4	11	126	14	16	2	16	3	16	5	9	6	32

Source: Amadeus (authors' own calculations); cells highlighted in green show the top 20th percentile of distribution (equivalent to 14+ employees)

Table A2.5 Country-sector distribution of average size of exiting firms, 2010-2015

Sector	AT	BE	BG	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LV	PL	PT	RO	SE	SI	SK	Total
CA	12	2	2	10	18		2	5	4	9	120		8	2	3	7	3	3	11	4	4	14	6	5	11
CB		99	4	7	21		2	4	6	5	19		3	2	2	9	3	3	32	7	5	2	62	5	14
CC	2	5	2	5	25	33	1	3	2	7	59		5	2	83	7	11	2	15	4	3	2	11	5	13
CE		7	2	2	28		28	5	5	9	26		14	2	2	32	4	2	5	6	2	2	114	5	14
CF		1	1	4	24		4	4	10	3	42			1	68	4	2	2		2	2	2	4	15	10
CG	6	21	2	6	21		2	6	11	12	75		4	2		6	3	2	9	10	2		18	15	12
CH	10	3	2	19	12		2	4	3	10	120		3	2	3	11	23	5	21	4	3	36	4	6	14
CI	1	1	2	4	55		3	4	34	10	53		3	1	5	10	1	2	15	4	2	2	17	2	11
CJ	10	1	2	16	104		1	4	20	8	28		1	1	10	25	8	3	20	4	4		15	6	14
CK	2	1	2	83	49		11	4	5	11	69	39	2	1	10	19	2	2	38	3	3	281	19	43	30
CL	7	637	2	53	112		1	8	2	32	75		1	2	9	26	1	2	68	10	11	37	1	22	51
D	1	10	1	5	6		1	3	4	2	9			3	2	3	2	1	5	3	4	47	1	9	6
E	1	2	2	5	48		1	4	9	7	21		2	5	12	9	1	7	10	4	6	1	9	14	8
JA	7	1	1	4	34		1	4	3	4	38	254	2	1	3	2	1	4	11	3	2	2	2	2	17
JB	1	2	2	4	2		1	3	3	4	139		1	1	27	3	2	1	10	3	2	23		138	18
JC	3	1	1	3	6	2	1	4	2	6	32	51	2	1	7	3	2	2	10	3	2	3	7	2	7
MA	4	5	1	3	50	5	1	9	4	6	84		1	2	208	10	2	2	11	2	2	37	3	2	20
MB	4	1	1	22	4		1	2	62	6	813			1	2	2		2	12	6	2	14	18	1	49
MC	1	8	1	4	8		1	7	3	4	18		1	2	4	3	2	2	8	3	2	1	3	3	4
Total	5	43	2	14	33	13	3	5	10	8	97	115	3	2	26	10	4	3	17	4	3	30	17	16	17

Source: Amadeus (authors' own calculations), cells highlighted in green show sectors which represent top 20th percentile of distribution (>14 employees)

Table A2.6 Sector-country distribution of average age of exiting firms, 2010-2015

