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Cross-country evidence  
on start-up dynamics

**Flavio Calvino,  
Chiara Criscuolo,  
Carlo Menon**

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This paper has been authored by Flavio Calvino (Scuola Superiore Sant'Anna, Pisa; and Paris School of Economics – University Paris 1), Chiara Criscuolo (OECD Directorate for Science, Technology and Innovation) and Carlo Menon (OECD Directorate for Science, Technology and Innovation; and Spatial Economic Research Centre, London School of Economics).

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## CROSS COUNTRY EVIDENCE ON START-UP DYNAMICS

Flavio Calvino<sup>1</sup>, Chiara Criscuolo,<sup>2</sup> and Carlo Menon<sup>3</sup>

OECD Paris

### ABSTRACT

The report provides a description of start-up dynamics exploiting the richness of the recently collected DynEmp v.2 database. The contribution of new firms in terms of new jobs to the existing workforce can be expressed as a combination of four different elements: the start-up rate; the average size of firms at point of entry; the survival rate; and the average growth rate of survivors. This decomposition shows that the four elements interplay in very different ways, even across economies with similar aggregate start-up contributions. The most homogenous component across countries is the survival rate, which is equal to just above 60% after three years from entry, to about 50% after five years, and to just over 40% after seven years. Furthermore, in most countries the probability of exiting is highest at the age of two, and decreases (linearly) beyond that age. When looking at employment growth of surviving businesses, it is found that the large majority of surviving micro start-ups do not grow; however, the tiny proportion of small start-ups which do grow creates a disproportionate amount of jobs.

**Keywords:** Start-ups; Employment dynamics; Entrepreneurship; Firm demographics.

**JEL Classifications:** L11; L26; D22.

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**Table 1. Contributors to the DynEmp v.2 data collection***Countries included in the dataset used for this report*

<b>Country</b>	<b>National representative</b>	<b>Institution</b>
<b>Austria</b>	Werner Hoelzl	WIFO Institute (Austrian Institute of Economic Research)
<b>Belgium</b>	Michel Dumont, Chantal Kegels, Hilde Spinnewyn	Federal Planning Bureau
<b>Brazil</b>	Carlos Henrique Leite Corseuil, Gabriel Lopes de Ulyseia	IPEA - Instituto de Pesquisa Econômica Aplicada
<b>Costa Rica</b>	David Bullon Patton	Ministry for Foreign Trade
<b>Denmark</b>	Dorte Høeg Koch	Ministry for Business and Growth
<b>Finland</b>	Mika Maliranta	The Research Institute of the Finnish Economy (ETLA) and Statistics Finland
<b>Hungary</b>	Adrienn Szep Szollosine, Erzsebet Eperjesi Lindnerne, Gabor Katay, Peter Harasztosi	Central Bank of Hungary, Hungarian Central Statistical Office
<b>Italy</b>	Stefano Costa	Italian National Institute of Statistics (ISTAT)
<b>Luxembourg</b>	Leila Peltier – Ben Aoun, Anne Dubrocard, Michael Prombo	STATEC
<b>Netherlands</b>	Michael Polder	Statistics Netherlands (Centraal Bureau voor de Statistiek)
<b>New Zealand</b>	Lynda Sanderson, Richard Fabling	New Zealand Treasury, Motu Economic and Public Policy Research and Statistics New Zealand
<b>Norway</b>	Arvid Raknerud, Diana-Cristina Iancu	Statistics Norway and Ministry of Trade and Industry.
<b>Portugal</b>	Jorge Portugal	Presidencia da Republica
<b>Spain</b>	Valentin Llorente Garcia	Spanish Statistical Office
<b>Sweden</b>	Eva Hagsten	Statistics Sweden
<b>Turkey</b>	Faik Yücel Günaydın	Turkish Ministry of Science, Industry, and Technology

## 1. Introduction

Previous OECD work has emphasised that young firms are the engine of job creation, and the same finding has been confirmed by a number of country-specific studies. Across a large sample of OECD and emerging countries, young-small firms – rather than small firms as a whole – are net job creators, even during the Great Recession (Criscuolo, Gal, and Menon, 2014a for evidence on 17 OECD countries and Brazil; Haltiwanger, Jarmin, and Miranda, 2013 for the United States; Lawless, 2014 for Ireland).

Young firms show significantly larger rates of average net employment growth relative to more mature incumbents, and while this is true across countries and sectors, evidence from the DynEmp project discussed in Criscuolo, Gal, and Menon (2014a) points to substantial differences across countries in the extent to which new firms can grow if they prove to be successful – eventually increasing the overall productivity of the economy. This report builds on a richer set of newly collected micro-aggregated data to explore the phenomenon of entry and post-entry growth in more detail, pointing to regularities and differences in business dynamism across countries.

Due to the intermediate nature of the dataset and the limited number of countries included thus far, it is important to stress that country comparisons are not the scope of the current analysis nor its main focus. The main aim of the document is to illustrate the potential of the database for policy analysis, providing a first outlet where the potential research agenda can be highlighted.

The report provides a first description of the contribution of young firms to job creation exploiting the richness of the DynEmp v.2 data, with a comprehensive characterisation of young firm dynamics. The report points to a number of important stylized facts on start-ups' dynamics across countries.

First, one size does not fit all. The contribution of new firms to the creation of new jobs can be expressed as a combination of four different elements: the start-up rate; the average size of firms at entry; the survival rate; and the average growth rate of survivors. Although the contribution by new firms to job creation is clearly evident and extremely important in all countries, there are substantial cross-country differences in the relative contribution from each of these factors. Countries might have very high entry rates but low average post-entry growth, others might have high entry rates but low survival probabilities or, vice versa, a low entry rate but high post-entry growth. These different elements are not necessarily positively correlated, and while all contribute to explaining differences in the extent to which start-ups contribute to aggregate job creation in the economy the extent to which they do so varies across countries. For instance, in Belgium the start-up rate is very low, but the post-entry growth rate of survivors is the highest in the sample. Conversely, in New Zealand and Turkey the start-up rate is high but average post-entry growth is much lower.

Another stylised fact which emerges from the characterisation of firm dynamics relates to the survival rate. For instance, when looking at survival probability, the data show that the survival rate is on average equal to just above 60% after three years from entry, to about 50% after five years, and to just over 40% after seven years. Furthermore, it appears as a striking regularity across many countries that the probability of exiting is highest when businesses are two years old, and decreases (linearly) beyond that age.

When looking at employment growth of surviving businesses, it is found that the large majority of surviving start-ups do not grow. This is not a new finding: a growing number of empirical contributions have shown that the majority of small start-ups remain small, and that employment growth is not always the entrepreneur's objective, and would fit in the category of so-called

*subsistence* entrepreneurs (Schoar, 2010). However, this report highlights that the tiny proportion of small *transformational* entrepreneurs' start-ups that do grow – around 3% on average across all countries – creates a disproportionate amount of jobs, from 21% (in Netherlands) to 52% (in Sweden) of the total job creation by micro start-ups. This point is extremely relevant for policy making. Without taking this disproportionate contribution of scale-ups into account, there is indeed the danger of overlooking the critical importance of young firms as the engine of job creation in light of the fact that the large majority of them do not grow, or grow very slowly.

This paper contributes to a line of research on cross-country differences in economic dynamism and allocative efficiency based on comparative firm demographics initiated by Bartelsman, Scarpetta and Schivardi (2005). It is also linked to the literature on firm size at entry and probability of survival (e.g. Agarwal and Audretsch, 2001), on entrepreneurship (e.g., Acs, Audretsch and Strom, 2009), and on firm growth patterns (Mata, Portugal, and Guimarães, 1994; Mata and Portugal, 2004; Coad, 2009). Finally, this study also contributes to the research that focuses on the employment growth and survival of cohorts of entrants in Europe (e.g., Anyadike-Danes et al., 2014).

The report is organised as follows. The next section illustrates the recently collected “DynEmp v.2” database. Section 3 presents an overview of start-ups' dynamics. Finally, Section 4 concludes and proposes avenues for future policy analysis.

## 2. The DynEmp v.2 database

The data used in this report are the intermediate outcome of the on-going second round of data collection within the DynEmp project, which is led by the OECD Directorate for Science, Technology and Innovation, with the support of national delegates and national experts in member and non-member economies.

The DynEmp project is based on a distributed data collection exercise aimed at creating a harmonised cross-country micro-aggregated database on employment dynamics from confidential micro-level data where the primary sources of firm and establishment data are national business registers. The project is supported by a network of national experts who run common Stata routines developed centrally by the OECD DynEmp team on the confidential micro data to which they have access (see also Criscuolo, Gal and Menon, 2014b). The experts also implement country-specific disclosure procedures in order to ensure that confidentiality is respected.<sup>4</sup>

A number of significant extensions are implemented in DynEmp v.2, with respect to the previous wave of the project, DynEmp Express. Firstly, the DynEmp network has been expanded to include several additional economies (e.g. Australia, Chile, China, Costa Rica, Denmark, Germany, Ireland, Korea, Mexico, Slovenia and Turkey<sup>5</sup>). Secondly, DynEmp v.2 now includes a more disaggregated analysis of transition dynamics allowing for the investigation of start-ups' dynamics in greater depth, and to follow cohorts of entrants after 3, 5 and 7 years after entry (this analysis is reported in “transition matrices”). Thirdly, the dataset allows for a more granular analysis at industry level, as data are now aggregated up to 2-digit sectors, rather than to three macro-sectors, as is the case in the DynEmp Express database. Furthermore, a number of additional variables have been included in the outcome data, such as employment growth volatility; average growth rate; gross job creation by the top 10% of the employment growth distribution (these variables are included in addition to information on job flows in the “flow databases”). Finally, the Dynemp v.2 routine includes a number of “distributed regressions”, i.e. regressions conducted separately within each country at the unit level following the same estimation method and model and over the same time period, and their estimates are included in the output allowing for further investigation on a number of dimensions (such as exit



probabilities over the recession) and for additional policy analysis on factors affecting the firm size distribution, such as size-contingent policies.

The outcome datasets of each country are carefully examined. Subsequently, a first set of data checks and analysis is sent back to the experts in each participating country, and the OECD DynEmp team engages in extensive interactions with the national experts whenever inconsistencies or irregular patterns are identified in the data.

The main building blocks of the data produced by the DynEmp v.2 routine can be summarized as follows: i) “flow datasets”; ii) “transition matrices”; and iii) “distributed regressions” estimates. Each of these elements is described in detail below.

The flow datasets contain annual statistics on gross job flows, such as gross job creation and gross job destruction, defined as the total job variation of growing and shrinking units, respectively; and on several statistical indicators of unit-level employment growth, such as mean, median, and standard deviation. The latter four statistics are also calculated for the turnover variable if available.

The transition matrices summarize the growth trajectories of cohorts of units from year  $t$  to year  $t + j$ , where  $t$  takes by default the values 2001, 2004, and 2007 and  $j$  is equal to 3, 5, or 7 (therefore, if data are available, transition matrices are calculated for the periods 2001-2004, 2001-2006, 2001-2008; 2004-2007, 2004-2009, 2004-2011; 2007-2010; 2007-2012; 2007-2014). The matrices contain a number of statistics (number of units in the cell, median employment at  $t$  and at  $t + j$ , total employment at  $t$  and at  $t + j$ , and mean growth rate) for different combinations of age and size classes at time  $t$  and  $t + j$ , and also statistics focusing on the dynamics of high-growth units.

The DynEmp v.2 network is also collecting three sets of distributed regressions outputs. The first set of OLS regressions focus on the dynamics of growth rates. The second set of regressions investigates by means of a Linear Probability Model the units’ exit probabilities. These regressions control for 2-digit industries specificities and for different age-size effects and allow comparing the pre vs. post-crisis dynamics. The third set of regressions is aimed at describing the firm or establishment growth distribution and at identifying potential significant discontinuities in these distributions, possibly due to the institutional and regulatory environment.

At the time of writing, 16 countries have been successfully included in the DynEmp v.2 database (namely, Austria, Belgium, Brazil, Costa Rica, Denmark, Finland, Hungary, Italy, Luxembourg, The Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, and Turkey). Data at firm-level are available for all the above mentioned countries. For most countries the time period between 2002 and 2011 is covered. For Costa Rica and Portugal only fewer years are available, while the time horizon for Austria, Brazil, Denmark, Luxembourg, Norway and Sweden is longer. For Costa Rica, no transition matrix is available due to the limited time extension of the source data. Details about temporal coverage by country are summarized in Table 2.<sup>6</sup>

**Table 2. Temporal coverage DynEmp v.2 over time by country**

country	year																	
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AUT																		
BRA																		
BEL																		
CRI																		
DNK																		
ESP																		
FIN																		
HUN																		
ITA																		
LUX																		
NLD																		
NOR																		
NZL																		
PRT																		
SWE																		
TUR																		

Note: temporal coverage by country of the database used for the analysis. Years for which annual flow data are available are coloured. For Costa Rica no transition matrix is available due to the limited time extension of the source data. Texture boxes correspond to years that have been excluded from the analysis due to data issues.

Source: OECD DynEmp v.2 database. Data for some countries are preliminary.

As emphasized by Criscuolo, Gal and Menon (2014a), the advantages of using harmonised micro-aggregated data from business registers for the study of business employment dynamics are manifold. First of all, the different channels of employment variation can be identified separately, distinguishing between gross job creation and job destruction, and between the extensive (firm entry and exit) and the intensive margin (post-entry growth). Furthermore, the role of firm age and size can be examined. Finally, each of these elements can be compared across countries, sectors and over time.

Measuring entrepreneurship and its economic effects in terms of job creation is not an easy task and appropriate data, taking into account the age and not only the size of businesses, are necessary. Furthermore, very few databases allow researchers to follow cohorts of the different units of analysis over time, despite the wide recognition that this is crucial when studying business dynamics, especially in the case of entrants (see for instance Bartelsman et al., 2009). Even fewer databases combine a cohort approach with a detailed industry disaggregation. The DynEmp v.2 database provides a unique infrastructure for this type of investigation.

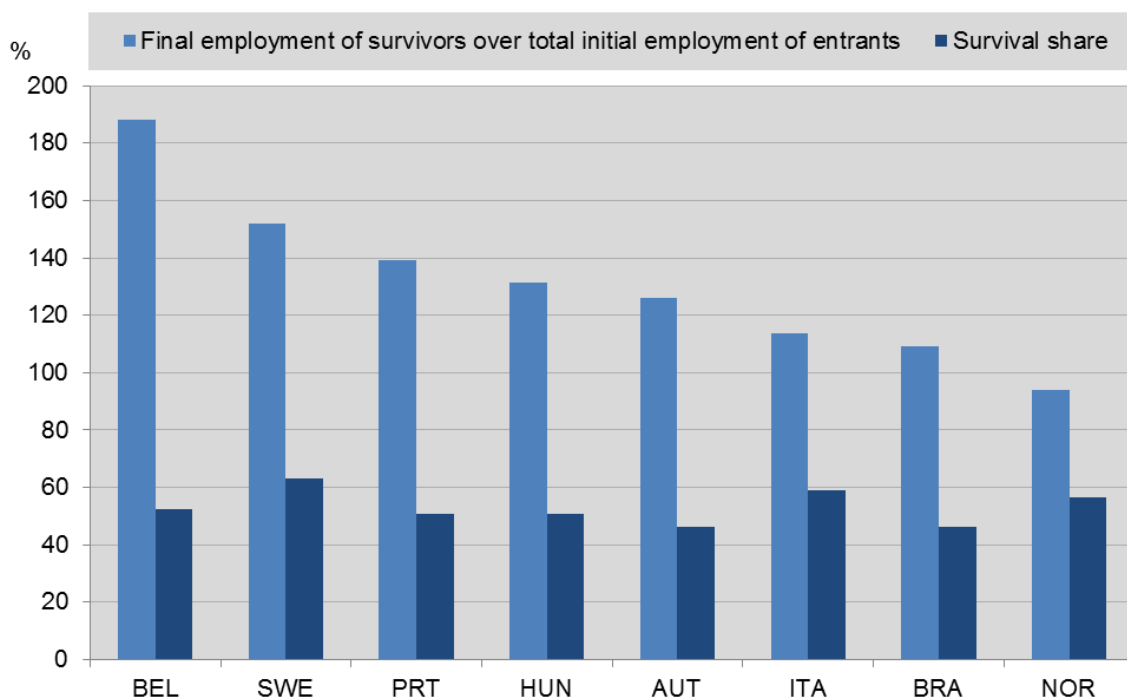
### 3. Start-ups and employment: descriptive evidence

New firms contribute to employment dynamics through three main channels: they create jobs whenever they enter the market with positive employment; they destroy jobs in the event of failure, of

which they are much more at risk than older firms; and they create and destroy jobs by hiring and firing workers (the so-called intensive margin) as all other firms do but at a greater rate in proportional terms given the turbulence in the performance of businesses in their first years of activity. Previous OECD work (Criscuolo, Gal and Menon, 2014a) has shown that the net sum of these three components is positive in a sample of 18 countries: young firms aged five or less are on average always – and by a fair amount – net job creators. Figure B1 in Annex B uses the new DynEmp v.2 data to show that this also consistently applies to all 2-digit sectors of the economy (non-financial business sector).<sup>7</sup>

In almost all countries, macro-sectors, and time periods, young firms are also net job creators at the intensive margin, i.e., when the contribution of entry and exit (the extensive margin) is excluded and only the post-entry net job creation of these firms is taken into account. This is illustrated in Figure 1, which shows the final employment of surviving micro start-ups expressed as the ratio over the total initial employment of all start-ups (thus including also those that exited in the interim) over a time horizon of five years. Across all countries included in the graph (except for Norway) net job creation by surviving micro start-ups is large enough to more than compensate for the job destruction of those micro start-ups that exit – despite the survivors representing only 40 to 60% of the total number of entrants at the beginning of the period.