Sector	AT	BE	BG	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LV	PL	PT	RO	SE	SI	SK	Total
CA	54	14	5	9	28		7	14	10	11	24		12	11	15	8	7	8	11	11	5	10	6	14	13
CB		12	6	10	23		6	15	14	19	20		13	12	24	8	6	11	13	11	6	12	24	14	13
CC	16	25	5	6	23	48	11	14	13	15	20		13	10	14	10	7	7	7	14	6	16	12	9	14
CE		23	8	4	28		6	14	54	15	20		24	7	27	11	10	3	9	12	6	9	11	11	15
CF		16	7	7	10		5	8	18	8	26			0	21	10	3	6		9	7	11	39	15	12
CG	15	18	5	8	28		6	16	16	16	25		13	12		9	8	4	7	16	6		16	10	13
CH	19	18	8	8	22		4	13	12	16	20		12	11	4	7	5	8	7	11	7	17	8	8	11
CI	5	7	6	6	16		12	15	8	13	23		22	14	15	10	6	2	8	3	9	45	24	12	13
CJ	6	27	9	13	20		10	16	15	14	20		20	12	7	10	3	6	16	15	1		4	8	12
CK	15	10	9	16	19		3	16	13	17	18	27	17	13	22	12	8	4	11	13	7	13	8	13	13
CL	21	23	9	7	19		3	11	13	17	21		5	9	13	6	0	3	9	14	2	18	2	7	11
D	10	23	5	13	6		6	8	9	17	8			5	17	7	4	6	6	6	5	7	5	11	9
E	22	9	5	5	20		9	11	20	13	13		4	12	8	11	7	9	6	5	4	65	7	9	12
JA	15	16	5	6	16		3	12	12	13	15	19	7	12	7	13	6	6	7	8	7	9	13	6	10
JB	1	11	7	8	7		8	10	8	10	12		4	12	13	4	3	5	8	4	6	10		13	8
JC	8	9	5	6	11	2	4	9	5	6	9	26	8	9	8	8	6	4	5	5	5	9	9	7	8
MA	11	13	6	9	13	6	7	10	10	8	11		11	11	9	8	6	4	6	8	6	7	9	7	9
MB	18	9	6	9	10		8	6	3	7	17			8	9	9		5	7	7	8	14	9	6	9
MC	11	16	5	6	14		7	10	7	10	9		7	10	13	6	7	4	4	6	5	7	8	8	8
Total	15	16	6	8	18	19	6	12	14	13	17	24	12	10	14	9	6	5	8	9	6	16	12	10	11

Source: Amadeus (authors' own calculations), cells highlighted in green show sectors which represent top 20th percentile of distribution (>14 employees)

Table A2.7 Total Turnover Share of Entrants (sector-country averages), 2010-2016

Sector	AT	BE	BG	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LV	PL	PT	RO	SE	SI	SK	Total
CA	0.98	0.32	0.47	0.2	0.69	4.45	0.21	0.35	0.57	0.21	0.83	0.23	0.39	0.31	0.09	0.58	0.64	0.3	0.92	0.48	1.51	0.33	0.5	0.14	0.56
CB	0.83	0.08	2.59	0.12	2.98	0	0.3	0.36	0.44	0.2	0.3	0	0.28	0.54	0.5	0.58	0.32	0.27	0.29	0.83	0.92	0.2	0.15	0.15	0.57
CC	0.41	0.23	0.96	0.74	0.36	0	0.42	0.41	0.67	0.22	0.25	0.26	0.5	0.61	0	0.49	0.58	0.76	1.24	0.65	0.9	0.17	0.37	0.11	0.48
CE	0.63	0.16	0.29	0.32	0.45	2.4	0.14	0.59	0.41	0	0.26	0.09	0.29	0.2	0	0.26	0.52	0.86	1.32	0.37	1.87	0.01	0.23	0.11	0.44
CF	0.34	0.05	0.77	1	0.27	0.1	0.4	0.74	1.39	0	0.21	0.63	0.12	0.54	0.01	0.46	0.97	1.19	1.45	0.56	1.97	0.13	6.91	0.78	0.79
CG	0.56	0.23	1.75	0.21	0.32	0	0.47	0.35	1.32	0.13	0.41	0.13	0.58	0.36	0.1	0.43	0.55	0.83	1.06	0.41	1.43	0.19	1.39	0.15	0.57
CH	0.89	0.13	0.84	0.38	0.42	0	0.5	0.65	3.16	0.17	0.72	0.06	0.52	0.34	0.1	0.51	0.96	1.42	1.57	0.65	1.37	0.15	0.48	0.13	0.69
CI	0.19	0	0.71	0.67	0.29	0	0.35	0.53	1.87	0.2	0.3	0	0.23	0.17	0	0.4	0.37	0.77	0.74	2.1	0.56	0.09	0.44	0.01	0.47
CJ	0.28	0.06	0.39	0.19	0.53	0	1.16	0.2	0.14	0.08	0.38	0	0.46	0.14	1.12	0.44	0.28	0.34	1.05	0.42	1.27	0.07	0.17	0.16	0.4
CK	0.39	0.23	0.62	0.25	0.53	3.23	0.2	0.23	0.35	0.15	0.11	2.97	0.51	0.35	0.85	0.4	0.73	0.48	0.85	0.47	2.69	0.15	0.21	0.13	0.64
CL	0.6	0	1.81	0.37	0.46	0	0.69	0.27	1.07	0.24	1.92	0.01	0.44	0.79	0	0.52	0.55	1.42	1.04	0.85	1.8	0.03	0.71	0.14	0.69
D	0.02	1.6	0.39	0.29	0.47	0.94	0	0.14	1.32	0.1	1.29	0	0.95	0.32	0	0.49	0.99	0.05	0.43	0.03	5.06	0.2	0.35	0	0.64
E	0.44	0.01	1.19	0.8	0.37	0	0.41	0.21	0.15	0.23	0.68	0	0.86	0.49	0.47	0.3	0.67	0.55	0.54	1.47	2.27	0.45	0.55	0.07	0.57
JA	0.68	0.33	1.39	1.77	0.31	0.62	0.33	0.42	0.57	0.13	0.81	0.12	4.48	2.18	0.81	0.25	0.75	2.55	0.91	0.64	1.92	0.3	0.5	0.16	0.95
JB	0.2	0.02	1.79	2.51	0.33	3.3	0.09	0.59	1.04	0.66	0.54	0.25	1.39	1.14	0.27	0.87	0.15	0.67	0.53	0.96	1.61	0.21	0.41	0	0.75
JC	0.72	0.25	2.31	1.77	0.42	0.24	0.96	0.53	0.87	0.29	0.99	0.46	1	0.49	2.02	0.57	3.69	1.65	2.57	1.35	1.45	0.47	0.43	0.22	1.1
MA	0.49	0.46	1.41	1.65	0.71	0.6	1.22	0.32	2.39	0.27	1.48	0.17	0.89	0.73	5.15	0.56	0.56	2.24	1.41	1.21	1.25	0.68	0.37	0.16	1.11
MB	0.55	0.45	1.23	0.91	0.37	7.14	1.57	0.37	1.4	0.29	0.36	4.55	0.66	0.5	0.18	0.89	3.33	1.35	0.21	0.55	2.79	0.24	2.34	0.05	1.12
MC	0.46	0.29	1.89	3.07	0.48	0.45	0.85	0.37	1.01	0.29	3.51	0.17	0.86	0.82	0.91	0.52	0.91	1.77	1.91	3.29	1.58	0.33	0.32	0.32	1.14
Total	0.51	0.26	1.2	0.91	0.57	1.27	0.53	0.4	1.06	0.2	0.81	0.4	0.8	0.58	0.69	0.5	0.92	1	1.05	0.91	1.8	0.23	0.75	0.15	0.72

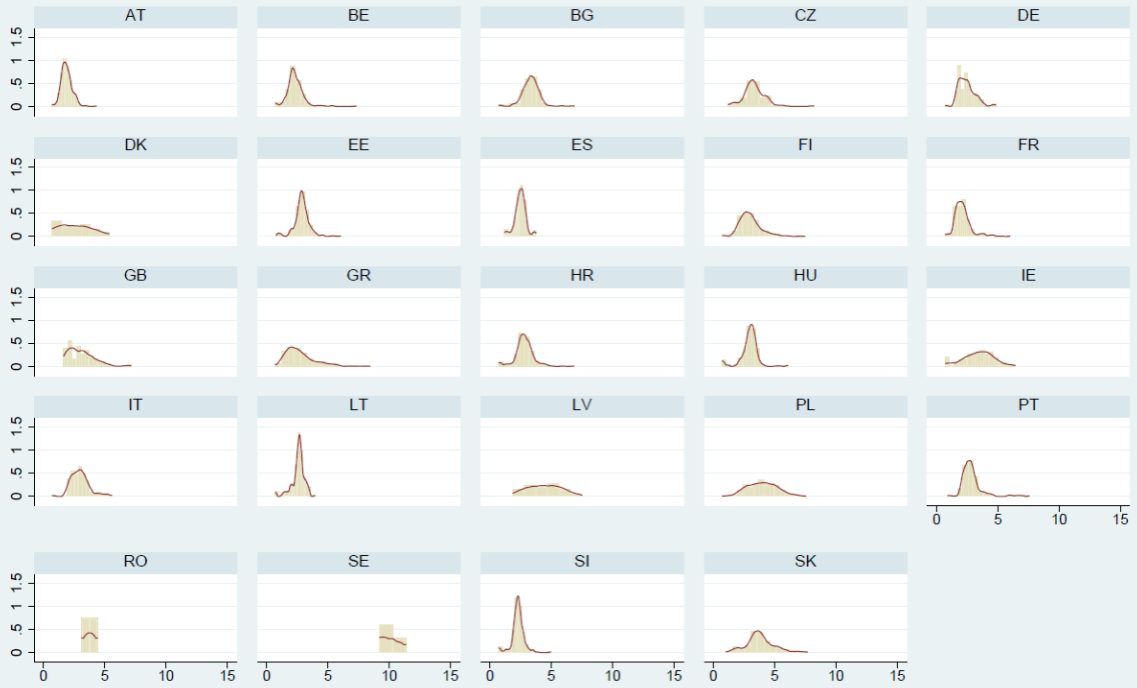
Source: Amadeus (authors' own calculations), cells highlighted in green show sectors which represent top 20th percentile of distribution (>0.7%)