**Figure 1. Survival share and job creation by micro (0-9) entrants over a five year period**



*Notes: the graph shows the share of survival and the ratio between final employment of survivors at time  $t + 5$  over total employment of entrants at time  $t$  for micro (0-9 employees) entering units. Figures report the average for different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. Sectors covered are: manufacturing, construction, and non-financial business services. Those countries for which specific confidentiality rules limited the comprehensiveness of the statistics are excluded from the graph. Owing to methodological differences, figures may deviate from officially published national statistics. Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.*

This report explores and characterises the job creation process of new and young businesses, by decomposing its main components and by inspecting closely the growth dynamics of cohorts of start-

ups. The starting point is the number of jobs created by new entrants over a three year interval, i.e., the final employment of start-ups which have survived until their third year of age as a proportion of country employment at the beginning of the period. This synthetic indicator has two main analytical advantages: firstly, it summarizes the contribution of both the intensive and extensive margins, i.e. the entry-exit dynamics and the survivors' net growth. Secondly, as shown in Annex A, the adopted measure of start-up contribution to employment creation – i.e. the number of jobs created by a cohort of entrants over a three year interval relative to employment at the beginning of the period – can be decomposed in four different elements: i) average start-up ratio at the beginning of the three year period; ii) average size at entry; iii) entrants' three year survival probability; and iv) three-year post-entry growth. In the following, these four elements will be examined in detail.

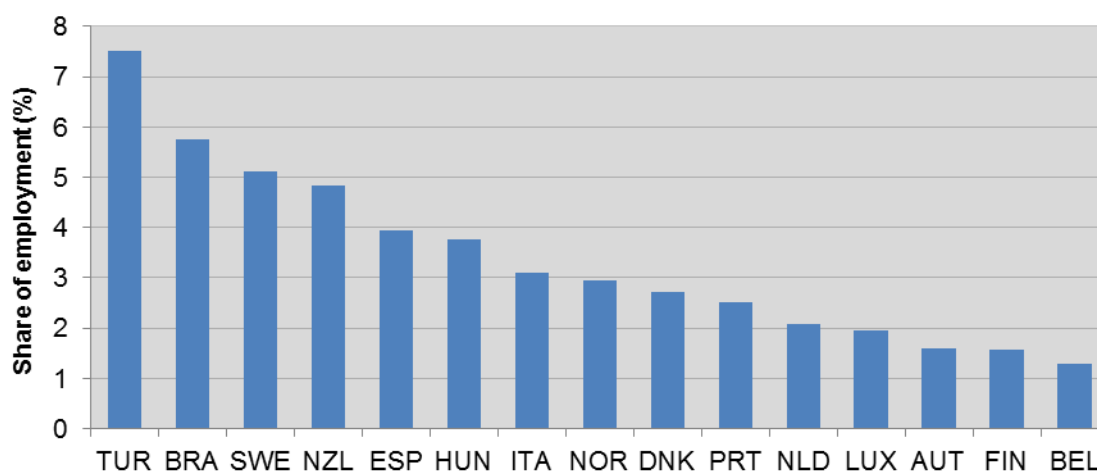
Before entering into the core of the analysis, it is useful to highlight that the main focus of the paper is on entrants of any size, mainly because of wider data availability for small countries with binding confidentiality requirements. However, small start-ups are generally more likely to be genuinely new firms (*de-novo* entry) as compared to larger entrants, which are relatively more likely to be the result of mergers or acquisitions or legal rather than economic changes in the life of a firm (i.e., *de-alio* entry; see Geurts and Van Biesebroeck, 2013). For this reason, all graphs reporting statistics relative to all entrants are replicated in Annex B limiting the selection only to *small* units (e.g., below 50 employees) for those countries for which data availability allows it. The comparison confirms that the main conclusions drawn from the descriptive analysis based on the full sample of entrants holds also when restricting to small units only.

### ***3.1. The components of start-up contribution to employment creation***

Figure 2 summarizes the main synthetic indicator on the average number of jobs created by surviving start-ups over a three years period. The measure is calculated as the ratio between total employment of entrants at the end of a three year period (on average for three different cohorts, born in 2001, 2004, and 2007, respectively) and overall employment in the country at the beginning of the three year period. This synthetic measure is henceforth referred to as “normalized net job creation” by surviving entrants.

Country heterogeneity emerges when observing the patterns of normalised net job creation by surviving entrants. A handful of economies – namely Turkey, Brazil, Sweden, New Zealand and, to a lesser extent, Spain and Hungary – are characterized by a higher normalized net job creation. In these countries, net job creation by entrants that survive at least three years represents up to 7% of overall employment; i.e. for every existing 100 jobs in the economy in any given year, the start-ups which are born in that year will add 7 new jobs within the following three years. For reference, Figure B4 and B5 in Annex B show similar dynamics focusing on small entrants only, over a three and five year period, respectively.

**Figure 2. Net job creation by surviving entrants relative to total employment**



Notes: the graph illustrates the ratio between employment at time  $t + 3$  of surviving entrants and overall country employment at time  $t$ . Figures report the average for different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. Sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

There are several factors that can help explain cross-country differences in the net job creation patterns of start-ups. Previous OECD work based on the DynEmp Express database points to important cross-country differences in this domain. The new DynEmp v.2 database contains detailed information on the growth and survival patterns of cohorts of start-ups over a three, five, and seven years period. The new database is therefore a much richer source of information to explore this issue in depth.

As mentioned, an analytical approach to identify cross-country differences consists in decomposing normalised net job creation by surviving entrants into four main components (see Figure 3 for an illustration and Annex A for analytic derivation and detailed definitions of each component):

- Start-up ratio, measured as the number of entrants relative to the country's total employment.<sup>8</sup> This can be considered a measure of the relative weight of entrepreneurship in the economy.
- Survival share, measured as the number of units that survive until or beyond the third year of life over the total number of starting units. This measure reflects the extent to which the selection process of entrants is strong in an economy.
- Average size at entry: calculated as the average number of employees for entrants. This measure might depend, *inter alia*, from entry barriers, competition, etc.
- Average post-entry growth, measured as the final over initial employment ratio of surviving entrants. This measure reflects the scale-up potential and the growth performance of surviving start-ups.

Figure 3. The components of start-up contribution to employment creation

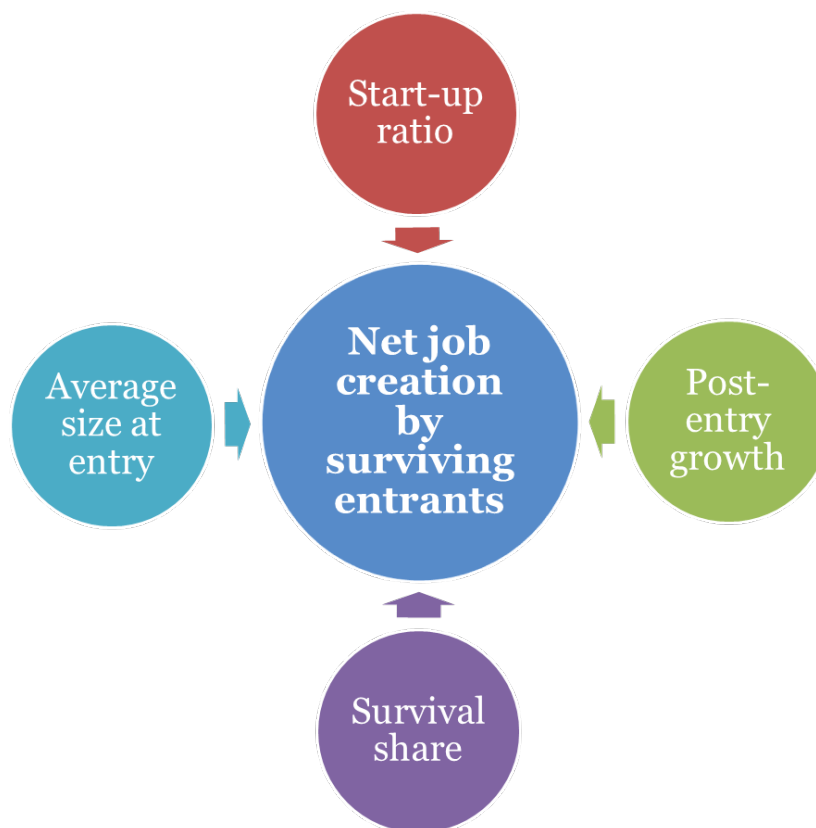


Figure 4 illustrates each of these four components separately (on average over time for the whole non-financial private business sector). Significant cross-country differences are evident not only for post-entry growth performance and survival shares of surviving entrants, but also for start-up rates. Start-up ratios are particularly high in Turkey, Spain, New Zealand and Sweden (more than 20 start-ups per thousand employees) and substantially lower in Belgium, Finland and Norway. Three-year survival rates range between about 55% in The Netherlands and Denmark to more than 70% in Sweden. Average size at entry is quite similar across the countries analysed with the notable exception of Norway and, to a lesser extent, Brazil and Austria where firms start significantly larger. Final-over-initial employment ratios range between about 110% in Norway to about 240% in Belgium. Figure B6 and B7 in the Appendix shows similar dynamics focusing on small entrants only (respectively over a three and five year period). Even when considering small entrants only, Austria and Norway show a distinctively high average starting size.

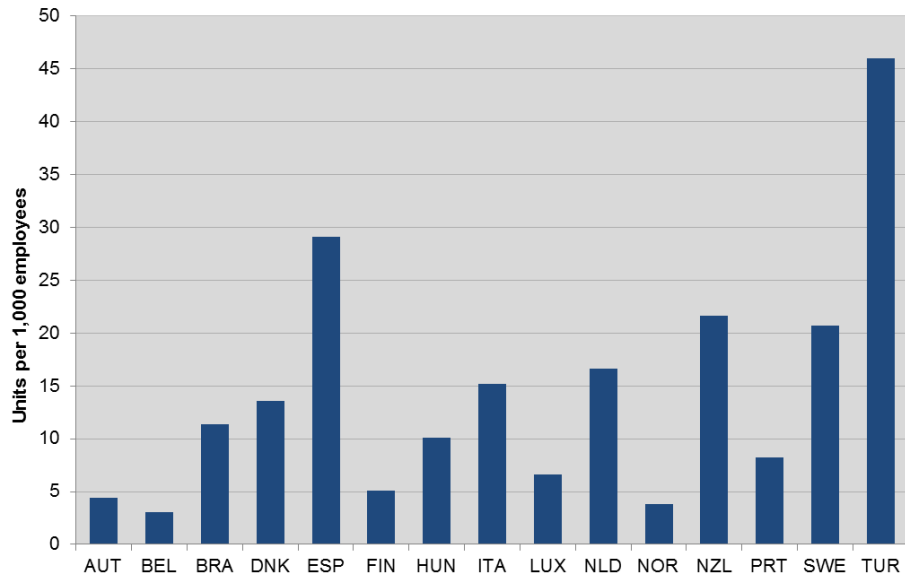
The first take-away from Figure 4 is the high degree of heterogeneity across countries – especially in post-entry growth and start-up rates – and the lack of a “one-size-fits-all” pattern. This is even more evident in the “spider graph” reported Figure 5, in which each of the four components is normalized over the maximum value for that component in the sample of countries analysed. The graph also visually emphasizes that survival share and growth rate show a more uniform pattern across countries than start-up ratio and average size at entry. For instance, Turkey, Brazil, and Sweden, the three countries with the highest normalised net job creation by entrants reported in Figure 2, show a very different combination of the growth decomposition components. Turkey has a very high start-up ratio, but entrants are the smallest in the sample and their survival share and growth rate are below

average. Conversely, Brazil has a rather low start-up rate, but this is counterbalanced by the second largest average size at entry in the sample. Sweden has a high start-up ratio and the highest survival share, but this is combined with a low average size at entry and a below average post-entry growth.

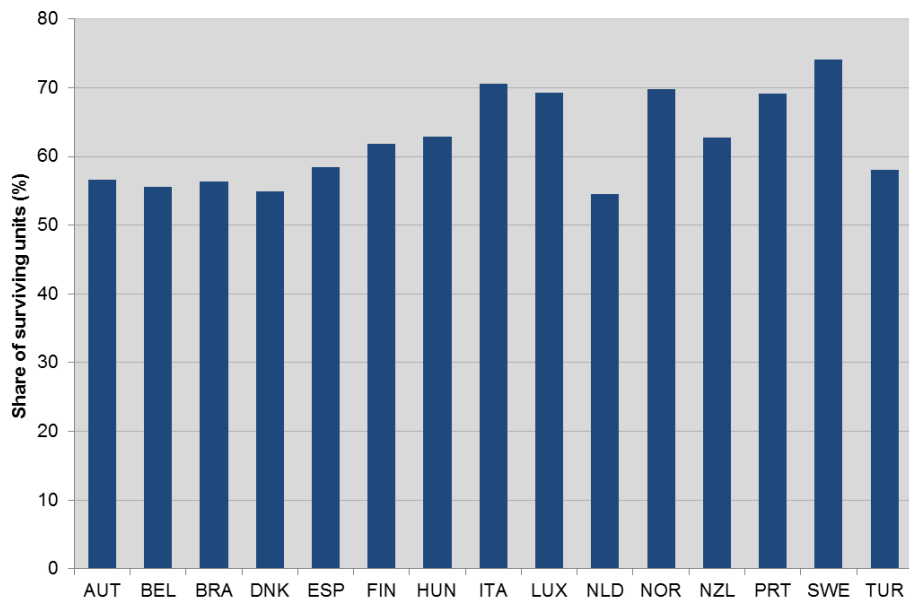
In addition, while on average post entry growth in Sweden is not that high, this hides the great heterogeneity which exists in the economy. As discussed in Section 3.5, firms at the top of the growth distribution are very dynamic and contribute significantly to high overall normalised net job creation. New Zealand also shows a similarly high normalized job creation by entrants (Figure 2), however as compared to Sweden the average size at entry and – especially – the survival rate are lower, compensated by a higher growth rate. Conversely, Belgium shows the lowest normalized net job creation by entrants in the sample. However, the country is characterized by the highest average growth ratio amongst survivors, as well as by above average average size at entry. This, however, is counterbalanced by the lowest start-up ratio in the sample. Finland has also relatively low net job creation by entrants; however, with respect to Belgium, both the start-up ratio and the survival share are higher, while the post-entry growth rate is significantly lower.

**Figure 4. Growth decomposition**

*Panel A. Start-up ratio*

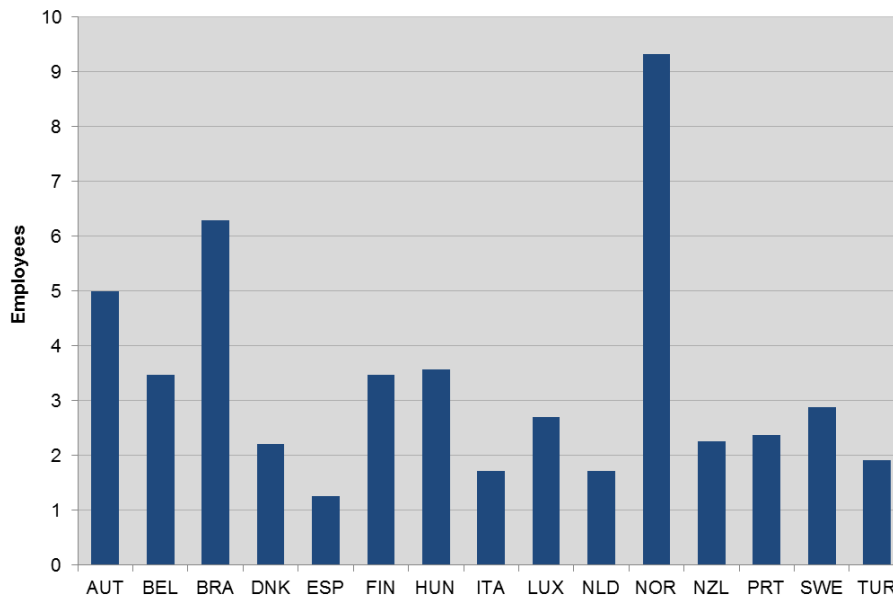


*Panel B. Survival rate (after 3 years)*

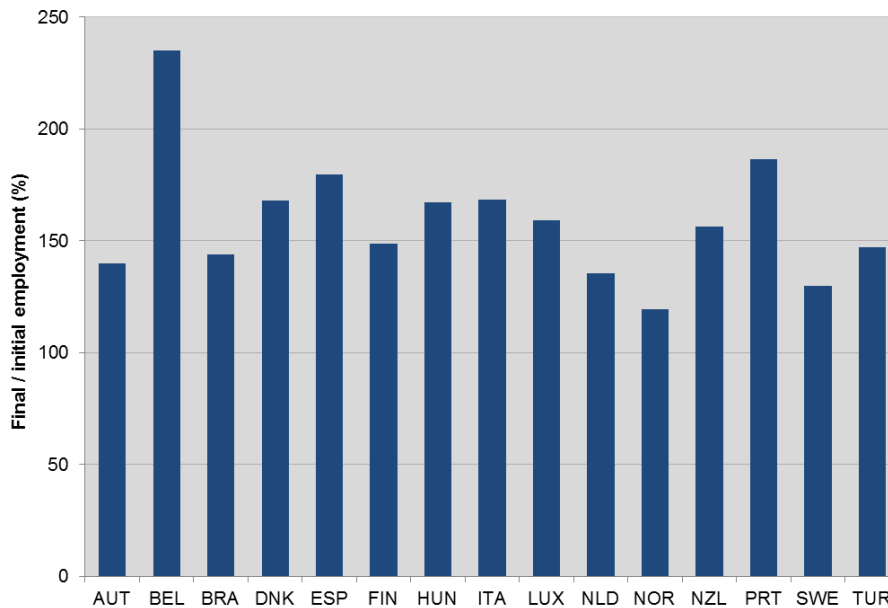




Panel C. Average size at entry



Panel D. Average post-entry growth

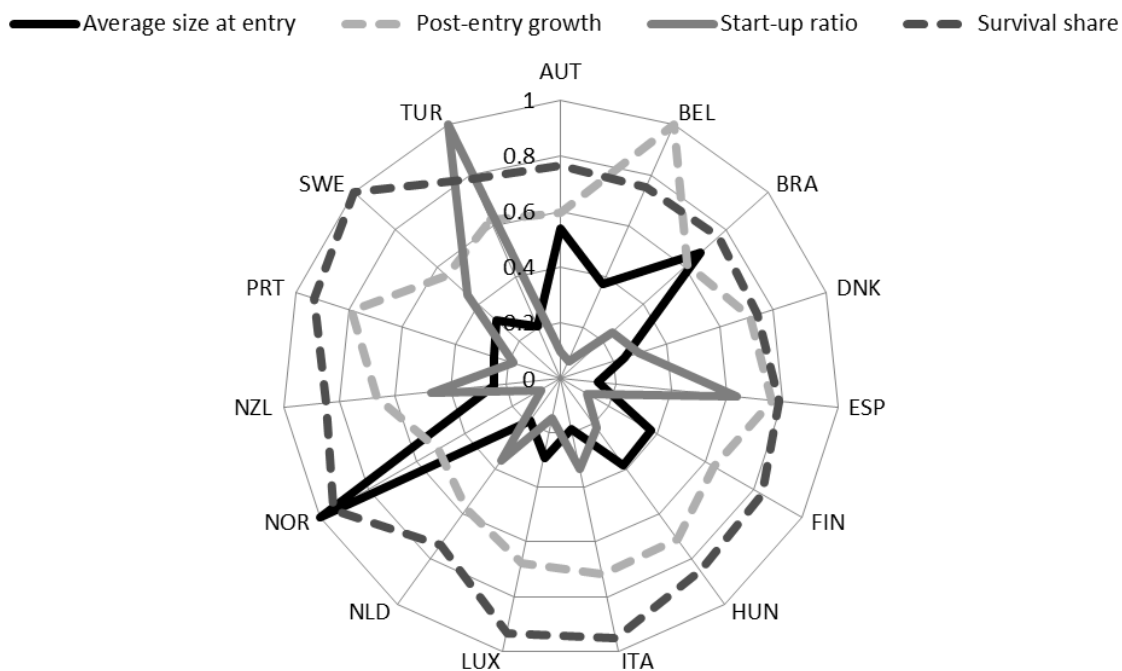


Notes: the graph illustrates the four components of the growth decomposition. Panel A: start-up ratio, expressed as total number of entering units over total employment (in thousands); Panel B: survival share of entrants, expressed as number of entering units surviving over total number of entrants per cent; Panel C: average size of surviving entrants expressed as total employment of surviving entrants over number of surviving entrants; Panel D: ratio between total employment at  $t + 3$  over total employment of surviving entrants. Figures report the average for different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. Sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

This evidence confirms that entrepreneurship is an extremely complex phenomenon, and that a similar outcome – e.g., high contribution by start-ups to employment creation – might mask very different start-up dynamics across countries. In turn, this emphasizes the importance of improving and widening the scope of the data sources used to analyse business dynamics.

**Figure 5. Growth decomposition: country comparison**



*Note: the graph illustrates the four components of the growth decomposition normalized over the maximum value across all countries included in the sample.*

*Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.*

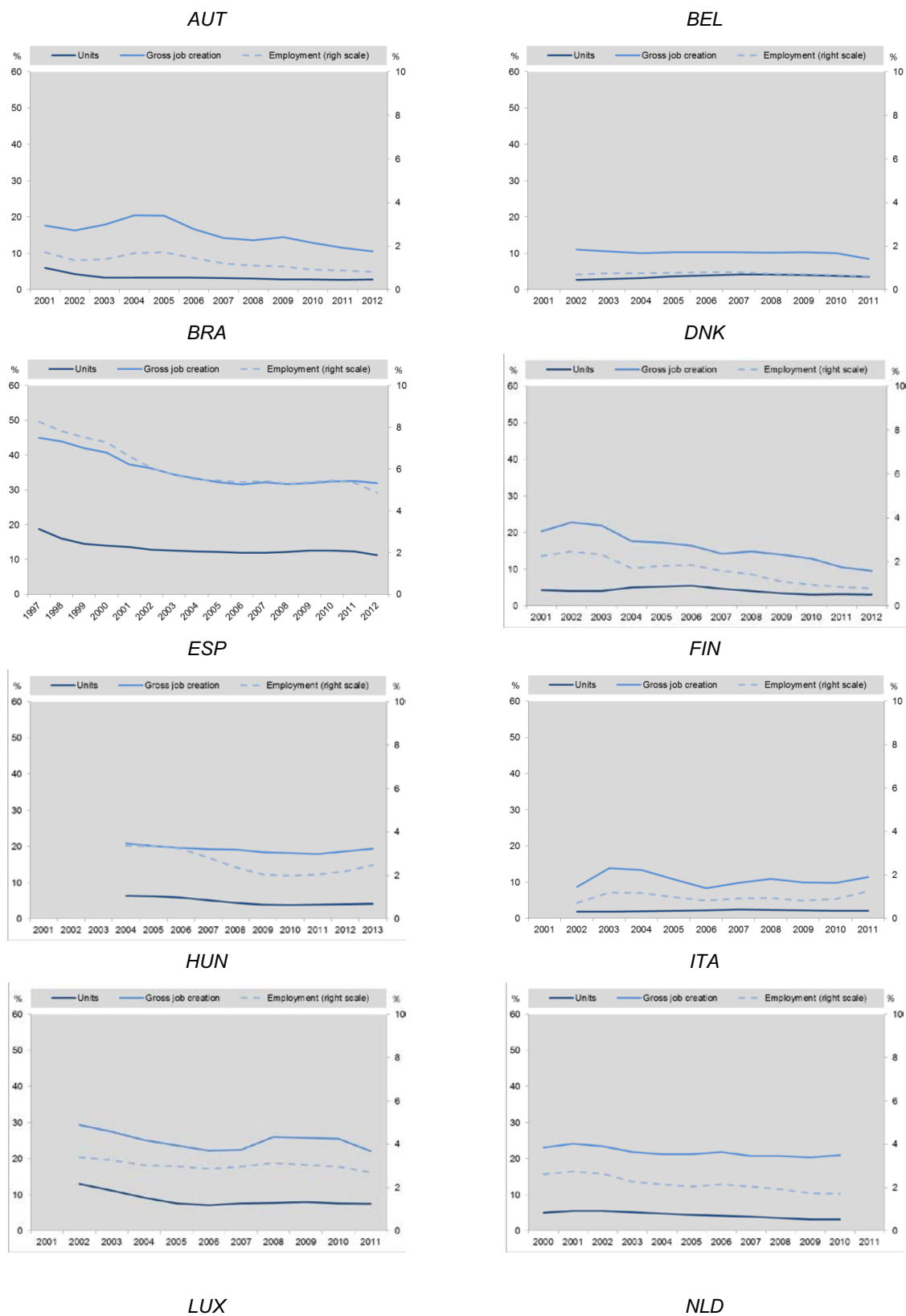
### 3.2. *Start-up ratios*

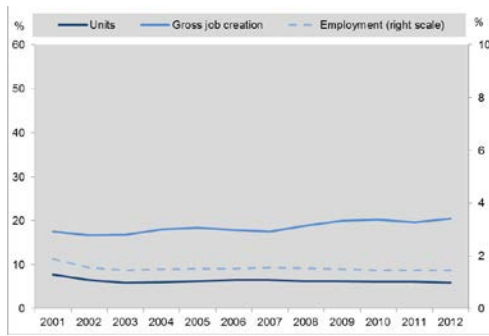
The start-up ratio is an indicator of the degree of entrepreneurship in an economy, which is at the core of the “creative destruction” process (Schumpeter, 1942). Recently, there has been growing concern that a “secular decline” in start-up creation is affecting the United States and other advanced economies (Decker et al., 2014; Criscuolo, Gal, and Menon, 2014a), which in turn could be linked to a slowing-down of reallocation dynamics. More specifically, Haltiwanger, Jarmin and Miranda (2012) illustrate that in the United States firm entry rates have experienced a substantial decline in the last decades, moving from about 13 percent (as a percentage of all firms) in the 1980s to about 7 percent in recent years. Furthermore, declining start-up rates are particularly evident in the U.S. local retail markets (see for instance Jarmin, Klimek and Miranda, 2005 or Davis et al., 2007). These contributions have emphasized that the changing structure of retail trade (that has moved towards more vertical integration) has been one of the elements underlying the decay in the start-up (but also in the exit) rates. This trend can be particularly worrying, in line with the idea that start-ups are major drivers of the process of creative destruction, and ultimately growth.

Scholars, however, maintain that start-up rates by themselves are not an exhaustive measure of the economic dynamism of an economy, as self-employment is not always “transformational” in nature (see Schoar, 2010). As emphasized by Decker et al. (2014), the distinction between transformational and subsistence entrepreneurs is very useful not only for developing economies. For instance, Hurst and Pugsley (2011) argue that many young and small business entrepreneurs in the United States affirm that they do not have any strong aspirations for high growth. More often the reasons to start their companies are instead non-pecuniary, such as time flexibility or personal goals (Astebro, 2013; Raknerud and van Praag, 2014). Furthermore, start-up rates can reflect the fact that entrepreneurship may be an alternative to uncertain future career prospects especially in periods of relatively high unemployment (see Santarelli and Vivarelli, 2007 for a discussion on the topic).

Figure 6 provides comparative evidence of the evolution of start-up rates over time in the countries analysed. The graphs report the role of start-ups in terms of the number of entrants over total number of units; the total employment share of entrants; and gross job creation by entrants in total gross job creation. Declining start-up rates are more evident for some countries, such as Austria, Brazil, Denmark, Italy, New Zealand, Sweden and Turkey. In others economies, such as for instance Belgium, Finland and the Netherlands, entry rates exhibit more ambiguous patterns.

Figure 6. The role of start-ups by country over time

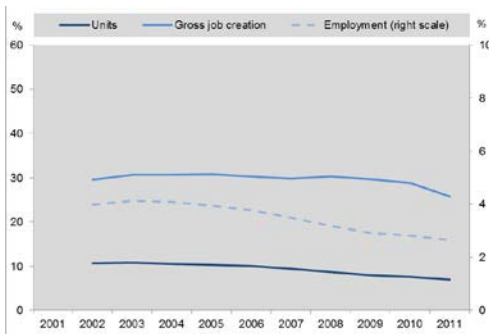




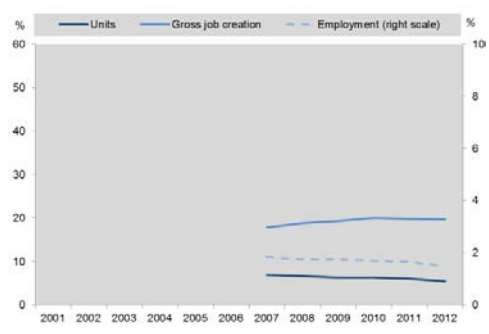
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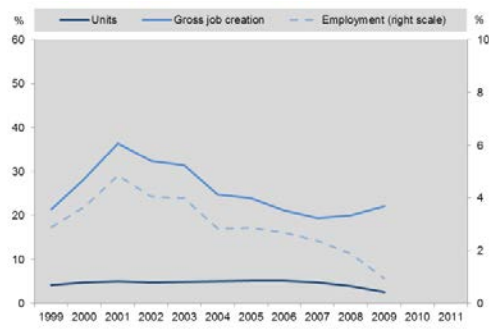
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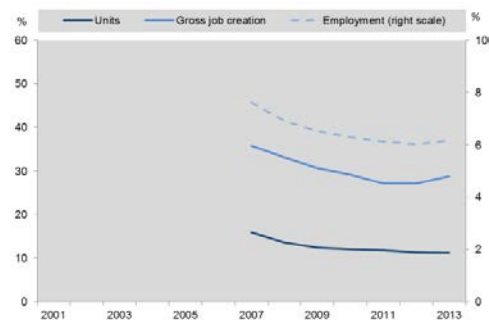
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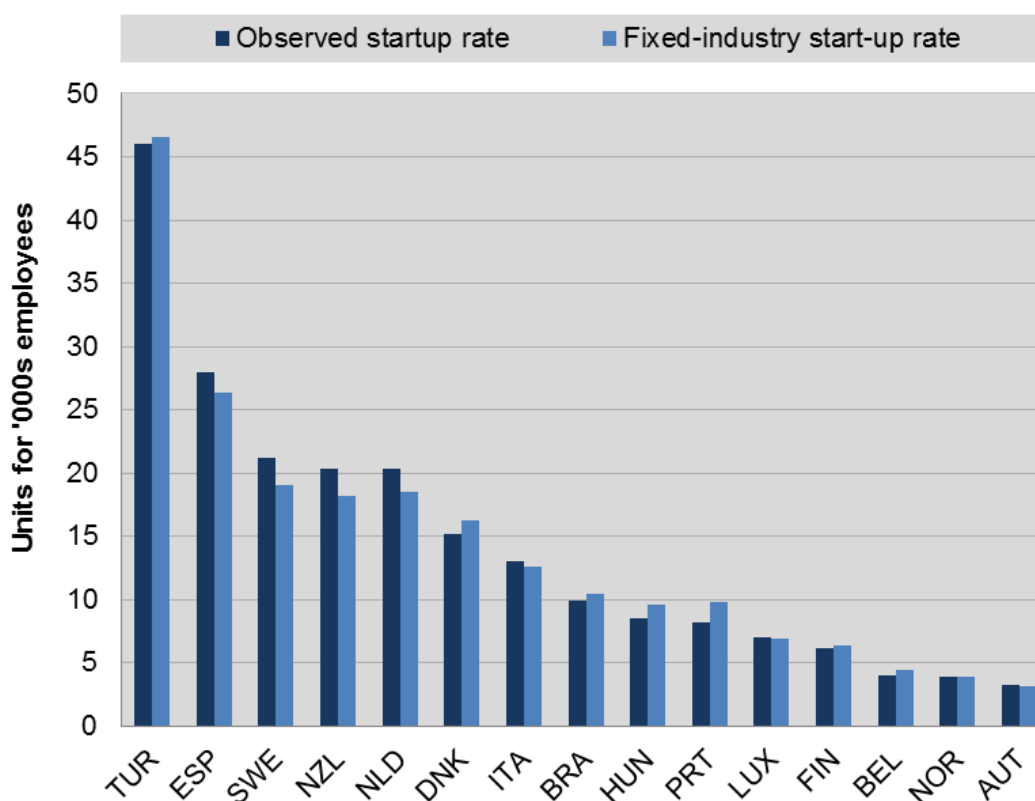


Notes: the graphs illustrate entry rates for all entrants over the available years. The share of units (with positive employment), total employment, and gross job creation are calculated as ratio over the total number of units (with positive employment), total employment, and total gross job creation in the economy, respectively. Figures report 3-year moving averages. Sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

Some of the cross-country differences in start-up rates observed at the aggregate level can be due to a different sectoral composition of the economy. In fact, as shown in figure B9 in the Appendix and as outlined in existing evidence for the United States, start-up rates and their evolution over time can be extremely different across sectors. However, even when imposing the same sectoral composition across countries, start-up rates differ significantly. Figure 7 compares the country level start-up rates, calculated keeping the industry composition constant at the average level across countries, with the averages observed in the same sample. As illustrated in the figure, there are some differences in the relative values, but those are overall small. Therefore, the different sectoral composition does not explain much of the observed cross-country differences in start-up rates.

**Figure 7. Start-up rates by countries keeping constant the industry structure**



Notes: Country averages keeping the industry composition fixed are calculated as  $y_i = a_{ik} * w_j$ , where  $i$  indexes countries, and  $j$  sectors;  $a_{ik}$  are the indicators calculated at the industry-country level, and  $w_j$  are the relative industry shares in total employment on average across all countries. Year 2007 (except Norway, for which 2004 is used). Sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

### 3.3. Size at entry

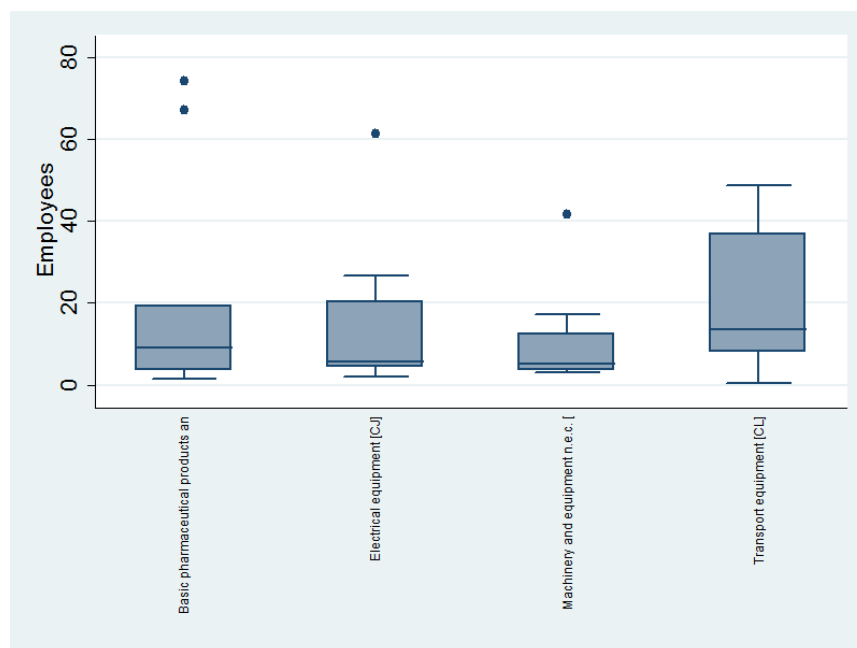
In a dynamic economy, characterised by low entry barriers and opportunities for new firms to experiment, the average size at entry is expected to be small. There is a long-standing debate and large body of empirical work concerning the relationship between firm growth and initial size. This strand of literature discusses the validity of the “law of proportionate effects”, or so called Gibrat’s law, which postulates the independence of firm growth from initial size (see Gibrat, 1931 and Sutton,

1997). Gibrat's law seems to hold not only as a theoretical benchmark, but also as a good first-order approximation of the empirical relationship between firm size and growth. A number of deviations from this law, however, seem to be in place especially for small (young) firms, which tend to grow faster (see for instance Coad, 2009 or Lotti, Santarelli and Vivarelli, 2009 for extensive discussions on the topic). On the other hand, a number of contributions suggest that low average size is negatively correlated with survival probability (see among the others Geroski, 1995; Audretsch and Mahmood, 1995; and Mata, Portugal and Guimaraes, 1995). Agarwal and Audretsch (2001) try to reconcile the two views (size-growth independence versus size-survival correlation), arguing that each outlook tends to be peculiar to the phase of the industry life cycle considered and to the degree of technological intensity of the sector analysed.