Table A2.8: Total Turnover share of exiting firms (country-sector averages), 2010-2015

Sector	AT	BE	BG	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LV	PL	PT	RO	SE	SI	SK	Total
CA	0.02	0	0.13	0.3	0.12	0	0	0.55	0.08	0.68	0.65	0	0.05	0	3.87	0.27	0	0.12	0.02	0.13	0.05	0.13	0.02	0.02	0.3
CB	0	0.53	0.53	0.2	0.6	0	0.07	0.52	1.02	1.02	0.72	0	0.02	0.03	0	0.32	0.02	0.35	0.1	0.38	0.05	0	1.03	0.05	0.31
CC	0.03	0.07	0.3	0.28	0.85	0.7	0.07	0.4	0.02	2.02	0.67	0	0.05	0	8.92	0.22	0.67	0.02	0.07	0.4	0.18	0	0.23	0.17	0.68
CE	0	0	0.05	0	0.12	0	0.65	0.28	0.02	0.13	0.13	0	0.03	0	0.02	0.23	0	0	0	0.7	0.02	0	2.28	0.02	0.2
CF	0	0	0	0.02	0.13	0	0.57	0.08	0.18	0	0.57	0	0	0	0.48	0	0.02	0.02	0	0.08	0	0	0.53	0	0.11
CG	0	0.1	0.13	0.12	0.3	0	0.18	0.25	1.57	0.73	0.6	0	0.17	0	0	0.1	0.1	0.12	0.02	0.23	0.05	0	0.15	0.03	0.21
CH	0.02	0.03	0.17	0.2	0.13	0	0.25	0.67	0.37	0.78	3.17	0	0.02	0.02	0.2	0.4	0.62	0.62	0.27	0.35	0.05	0.05	0	0.1	0.35
CI	0	0	0.05	0.03	0.2	0	0.02	0.13	2.05	0.08	0.48	0	0.03	0	0.98	0.23	0	0.03	0	0.02	0	0	0.13	0	0.19
CJ	0.02	0	0.02	0.05	0.92	0	0	0.25	0.15	0.1	0.27	0	0	0	0.17	0.22	0.02	0.28	0.02	0.08	0	0	0.03	0.02	0.11
CK	0	0	0.03	0.08	0.2	0	0.13	0.17	0.03	0.27	0.52	0	0.02	0	0.62	0.17	0	0	0.22	0.07	0.02	0.22	0.13	0.07	0.12
CL	0.03	0.33	0.02	0.03	0.02	0	0	0.02	0.02	0.13	0.1	0	0.02	0	7.7	0.28	0	0.02	0.02	0.07	0	0.02	0	0	0.37
D	0	0.22	0.05	0.08	0.12	0	0	0.15	0.03	0.05	0.08	0	0	0	0	0.07	0	0	0	0.02	0	0.03	0	0.38	0.05
E	0.02	0	0.05	0.17	0.98	0	0	0.27	0.85	0.2	0.15	0	0	0	0.27	0.55	0	0.07	0	0.4	0.57	0	0.17	0.08	0.2
JA	0.4	0.07	0.22	0.27	2.95	0	0.13	0.83	0.27	0.28	0.42	3.3	0	0.22	0.1	0.02	0.02	2.48	0	0.35	0.15	0.03	0.18	0.08	0.53
JB	0	0	0.05	0.02	0.02	0	0	0.05	0.02	0.07	0.37	0	0	0	0.17	0	0	0	0	0.13	0	0	0	0.8	0.07
JC	0.02	0.07	0.27	0.57	0.45	0	0.17	0.37	0.08	0.43	1.72	1.3	0.03	0.1	0.33	0.12	0.08	1.02	0.1	1.58	0.02	0.27	0.4	0.08	0.4
MA	0.05	0.22	0.57	0.23	1.43	0	0.23	0.65	0.28	0.08	1.18	0	0.05	0.8	0.52	0.27	0.13	0.07	0	0.08	0.15	0.23	0.52	0.2	0.33
MB	0.07	0.03	0.02	0.15	0.12	0	0.12	0.23	4.98	0.08	3.5	0	0	0.03	0	0.1	0	0.08	0.05	0.07	0.33	0.08	1.1	0.03	0.47
MC	0.1	0.57	0.92	0.25	0.32	0	0.22	4.43	1.38	0.85	0.6	0	0.08	0.12	0.13	0.43	0.08	0.33	0.13	1.07	0.35	0	0.72	0.33	0.56
Total	0.04	0.12	0.19	0.16	0.52	0.04	0.15	0.54	0.71	0.42	0.84	0.24	0.03	0.07	1.29	0.21	0.09	0.3	0.05	0.33	0.1	0.06	0.4	0.13	0.29