In our database, the average size of entrants is remarkably low. Figure 8 illustrates average size at entry for all start-ups that survive over a five year period for those four 2-digit industries showing the widest cross-country variation in entry size. The box-plot graph provides a comprehensive picture of the cross-country distribution of average size at entry within the selected 2-digit sectors. A much skewed cross-country distribution of average size at entry, with substantially high cross-country mean, is particularly evident for the Basic Pharmaceutical Products and the Transport Equipment sectors.

**Figure 8. Surviving entrants: differences in average size at entry by 2-digit sector**

*Box plot graph showing the 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup> percentiles and adjacent and outside values of the cross country distribution*

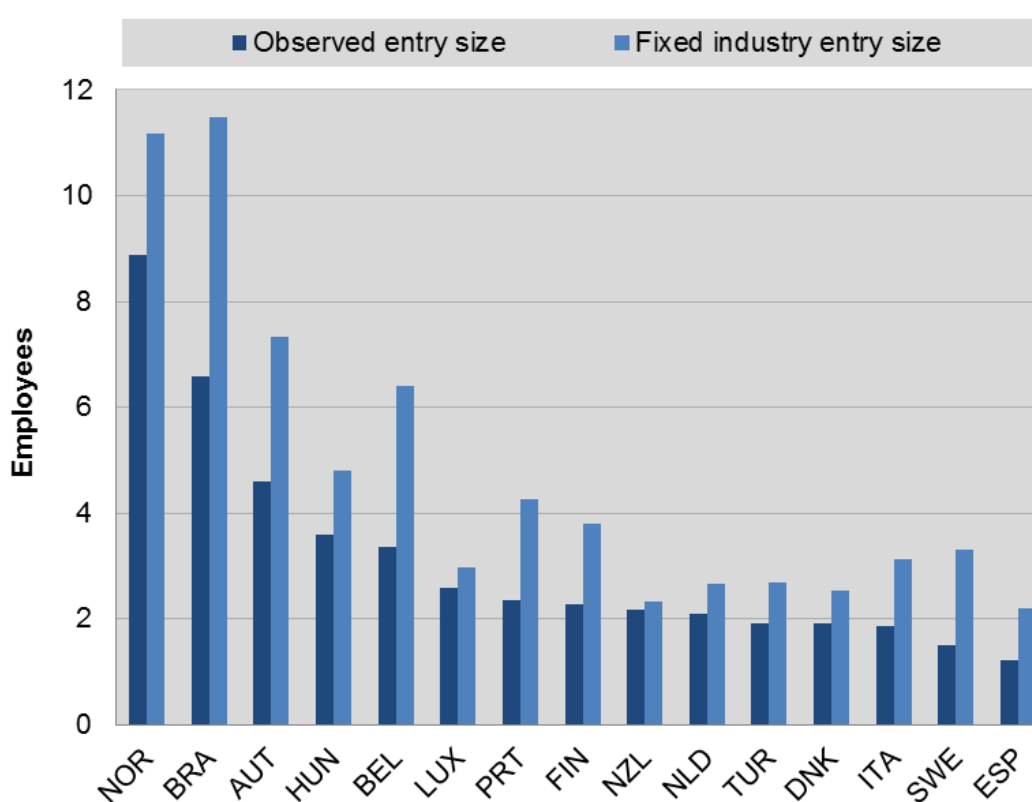


*Notes: The graph reports the cross-country distribution of average size at entry for all entering units surviving to t+5 by 2-digit sector. Average size at entry is expressed as the ratio between total employment of surviving entrants over number of surviving entrants. Figures report the average for different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. The box identifies the lower adjacent value (low bar/whisker below the box), the 25<sup>th</sup> percentile (lower end of the box), the median (bar inside the box) the 75<sup>th</sup> percentile (upper end of the box), and the upper adjacent value (bar/whisker above the box) of countries' average-size-at-entry distribution. Points represent outside value. For further information and definitions of adjacent and outside values see Cox (2009). Owing to methodological differences, figures may deviate from officially published national statistics.*

*Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.*

While Figure 8 shows that there is substantial variation across countries in average size at entry within some sectors, Figure 9 visually inspects whether the average cross-country values of this variable are still affected by the sectoral composition. The graph shows that, in most countries, values obtained keeping the sectoral composition constant across countries are comparable to the simple averages, suggesting that sectoral composition plays only a limited role in explaining cross-country differences. However, it is interesting to note that in the four countries in which the size at entry is higher than the average – Austria, Belgium, Brazil and Norway – the aggregate average size at entry would be significantly higher if their industrial structure would mirror that of the average country. Therefore, if anything, sectoral specialization seems to compress, rather than amplify, cross-country heterogeneity in entry size.

**Figure 9. Size at entry by countries with keeping industry structure constant**



Notes: Country averages keeping the industry composition fixed are calculated as  $y_i = a_{ik} * w_j$ , where  $i$  indexes countries, and  $j$  sectors;  $a_{ik}$  is the size at entry calculated at the industry-country level, and  $w_j$  are the relative industry shares in total employment in average across all countries. Year 2007 (except Norway, for which 2004 is used). Sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

### 3.4. Survival share and probability of exit

Taken in isolation, the share of start-ups that survive over the first years of activity is a multifaceted indicator for policy-making. A *high* survival rate can be interpreted as an indicator of a supportive environment for start-ups, e.g. in terms of access to finance; while a *low* survival rate could signal that many start-ups are free to enter the market and experiment with risky business strategies. A

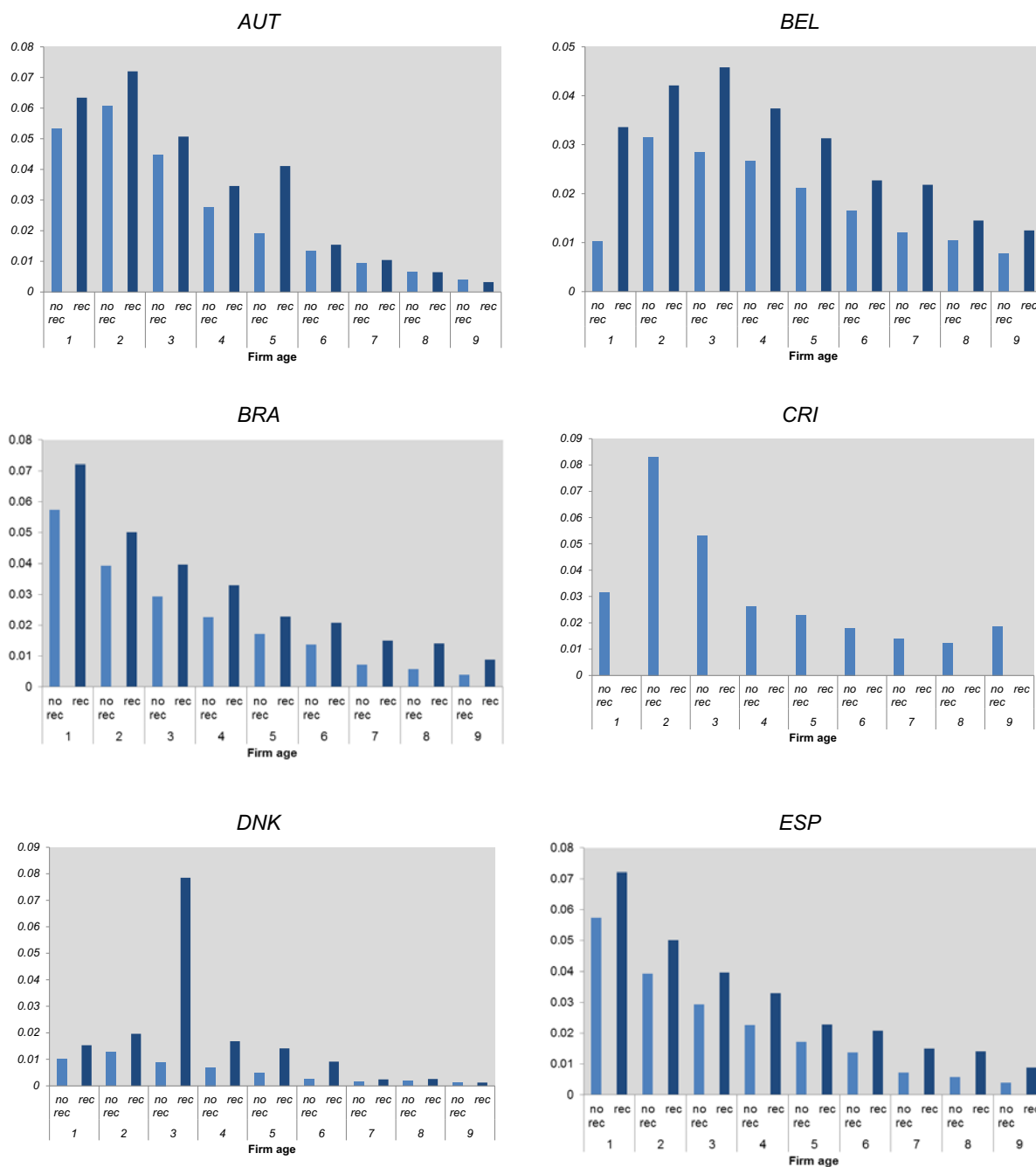


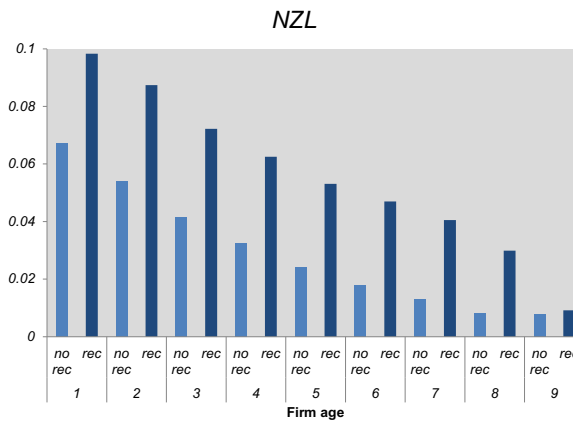
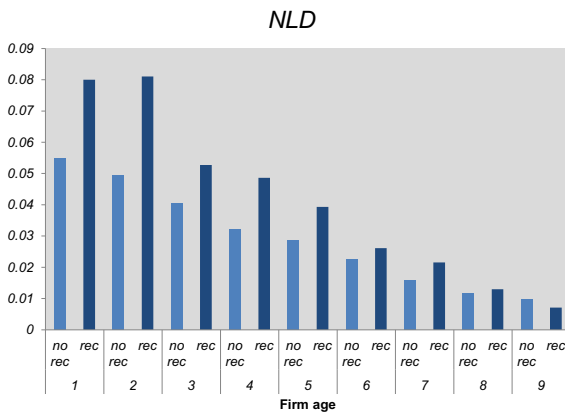
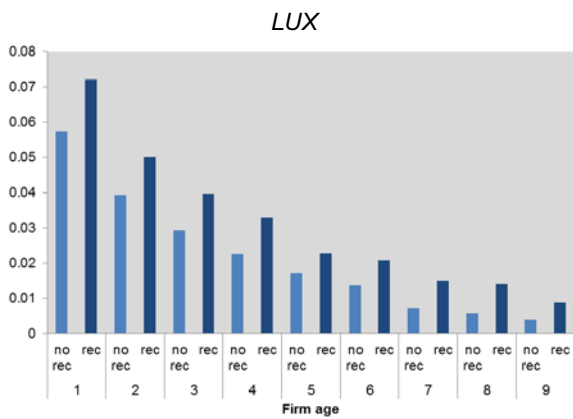
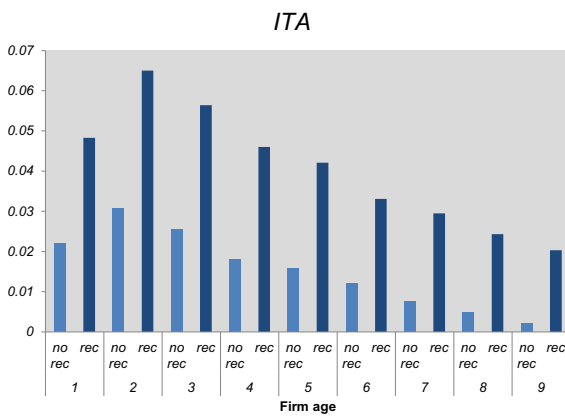
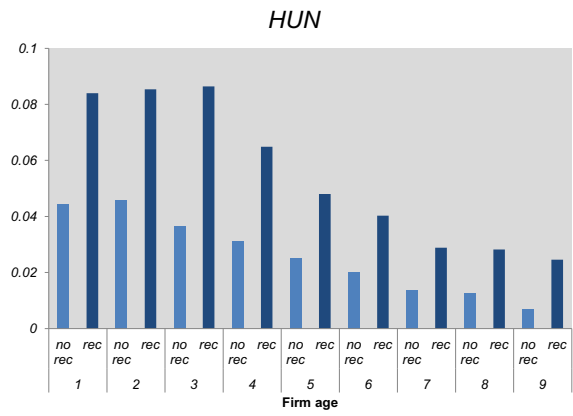
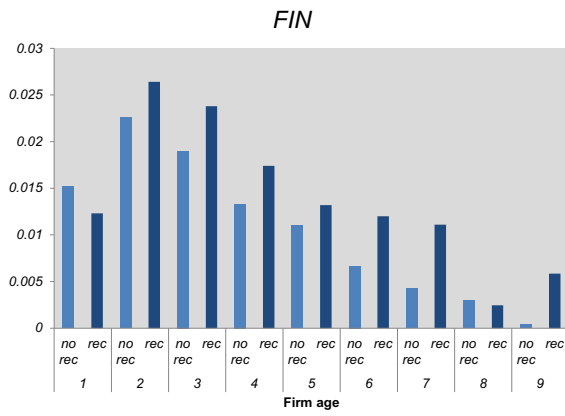
fraction of those succeed and grow fast, while those that are unsuccessful can leave the market smoothly without trapping resources into low-productivity activities. This process reflects an “up-or-out” dynamics that is the lifeblood of a Schumpeterian “creative destruction” process.

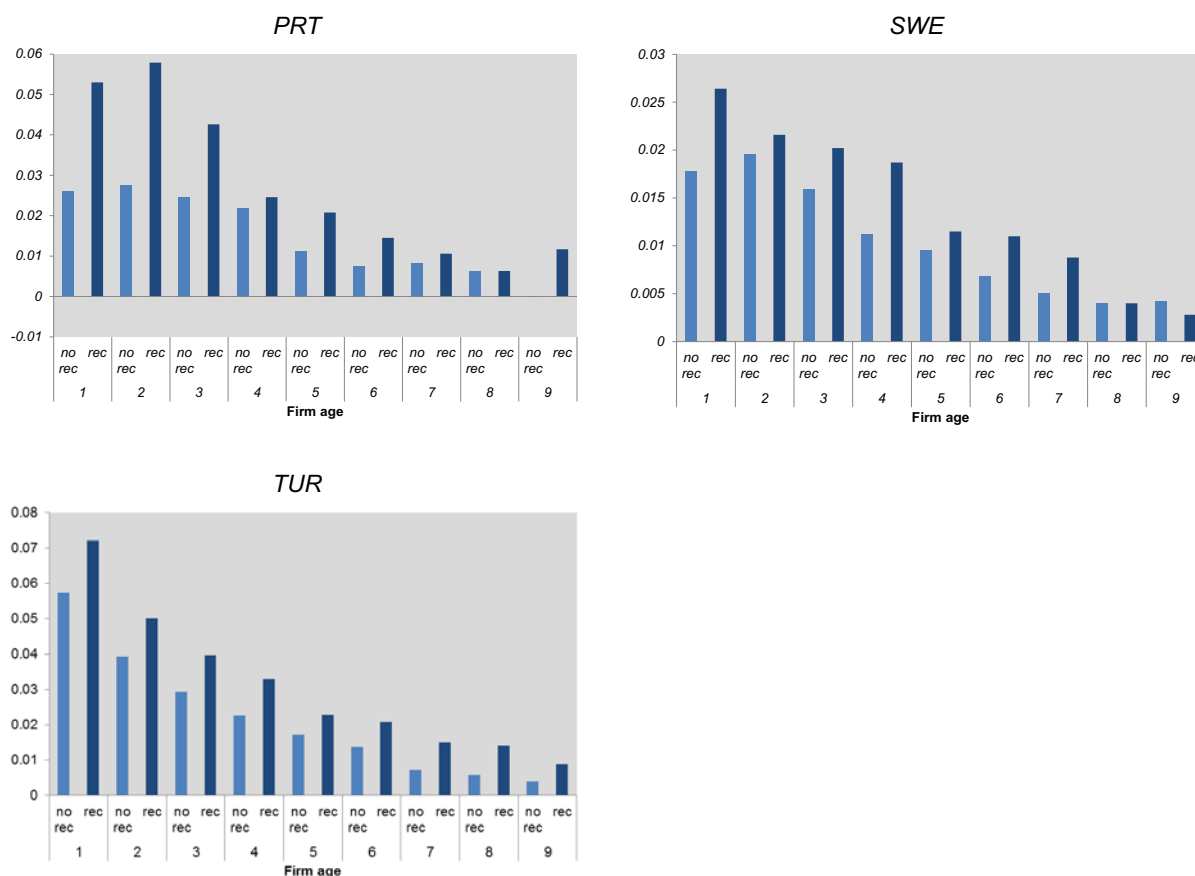
In the database under scrutiny, variation in survival rate is also evident. Figure 4 shows that the survival shares over the first three years of life span from about 55% in Netherlands to around 74% in Sweden. Figure 10 further decomposes this pattern by firm age and by country, before and during the great recession; more specifically, the graphs illustrate the dynamics of the exit probability conditional on age (reported on the horizontal axis) and its variation over the crisis.<sup>9</sup> In most countries the average probability of exiting (controlling for units’ size class, 3-digit sector and year) peaks when units are between two or three years old. Furthermore, the general effect of the recession in the countries analysed is to increase the probability of exit across all age categories considered. Interestingly, in some countries the increase is not equally distributed, with some age intervals seeing a much higher increase in exit probability than others (like e.g. Finland for age 6-7; Denmark for age 3-4; Austria for age 5).

**Figure 10. Relative probability of exit at different ages**

*In recession (rec) and no-recession (no rec) periods; regression coefficients*







Notes: the graphs report the age coefficients of the exit “distributed regression” (which has as response variable an exit dummy and as explanatory variables age, size, 3-digit sector and year dummies) interacted with a recession dummy (equal to one in the years 2008 and 2009, and equal to zero otherwise). Each country in the database is analysed separately. Norway has been excluded due to ongoing checks on unusual dynamics in the underlying data. Costa Rica reports only no recession, due to the time frame for which data are available. Firm age is reported on the horizontal axis (1 to 9 years old). Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

### 3.5. Post-entry Growth

Previous work has already highlighted that the average growth rate of start-ups – although always positive on average– entails a substantial degree of heterogeneity within cohorts of otherwise similar entrants, with the large majority of small start-ups growing very slowly, and a tiny proportion of them experiencing very fast growth (Criscuolo, Gal, and Menon, 2014c; Anyadike-Danes et al., 2014). It is therefore important to further explore this firm-level heterogeneity in the growth performance of start-ups in order to draw useful policy implications.

Figure 11 analyses the post-entry dynamics of micro-entrants (entrants with 0-9 employees) in the whole non-financial business sector, classifying them according to their size class five years later (or in the “exit” group if they did not survive). From Panel A, which presents the figures in terms of number of units, it is evident that most micro start-ups either remain stable (i.e., at the end of the period they are in the same size class in which they were at the beginning of the period) or exit the market. In every country, the number of micro start-ups moving to a higher size class at the end of the period is extremely small – on average around 3% and never more than 8%. The graph also shows

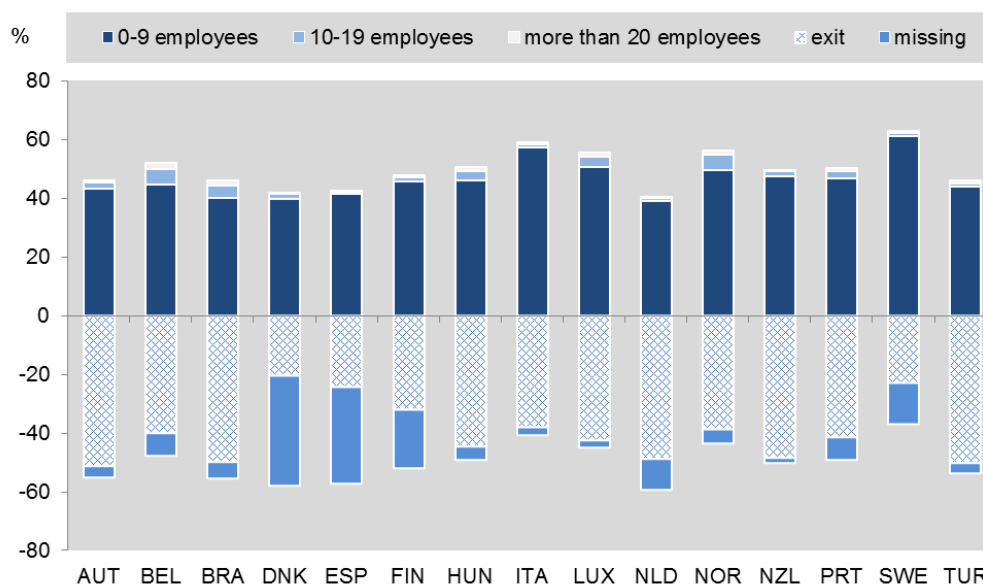
that, in all economies excluding Austria, Brazil, and Turkey, the number of surviving micro start-ups is higher than the number of exiting units.

The pattern is however completely different if, rather than looking at firms, one looks at jobs. Panel B in Figure 11 illustrates post-entry dynamics of micro entrants in terms of their net job creation (the difference between employment at the beginning and at the end of the five year period, respectively). The very few micro-entrants whose size is bigger than 20 employees at the end of the horizon are responsible for most job creation of micro start-ups in all countries – on average 37% with a maximum of 52% in Sweden. Furthermore, in most countries gross job creation by surviving micro start-ups more than compensates gross job destruction by exiting units.<sup>10</sup>

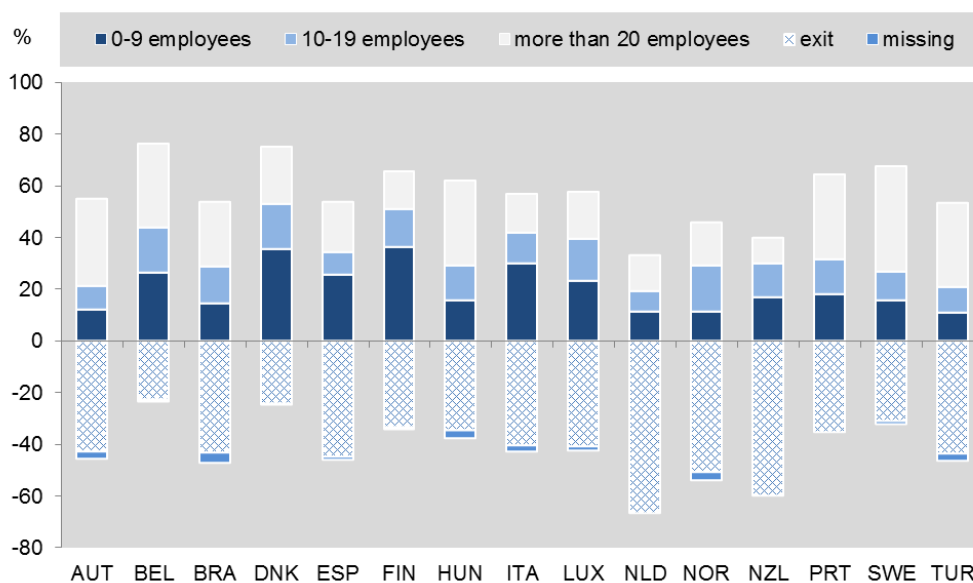
Similar to evidence on the probability of exit presented above, average employment growth is much higher and volatile in the first two to three years of a firm's life. Figure 12 focuses on entering units surviving over a period of three years, classified by their age class at time  $t$  (entrants; units one or two years old; and units three to five years old). The figure compares average employment growth (in Panel A) and average employment growth volatility (in Panel B) in the whole non-financial business sector. Employment growth volatility is calculated as the standard deviation of the yearly employment growth index at firm level over time, and it is then averaged over the group of firms considered (see Criscuolo, Gal and Menon, 2014b, for details). The upper graph clearly shows that surviving entrants grow on average substantially more than their older counterparts. The difference is particularly significant in Denmark, Belgium, Finland and Spain. On the other hand, surviving start-ups' growth appears to be also more volatile (in terms of their employment growth rates) in most countries (bottom graph). Belgium, Denmark, Portugal and Spain present the largest differences in growth rates between surviving entrants and older units. This pattern, again, points to the critical importance of the first couple of years of life for the new entrants. Restricting the sample to micro (0-9 employees) firms only (Figure B10 in Annex B) produces very similar patterns. The figures show clearly a significant gap between the growth just after entry and growth of firms later in the life cycle. However, the extent to which this gap exists is very different across countries.

**Figure 11. Focus on micro-entrants: stable vs. growing vs. exiting**

*Panel A. Share of units in all micro entrants*



*Panel B. Contribution to total net job creation*

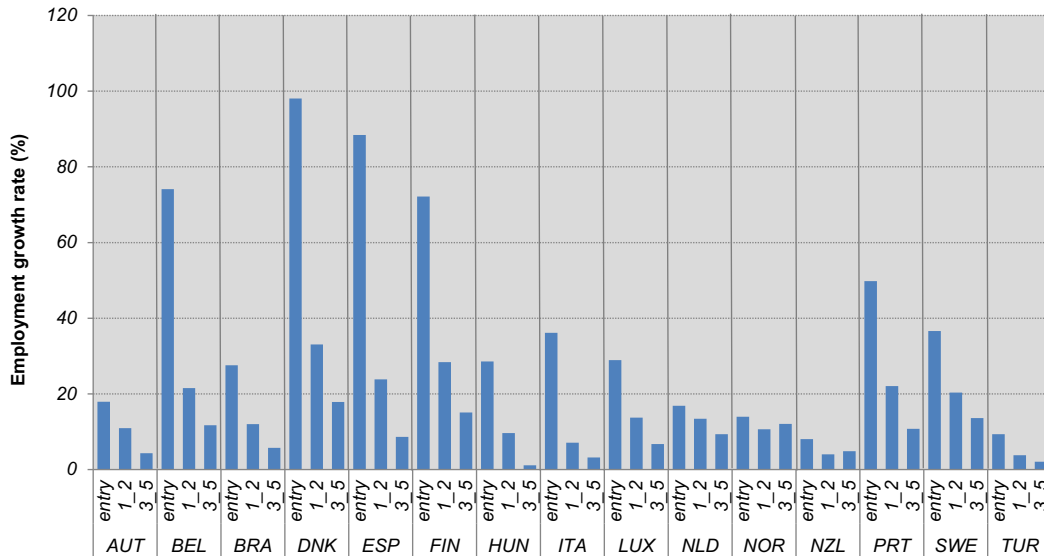


Notes: Panel A represent the share (in terms of number of units) of micro (0-9 employees) entrants by size class at time  $t + 5$ . Panel B represents the contribution to net job creation (defined as net job creation by the group over total net job creation of micro entrants) for micro (0-9 employees) entrants by size class at time  $t + 5$ . Size classes are aggregated as follows: 0-9 (stable), 10-19 and 20 plus (growing), exit (shrinking) and units for which the size class at time  $t + 5$  is missing. Figures report the average for different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. Sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

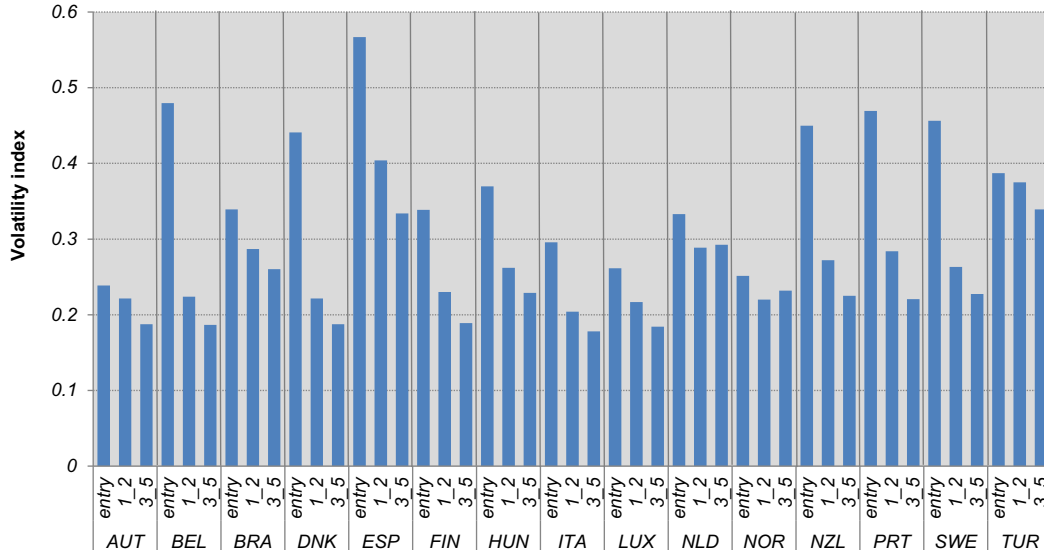
Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure 12. Surviving units by age class: growth and volatility**

*Panel A. Average employment growth index*



*Panel B. Average employment growth volatility*



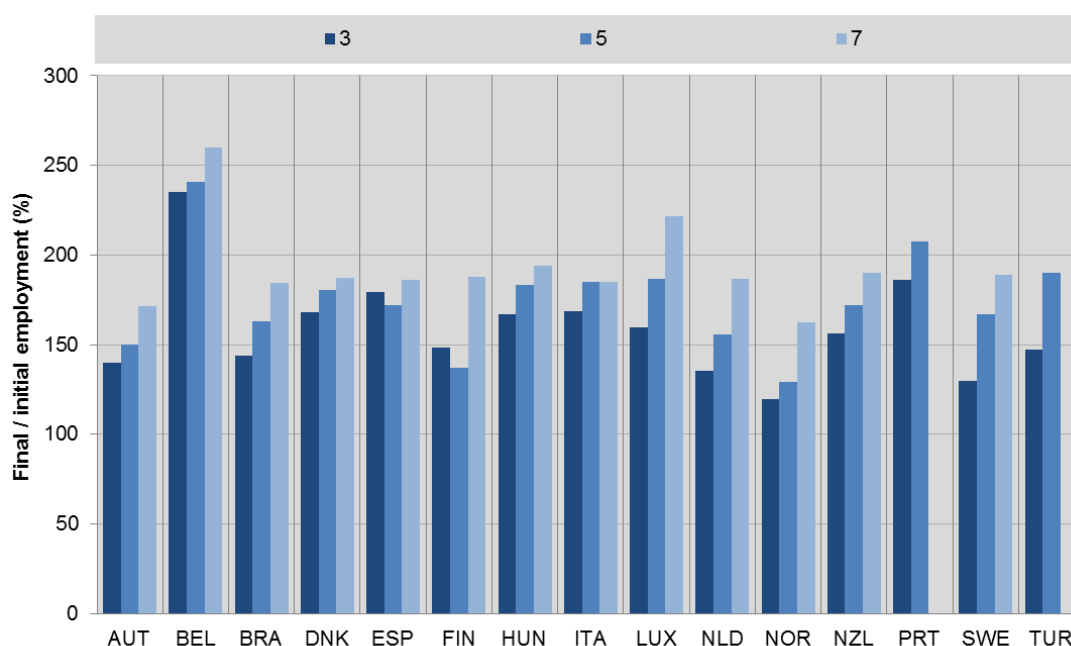
Notes: Panel A illustrates the average employment growth index for all units surviving at time  $t+3$  by age class at time  $t$  (entry, 1-2 and 3-5 years old). Panel B represents the average employment growth volatility for all units surviving at time  $t+3$  by age class at time  $t$  (entry, 1-2 and 3-5 years old). Employment growth volatility is calculated as the standard deviation of the yearly employment growth index at firm level from  $t$  to  $t+3$ , and it is then averaged over the group of firms considered. Figures report the average for different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. Sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

Confirming significant differences across countries in the growth performance of cohorts, Figure 13 shows that although for all countries most of the growth of new entrants happens in the first 2-3 years of activity, there are significant differences across countries in the extent to which start-ups continue to grow in the following years. The graph shows the final/initial employment ratio for cohorts of surviving start-ups. In countries like Belgium and Sweden start-ups continue to grow also after five and seven years after entry, while in other countries – like Italy and Denmark – the trend is much flatter after the third year.

**Figure 13. Final over initial employment after 3, 5, and 7 years**

*Country average of starting year 2001 and 2004, surviving entrants*



*Notes: the graph shows the ratio between employment at time  $t + j$  and employment at time  $t$  of surviving entrants. Figures report the average for different time periods  $t = 2001$  and  $2004$ , conditional on their availability. Sectors covered are: manufacturing, construction, and non-financial business services. Each of the time lags  $j = 3, 5, 7$  is reported separately. Owing to methodological differences, figures may deviate from officially published national statistics.*

*Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.*

### 3.6. The “crisis” cohort

An important policy question that has arisen after the crisis is whether firms that were start-ups during the crisis had been particularly penalized by operating in such a difficult environment, both in terms of credit availability and in terms of aggregate demand and uncertainty. This section aims at providing some first descriptive evidence on this issue, disentangling the peculiarities associated with cohorts experiencing the crisis in their first three years of activities, relative to the cohorts of firms born in 2004 and in 2001, respectively, which were confronted with more ordinary conditions in the three years following entry.

Looking at the 2007 cohort is particularly informative, as the crisis was largely unexpected when these firms were created. Therefore, the effects of the crisis on post-entry growth and survival share are not excessively contaminated by different starting conditions with respect to the 2001 and 2004



cohorts. However, since the outspread of the international financial crisis in the second half of 2008, the 2007 cohorts were faced with extraordinary circumstances which affected their growth and survival probability.