Source: Amadeus (authors' own calculations), cells highlighted in green show sectors which represent top 20th centile of distribution (>0.34%)

Figure A2.1: Intra-countries dispersions of productivity differences between sectors based on top vs. bottom deciles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Density
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Graphs by country_NUM

Annex 3: Treatment of outliers

Sector-country-year outliers' summary for the above variables

1. Entry rates

Country-years: Denmark (DK) 2011; Greece (GR) 2016. Some concerns raise Latvia and Romania with the highest entry rate of 8%, but could reflect market trends in post-transition economies with start-up entry exhibiting higher rates compared European advanced counterparts.

Sectors: Manufacturing Coke (CD); Activities of households as employers (T); and Activities of extra-territorial organs (U).

Figure IV1a and IV1b (sector and country averages of entry rates respectively plotted in ranking order after accounting for these outliers (p.42 of a detailed descriptive data analysis file)

2. Exit rates

Country-years: bearing in mind that on average about 1/3 to 50% of start-ups may exit during the first three years from the beginning of their operation, we set 50% threshold to capture country-year outliers. As a result, year 2017; Czech Republic (CZ) 2016; Greece (GR) 2016 have been excluded from the start of the analysis.

Sectors: Manufacturing Coke (CD); Public Administration and Defence (O); Activities of households as employers (T); and Activities of extra-territorial organs (U).

A sector-year analysis further revealed that 2016 continues to be problematic showing doubling of rates from the previous year consistently across all sectors. It has been removed with all country-year (p.8-10), country-sector, sector-year (p.20) and country and sector averages (p.43) being revisited to account for this.

3. Average entrant size

Country-year: Great Britain 2010,2011, 2012, 2013 (country_yr codes: 81-84)

Ireland (IE): 2012, 2013, 2017 (country_yr codes:115, 116, 120)

Netherlands: country==”NL”

Sectors: Manufacturing Coke (CD); Public Administration and Defence (O); Activities of households as employers (T); and Activities of extra-territorial organs (U).

4. Average market share of entrant

Country: Denmark 2011

Sectors: Slovenia (SI) sector Manufacturing of Pharmaceuticals (CF) (sector_country=199); Netherlands (NL) sector Manufacturing of Pharmaceuticals (CF) (sector_country=199); Manufacturing Coke (CD); Public Administration and Defence (O); Activities of households as employers (T); and Activities of extra-territorial organs (U).

5. Total market share of entrant: DK 2011

Country: Denmark 2011

Sectors: Manufacturing Coke (CD); Public Administration and Defence (O); Activities of households as employers (T); and Activities of extra-territorial organs (U).