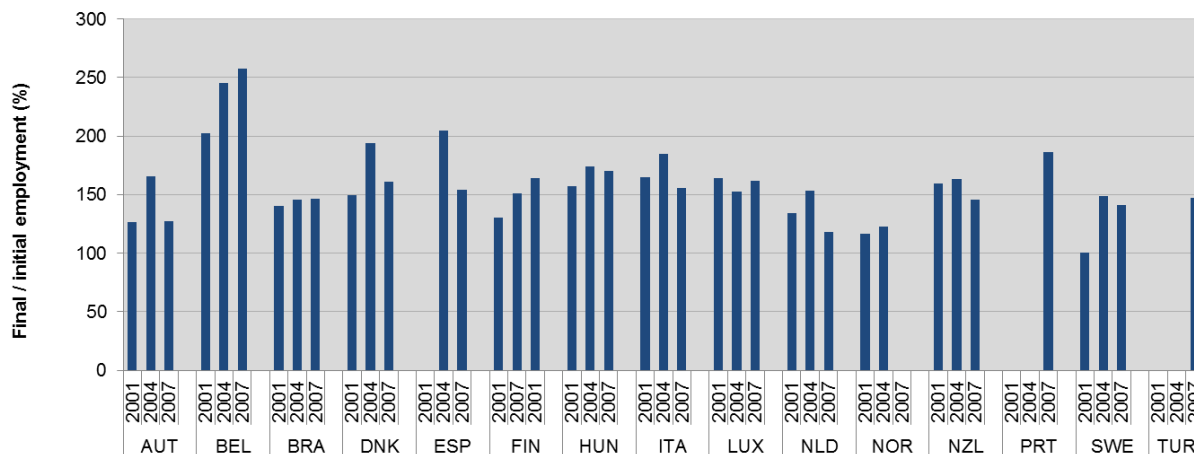
Post-entry growth patterns (in terms of final-initial employment ratio) are indeed negatively affected by the crisis in most countries (Figure 14, Panel A). However, significant exceptions hold: in Hungary and Sweden, the negative differences between the 2007 and 2004 cohort of entrants are limited, while in Belgium and Finland the post-entry growth performance of the 2007 cohort is actually better than the one of the 2004 cohort.

Similarly, survival rates in the first-three years of activity are lower for the “crisis” cohort in all but four countries (Brazil, Finland, Luxembourg and Netherlands) reflecting the fact that firms born in 2007 were faced with much tougher market conditions (Figure 14, Panel B).

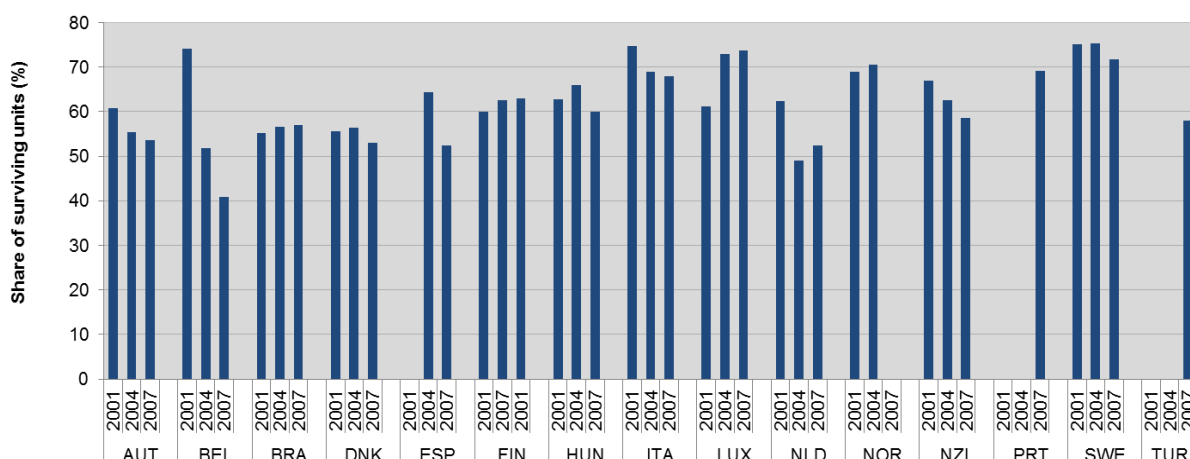
On the other hand, variation across cohorts in average size at entry shown in Figure 15 (taken from the annual flow data) over the crisis appears to be more limited, apart from Sweden, Norway and Austria, where a decline of the latter can be noted. This likely reflects the non-trivial role played by industry composition in explaining average size at entry, as shown in Figure 9, since industry composition is unlikely to change significantly in a country over a decade. Figure 15 also looks at average exit rates over the 2003-2012 period. The indicator suggests that average size has been decreasing in many countries, while exit rate has been generally increasing.<sup>11</sup> However, these dynamics do not show any particular distinctive pattern over the crisis.<sup>12</sup>

**Figure 14. Growth decomposition by cohort 2001; 2004, 2007**

*Panel A. Average post-entry growth rate*



*Panel B. Survival rate*

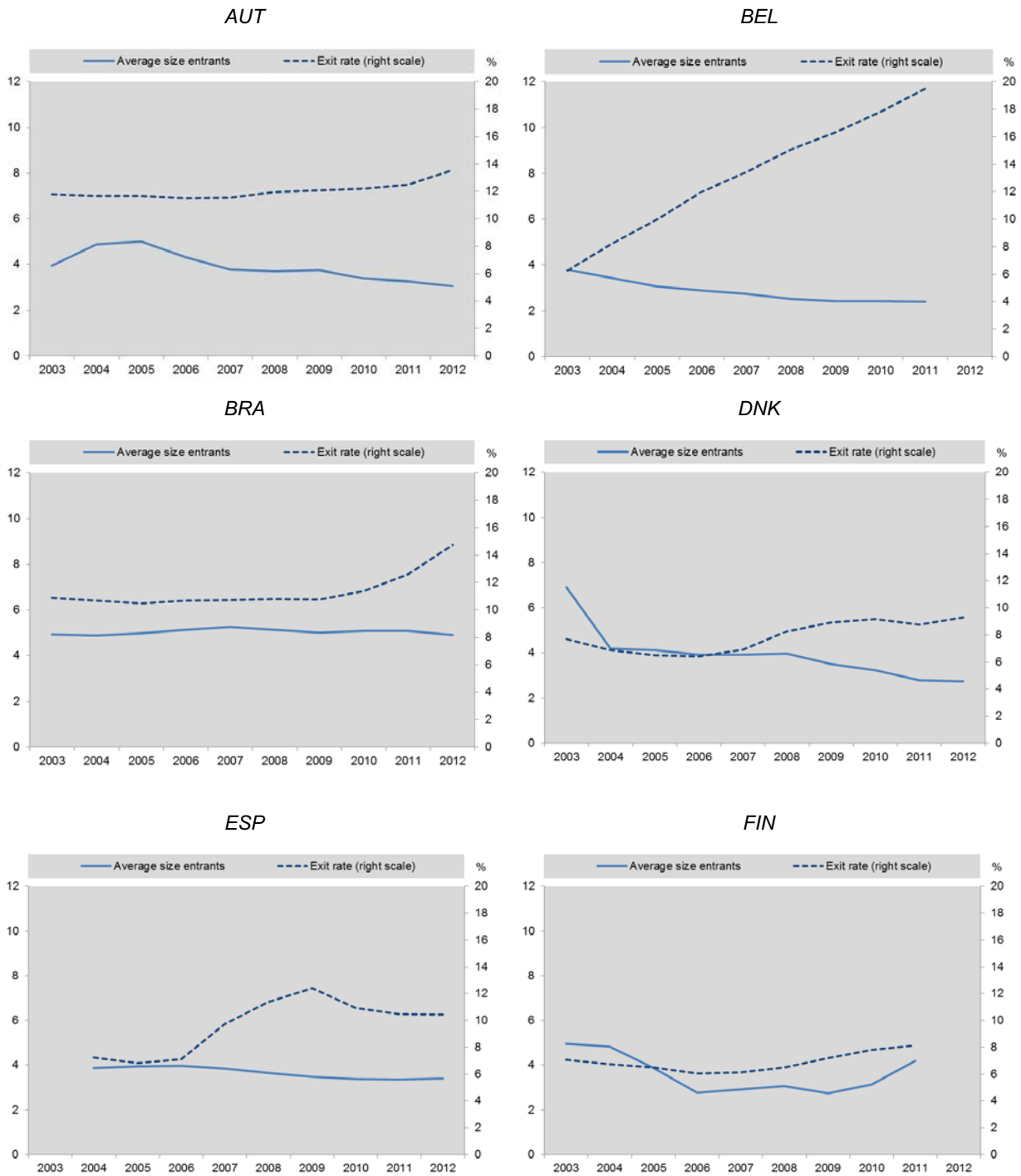


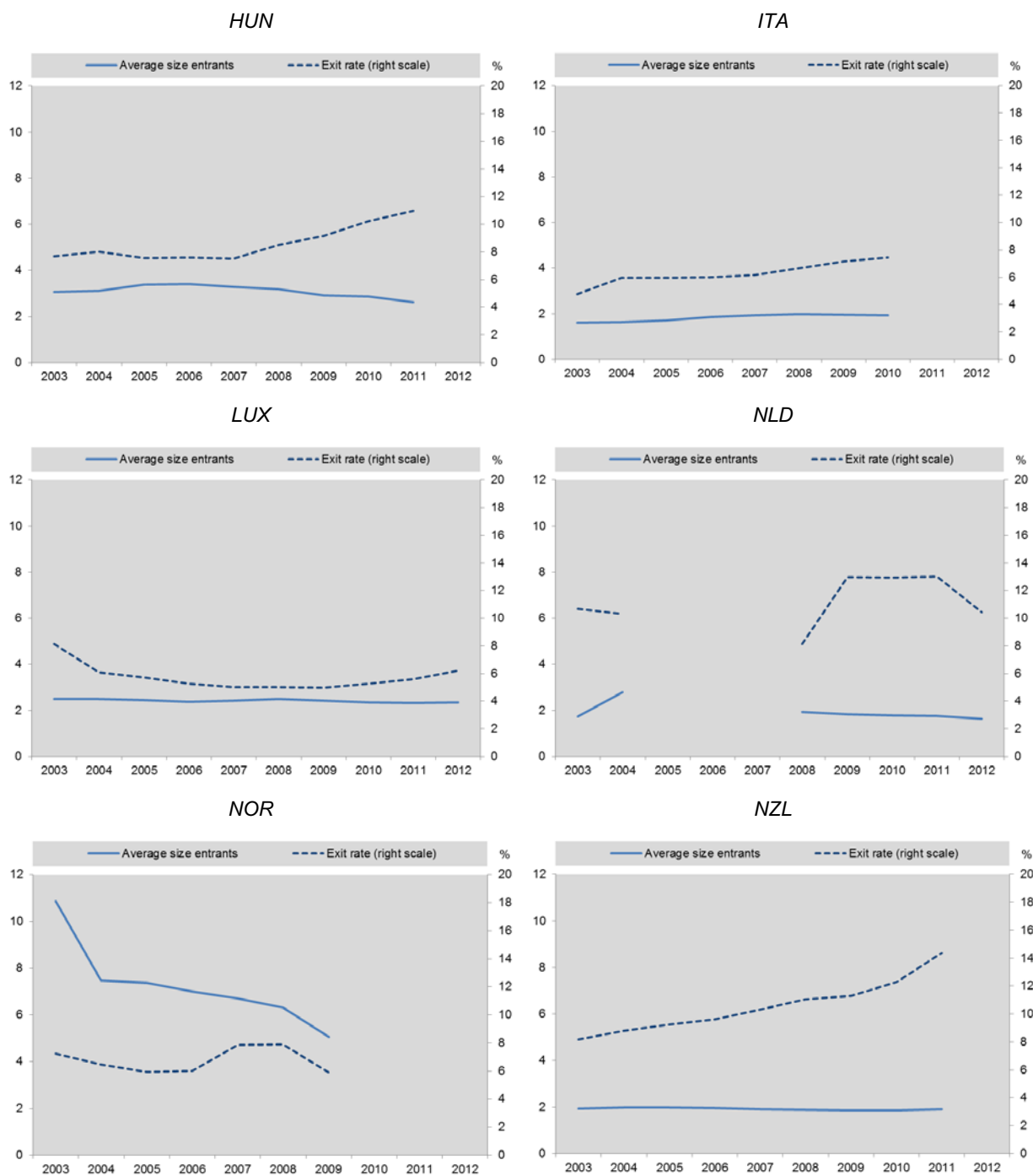
Notes: the graph illustrates the first two components of the growth decomposition by year. Panel A: ratio between total employment at  $t + 3$  over total employment of surviving entrants; Panel B: survival share of entrants, expressed as number of entering units surviving over total number of entrants per cent; Figures report different time periods  $t = 2001, 2004$  and  $2007$  separately, conditional on their availability. Sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

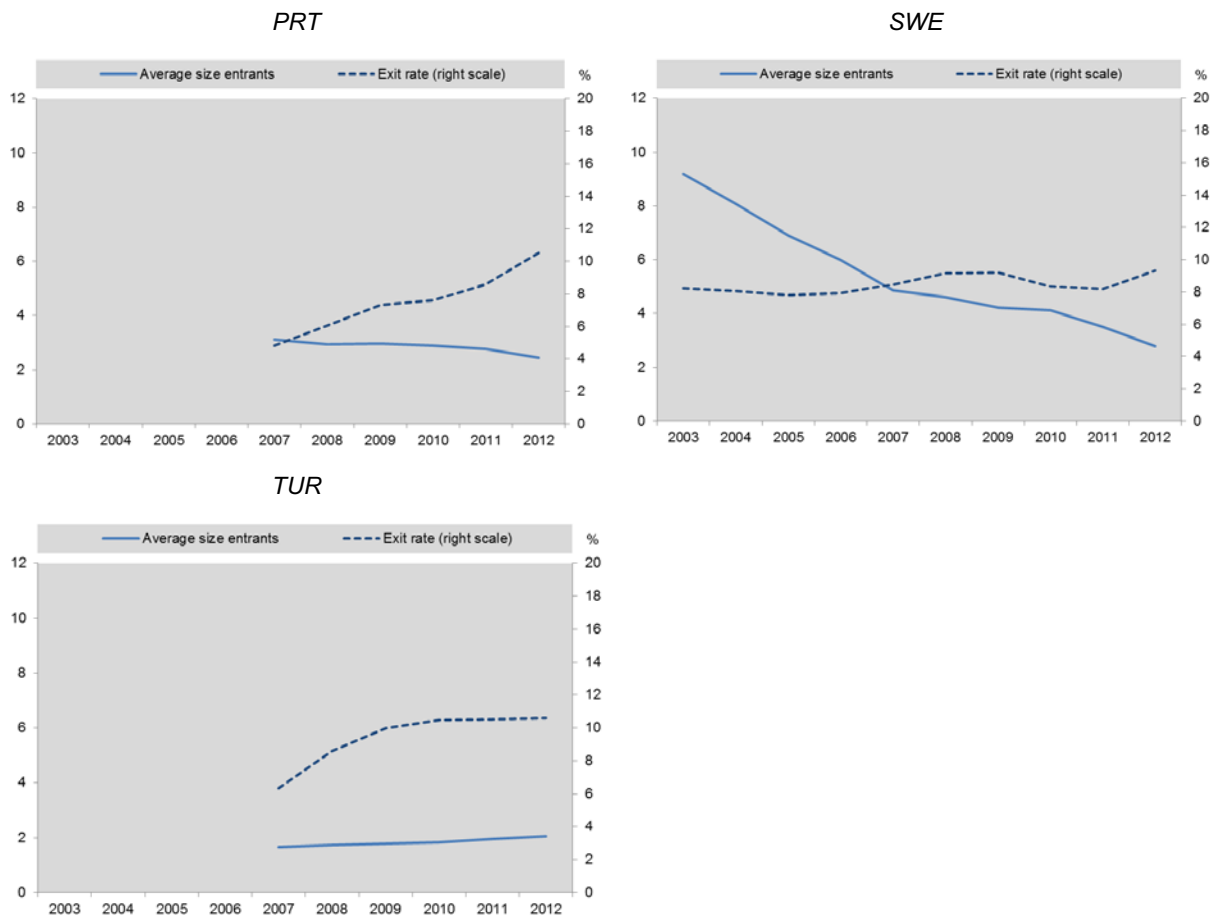
Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure 15. Average size at entry and exit rate of firms less than 3 year old**

*Annual flow data*







Notes: the graphs show average size of entering units and the exit rates of firms aged 0 to 2 by country and year, between 2003 and 2012 (conditional on availability). Figures reported are 3-year moving averages. Average size is calculated as total employment of entering units over number of units with positive employment. Exit rates are calculated as number of exiting units with positive employment over total number of units with positive employment. Sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

#### 4. Conclusions and next steps

This paper explores in depth the characteristics and growth dynamics of entrants across a number of OECD countries participating in the OECD “DynEmp” project on employment dynamics. Thanks to the unprecedented granularity of the new “DynEmp v.2” database, the descriptive evidence provides a new important base for effective policy making. The OECD is now in the process of collecting data for a number of additional OECD and non-OECD countries, therefore the analysis can be extended to several other economies at different stages of development and with different regulatory frameworks.

A number of cross-country differences emerge on the job contribution by entrants, as well as empirical regularities that consistently hold across all countries in the sample. First, one size does not fit all: the relative weight of the phenomenon in the economy and its patterns is quite heterogeneous, with countries like Sweden and New Zealand showing a contribution to net job creation by entrants more than twice as large as countries like Austria, Finland, and Belgium.

The decomposition of the net job contribution by entrants into four components – average size at entry, start-up ratio, survival rate, and average growth rate – also shows remarkable cross-country differences, especially in start-up ratios and average post-entry growth performances. The detailed exploration of those four components unveils interesting empirical regularities. For instance, the first two years of a firm’s activity seem to be crucial in determining the fate of that firm: in most countries the first two years of activity are characterised by a much higher average employment growth rate for those entrants that survive; at the same time the probability of exit peaks at the age of two, and decreases linearly thereafter.

The analysis of the growth patterns of micro start-ups also provides useful evidence for policy-making. As already emphasised by the relevant economic literature, only a tiny proportion (around 5%) of micro start-ups manage to grow quickly over the first years, while the remaining part is equally split among those that exit, and those that maintain a stable level of employment. However, these figures should not undermine the huge importance of the small group of start-ups which do grow significantly, as those are responsible for a very large contribution to job creation – ranging from 21% to 51% of the total job creation by the reference cohort of start-ups.

Given the evidence presented so far and the evident cross-country variation in business dynamism, we will extend the work to focus on policy analysis. Previous OECD studies has shown that policy can have an influential role to play in shaping the environment in which successful start-ups can enter the market, experiment, innovate, and grow (Andrews, Criscuolo, and Menon, 2014; Bravo-Biosca, Criscuolo and Menon, 2013; Andrews and Criscuolo, 2013). Exploiting the richness of the new dataset, which contains statistics at the country-industry-year level differentiated across entrants and incumbents, it is possible to improve our understanding of the differential impact of policies on entrants versus incumbents.

Second, another important issue which has been only tangentially investigated in this paper is the characterization of the “high-growth” start-ups, i.e., of the tiny proportion of successful start-ups which disproportionately contribute to job creation. With the available data, it is possible to investigate their relative contribution to aggregate job creation by country, time period, and industry.

Third, since the dataset covers around 10 years for most countries, starting from early 2000s’ until the 2011 or 2012, the effect of the Great Recession can also be investigated more in depth. In particular, the economic literature has discussed whether during recessions a “scarring” or a “cleansing” effect prevail for start-ups. Recessions may spur a cleansing process in the economy, as unproductive firms exit the market and free up resources which could be employed by more productive firms. On the other hand, recessions may also have a “scarring” effect on the economy, impeding the developments of potentially successful new firms and hampering the process of reallocation, e.g. because of frictions in the financial market. The disproportionate exit rate among start-ups which is often found during recessions may have long-lasting detrimental effects on growth also in the medium to long run. Evidence from the United States suggests that during the last recession, contrary to previous recessionary episodes, the intensity of reallocation fell rather than rose; furthermore, the reallocation that did occur was less productivity enhancing than in prior recessions (Foster, Grim, and Haltiwanger, 2014). The Dynemp database combined with productivity data can help shed light on whether this was the case in other economies.

## NOTES

<sup>1</sup> Scuola Superiore Sant’Anna, Pisa; and Paris School of Economics – University Paris 1.

<sup>2</sup> OECD, Science, Technology and Innovation Directorate.

<sup>3</sup> OECD, Science, Technology and Innovation Directorate; and Spatial Economic Research Centre, London School of Economics.

<sup>4</sup> The OECD DynEmp team has developed customized modules for those countries requesting it so that part or all of the confidentiality checks are conducted automatically and internally by the Stata routine.

<sup>5</sup> Note however that data for Chile, Korea and Ireland has not been included in the current analysis as further checks are currently under way. Mexico, and Slovenia have not yet shared data with the OECD team. Australia’s data cannot yet be published due to their preliminary nature.

<sup>6</sup> Data relative to 2010-2011 in Norway have been excluded from the analysis due to ongoing checks on unusual dynamics in the underlying data; data relative to 2006 in The Netherlands have been also excluded due to the redesign of the Business Register in that year.

<sup>7</sup> Figure B1 illustrates the share of total employment, gross job creation and gross job destruction by small (0-49 employees) young (0-5 years old) units by 2-digit sector, on average, in the countries analysed. In *all* 2-digit sectors young small units i) are always net job creators, and ii) their relative contribution to gross job creation is always significantly higher than their share in total employment. The share of gross job creation by small young units is on average higher in services, with a number of 2-digit sectors (including “IT and other information services” and “Other business services”) in which young-small firms contribute for more than 40% of total gross job creation in the sector. In some countries, the share of gross job creation by young firms in certain service sectors is above 70% (Figure B2 in Annex B), while the corresponding share of gross job destruction is below 50% (Figure B3 in Annex B).

<sup>8</sup> Indicators on the number of start-ups are more commonly normalized on the total number of firms, rather than on employment. However, the second option is preferred because it leads to an indicator that is not affected by the average firm size in the economy.

<sup>9</sup> The graph is extracted from the outcomes of one of the “distributed regressions” which are performed by the DynEmp routine (see Criscuolo, Gal and Menon, 2014b for further details).

<sup>10</sup> A caveat is however necessary for this analysis. Due to the specificity of their confidentiality rules and the relative small size of their economy, the confidentiality blanking of the output datasets for Denmark, Spain, Finland, Luxembourg, New Zealand, and Netherlands may lead to underestimating the share of micro start-ups moving to a higher size class, as well as their contribution to net job creation.

<sup>11</sup> The indicators for The Netherlands are affected by breaks in the longitudinal structure of the business register.

<sup>12</sup> Figure B11, B12, and B13 in Annex B shows that similar conclusions hold when limiting the analysis to small entrants only.

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## ANNEX A: TECHNICAL APPENDIX

### Growth decomposition

Let us define normalized net job creation by surviving units in age-class  $a$  (entering, 1-2, 3-5, 6-10, 11+), size-class  $s$  (0-9, 10-19, 20-49, 50-99, 100-249, 250+), macro-sector  $m$  (manufacturing, construction and non-financial business services) and country  $c$  (see the introduction for the list of countries in the sample) between time  $t$  (2001, 2004, 2007) and  $t + j$  (with  $j = 3, 5, 7$ ) as follows

$$Norm\_NJV_{asmct}(t, t + j) = \frac{EMP_{asmct}^{surv}(t + j)}{EMP_{smct}(t)}$$

where

$$EMP_{smct}(t) = \sum_a EMP_{asmct}(t)$$

The numerator of normalized net job creation  $EMP_{asmct}^{surv}(t + j)$  identifies employment at time  $t + j$  of units which at time  $t$  were in age-class  $a$ , size-class  $s$ , macro-sector  $m$  and country  $c$  and that survive between time  $t$  and  $t + j$ . The super-script *surv* identifies only units surviving until time  $t + j$  and the parenthesis indicate that employment is reported at time  $t + j$ .

For simplicity, let us consider the case of the growth decomposition by year presented in the report (Figure 14, normalized net job creation of surviving entrants in all size classes and all macro-sectors). In this case  $a$  therefore refers to all entering units in the economy. Let us call

$$EMP_{act} = \sum_s \sum_m EMP_{asmct}$$

By means of straightforward substitution, normalized net job creation of surviving entrants becomes

$$Norm\_NJV_{act}(t, t + j) = \frac{EMP_{act}^{surv}(t + j)}{EMP_{ct}(t)}$$

Note that in this case the denominator of normalized net job creation  $EMP_{ct}(t)$  represents country total employment at time  $t$ .

We decompose normalized net job creation by surviving entrants as follows

$$\frac{EMP_{act}^{surv}(t + j)}{EMP_{ct}(t)} = \frac{EMP_{act}^{surv}(t + j)}{EMP_{act}^{surv}(t)} * \frac{EMP_{act}^{surv}(t)}{NrUnits_{act}^{surv}(t)} * \frac{NrUnits_{act}^{surv}(t)}{NrUnit_{act}(t)} * \frac{NrUnit_{act}(t)}{EMP_{ct}(t)}$$

where  $NrUnits_{act}^{surv}(t)$  identifies the number of entrants in country  $c$  surviving between time  $t$  and  $t + j$  and  $NrUnit_{act}(t)$  identifies the total number of entrants in country  $c$  at time  $t$ .

In the report we refer to  $\frac{EMP_{act}^{surv}(t+j)}{EMP_{act}^{surv}(t)}$  as the final over initial employment ratio (or as the average post-entry growth rate) and we use it as a proxy for post-entry growth performance. Note that it identifies employment at time  $t + j$  of surviving entrants (at time  $t + j$ ) as a proportion of overall employment at time  $t$  of the whole cohort of start-ups entering (at time  $t$ ).

Furthermore, we define average size at entry for surviving start-ups as the second component of the decomposition  $\frac{EMP_{act}^{surv}(t)}{NrUnits_{act}^{surv}(t)}$ . It is the ratio between total employment at time  $t$  for entrants surviving until time  $t + j$  over the number of entering units surviving until time  $t + j$ .

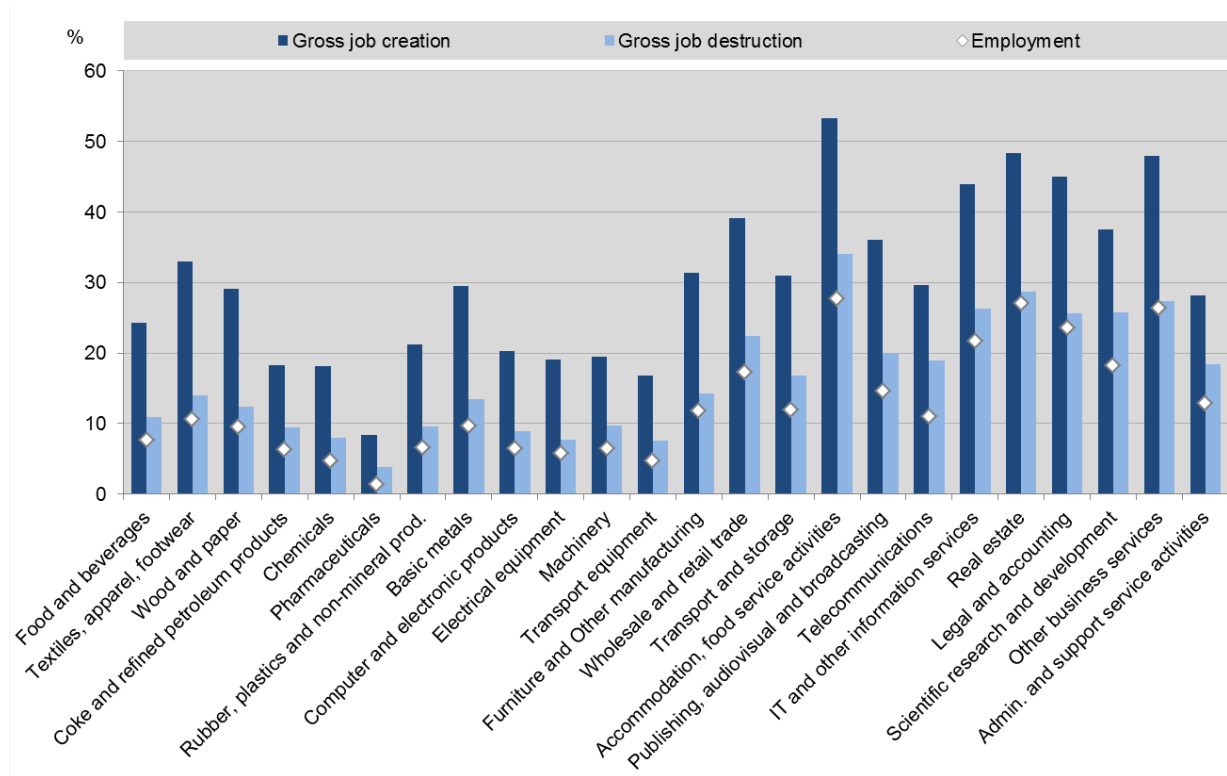
We define the survival share for entering units as  $\frac{NrUnits_{act}^{surv}(t)}{NrUnit_{act}(t)}$ , which indicates the number of entering units surviving until time  $t + j$  over the total number of entrants. Note that the graphs report this measure in percentage terms.

We define the start-up ratio (in terms of employment) in the economy  $\frac{NrUnit_{act}(t)}{EMP_{ct}(t)}$  as the total number of entering units over total employment. Note that the graphs report this measure in terms of start-ups per thousands of employees.

The same rationale applies for the growth decomposition of small entering units only, in Appendix (Figures B12 and B13). Some graphs (e.g. Figure 4) report figures as averages over time (see the graph notes).

## ANNEX B: ADDITIONAL TABLES AND FIGURES

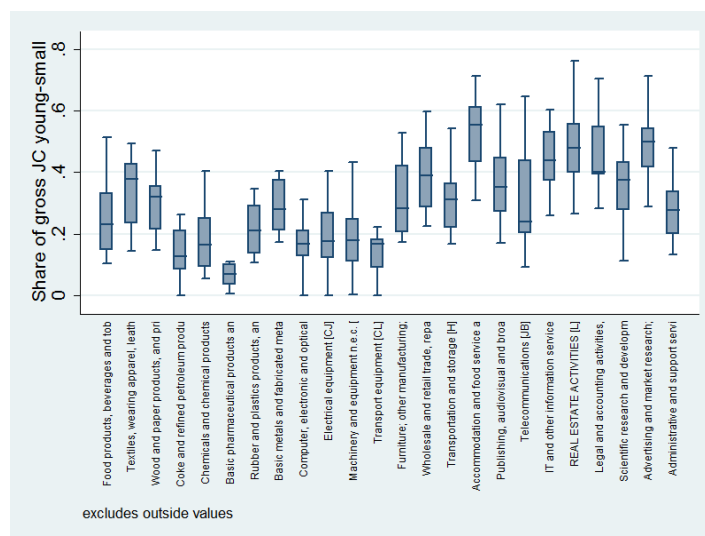
Figure B1. Share of total employment, GJC and GJD of small young units by 2-digit sector



Notes: the graph reports the share of total employment (total employment of small young units over total employment), the share of gross job creation (gross job creation of small young units over total gross job creation) and the share of gross job destruction (gross job destruction by small young units over total gross job destruction) of small (0-49 employees) young (0-5 years old) units by 2-digit sector. Figures report averages over the available years in every country. Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

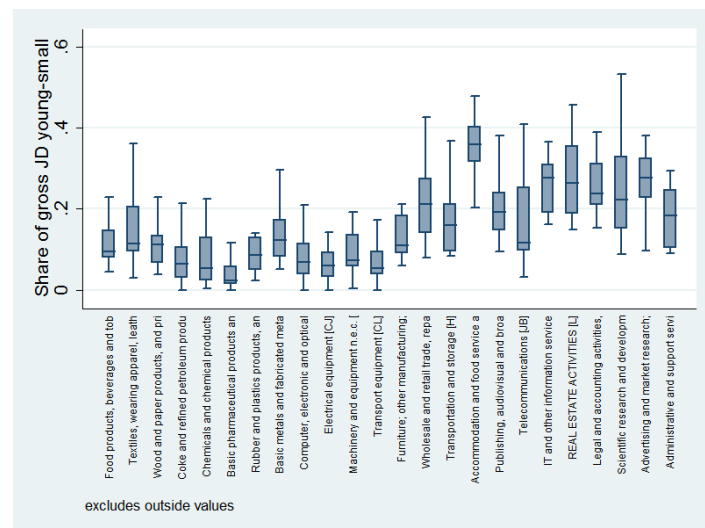
**Figure B2. Average shares of gross job creation of small young units by 2-digit sector**



Notes: the graph reports the cross-country distribution of the share of gross job creation (gross job creation of small young units over total gross job creation) of small (0-49 employees) young (0-5 years old) units by 2-digit sector. Figures report averages over the available years in every country. The box identifies the lower adjacent value (low bar/ whisker below the box), the 25<sup>th</sup> percentile (lower end of the box), the median (bar inside the box) the 75<sup>th</sup> percentile (upper end of the box), and the upper adjacent value (bar/ whisker above the box) of countries' average-size-at-entry distribution. Points represent outside value. For further information and definitions of adjacent and outside values see Cox (2009). See Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

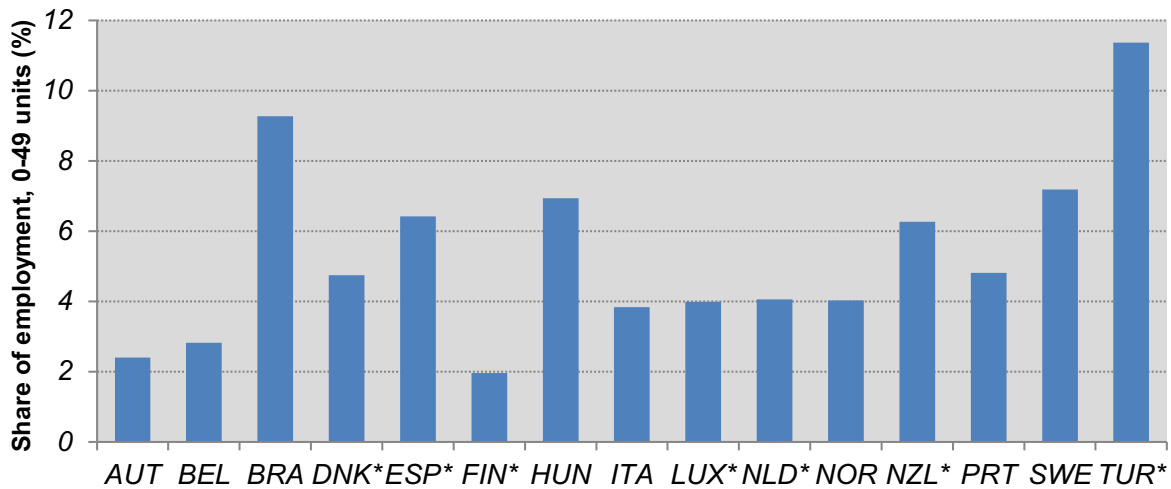
**Figure B3. Average shares of gross job destruction of small young units by 2-digit sector**



Notes: the graph reports the cross-country distribution of the share of gross job destruction (gross job destruction of small young units over total gross job destruction) of small (0-49 employees) young (0-5 years old) units by 2-digit sector. Figures report averages over the available years in every country. The box identifies the lower adjacent value (low bar/ whisker below the box), the 25<sup>th</sup> percentile (lower end of the box), the median (bar inside the box) the 75<sup>th</sup> percentile (upper end of the box), and the upper adjacent value (bar/ whisker above the box) of countries' average-size-at-entry distribution. Points represent outside value. For further information and definitions of adjacent and outside values see Cox (2009). See Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure B4. Net job creation by small surviving entrants over total employment (j=3)**