6. Employment, Productivity and Turnover

6.1 Turnover country sector

One of the most striking results is the “out of scale” (consistently away from the sector mean) turnover averages of the whole country of Netherlands (see also LEM WP into the GROWINPRO project). This is particularly true for the last two years 2016-2017, but relevant across the whole time span. Spain manufacturing of coke average is also out of scale over 5 billions 5.340.000.000, likewise Belgium manufacturing of coke is over 1 billion 1.370.000.000, when the sector average (excluding Belgium and Spain) is in the order of 374 million. In the same table we resister a (relatively” high) value of turnover in UK telecommunications but this is mainly driven by the recent expansion of Vodafone.

6.2 Turnover sector year

As far as the time span distribution is concerned, we clearly register a to high jump in the 2017 year across the board. This would suggest to refrain from using it completely. We can in general note the “transport equipment, electricity and gas and telecommunications” are all high compared to other sectors, but these data are stable through time and probably due to a “natural” monopoly phenomenon.

6.3 Turnover country year

Netherlands seem to be only out of scale in the last two years so it is not clear what to do. Probably we need to be conservative and exclude the whole period altogether. Denmark data starts really in 2013, being he isolated point in 2011 clearly out of scale.

6.4 Employment country sector

Exclude completely Netherlands, also the employment figure is completely out of scale, it is difficult to see how to make sense of a reasonable comparison with other countries. Germany employment figure seems fine in transport though, being the German role absolutely dominate in EU transport sector

6.6 Employment sector year

The main observation for sectoral time variation is the too big jump in 2017, that should be excluded.

6.7 Employment country year

As per turnover Denmark data starts really in 2013. The isolated point in 2011 should be deleted. There is an unreasonable big jump in 2017 especially driven by Belgium, Germany, France and GB. Employment size in Poland in 2010 highly suspicious but we would not exclude it (resilience of country to the crisis).

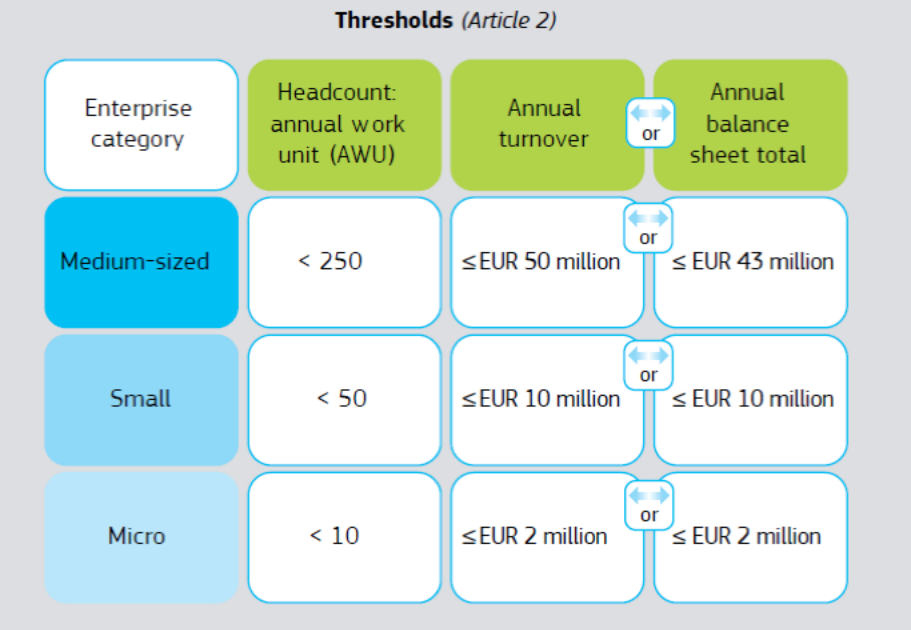
6.8 Turnover and Employment: overall assessment:

1. Exclude manufacturing of coke in Belgium and Spain.
2. Exclude all Netherland in 2016-2017 (or altogether)
3. Exclude Denmark in 2011
4. Exclude all data for 2017

5. For exit rates also exclude 2016

Annex 4: SMEs definition guide

Table A4.1. SMEs definition guide



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