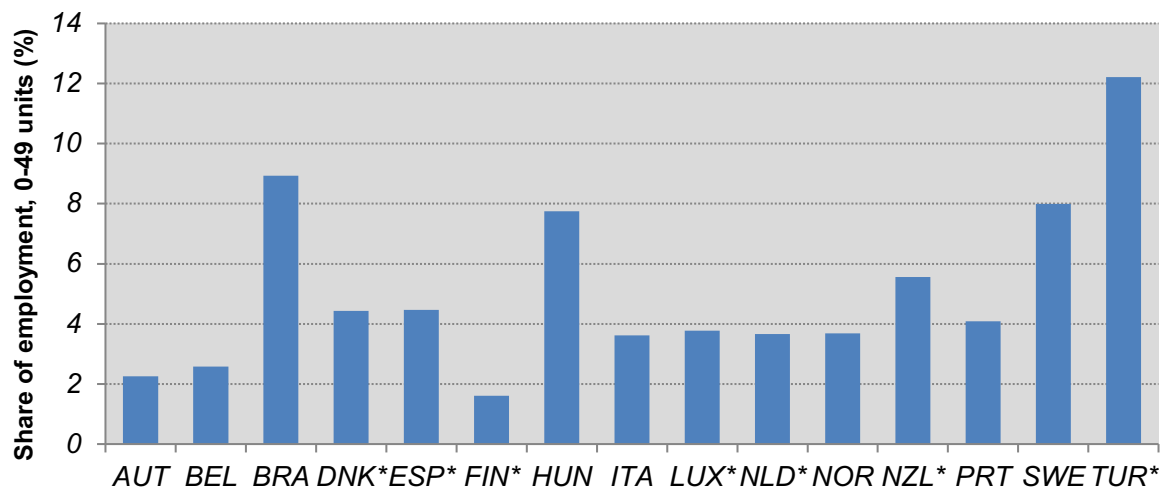


Notes: the graph illustrates the ratio between employment at time  $t + 3$  of surviving entrants with 0-49 employees and overall country employment of units with 0-49 employees. Figures report the average for different time periods  $t = 2001, 2004$  and 2007, conditional on their availability. Sectors covered are: manufacturing, construction and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

\* Specific confidentiality rules enforced in this country might affect the comprehensiveness of the reported statistics, which could be therefore substantially different from the real value.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure B5. Net job creation by small surviving entrants over total employment (j=5)**



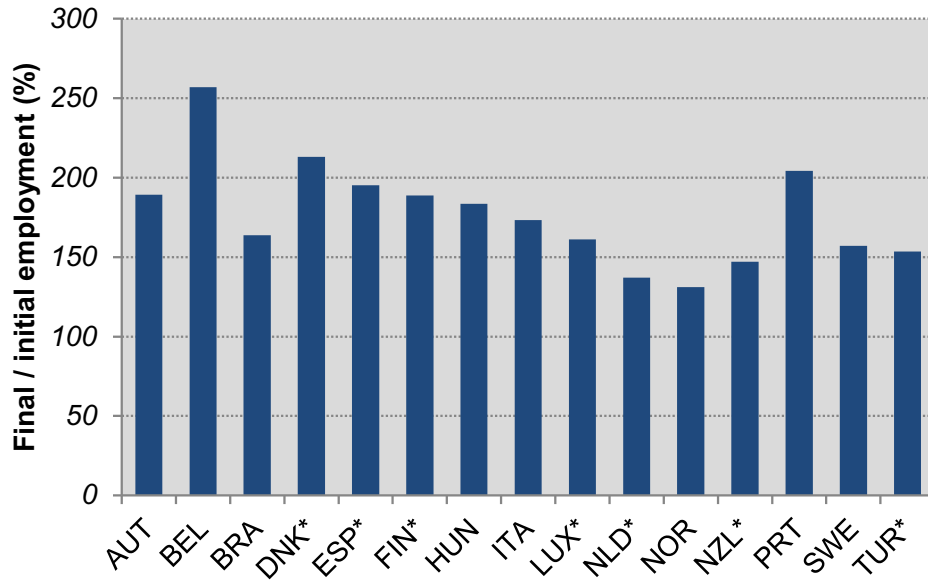
Notes: the graph illustrates the ratio between employment at time  $t + 5$  of surviving entrants with 0-49 employees and overall country employment of units with 0-49 employees at time  $t$ . Figures report the average for different time periods  $t = 2001, 2004$  and 2007, conditional on their availability. Sectors covered are: manufacturing, construction and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

\* Specific confidentiality rules enforced in this country might affect the comprehensiveness of the reported statistics, which could be therefore substantially different from the real value.

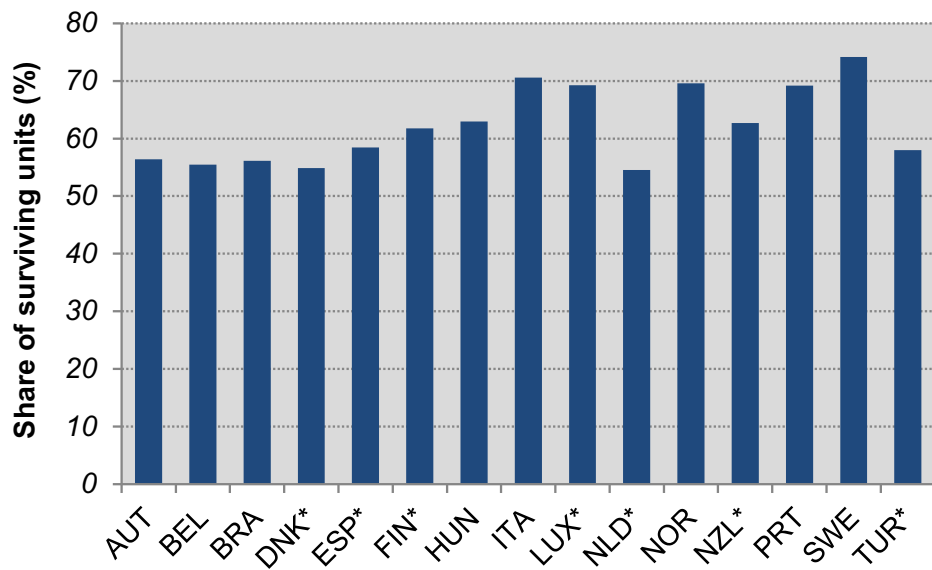
Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure B6. Focus on small entrants: Growth decomposition (j=3)**

*Panel A. Average post-entry growth rate*

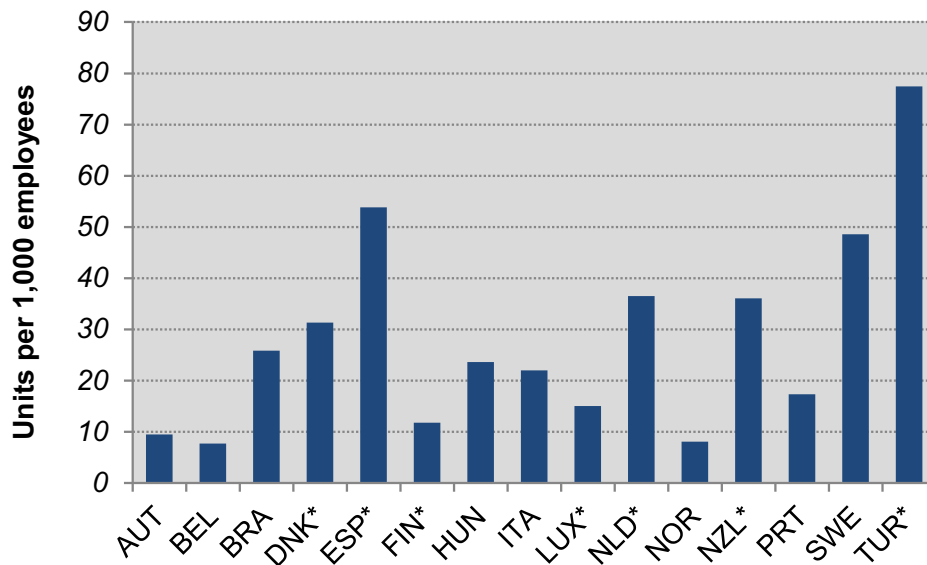


*Panel B. Survival rate*

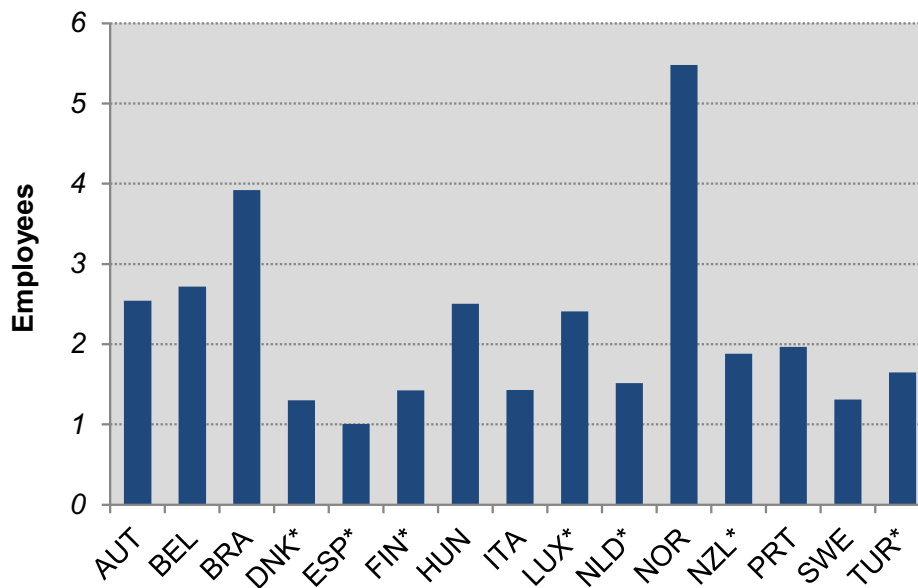




Panel C. Start-up ratio



Panel D. Average size at entry



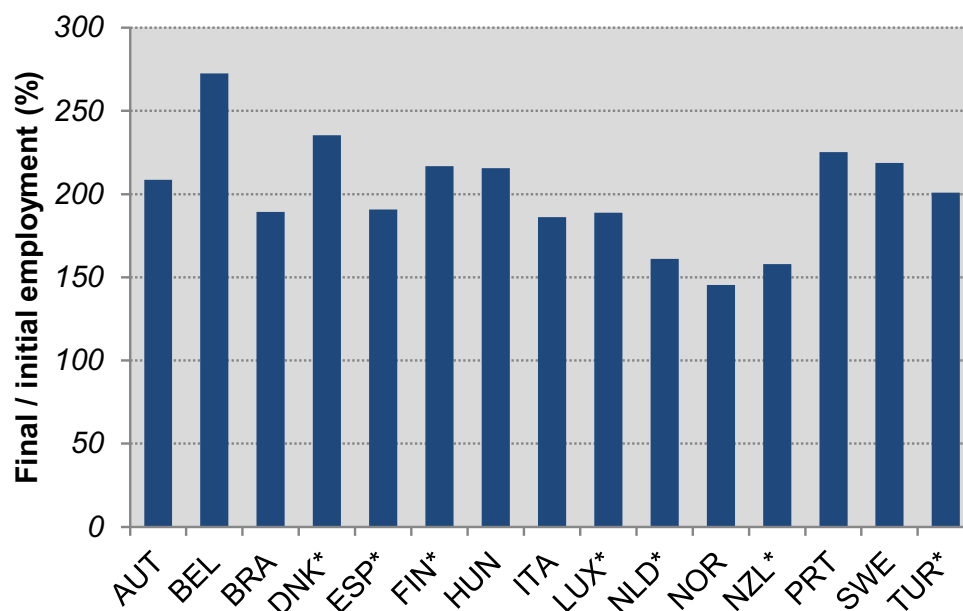
Notes: the graph illustrates the four components of the growth decomposition. Panel A: ratio between total employment at  $t + 3$  over total employment of surviving 0-49 entrants; Panel B: survival share of 0-49 entrants, expressed as number of 0-49 entering units surviving over total number of 0-49 entrants per cent; Panel C: start-up ratio, expressed as total number of entering units over total employment of units with 0-49 employees (per 1.000 employees); Panel D: average size of surviving 0-49 entrants expressed as total employment of 0-49 surviving entrants over number of 0-49 surviving entrants. Figures report the average for different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. Sectors covered are: manufacturing, construction and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

\* Specific confidentiality rules enforced in this country might affect the comprehensiveness of the reported statistics, which could be therefore substantially different from the real value.

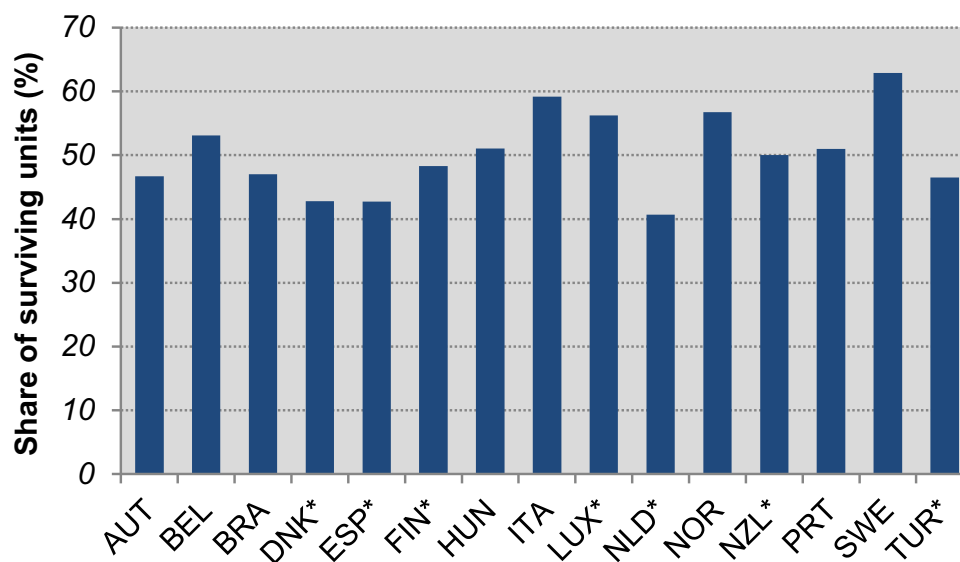
Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure B7. Focus on small entrants: Growth decomposition (j=5)**

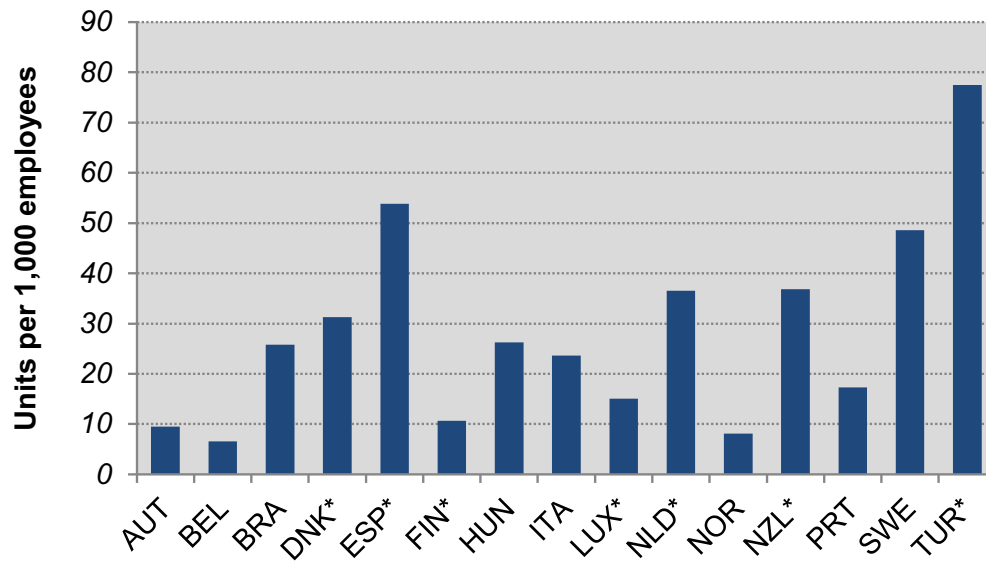
*Panel A. Average post-entry growth rate*



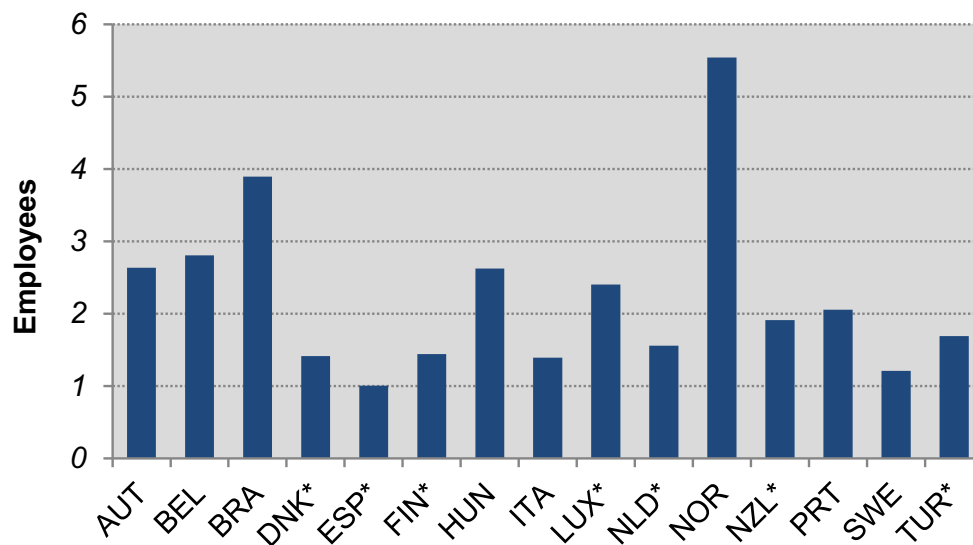
*Panel B. Survival rate*



Panel C. Start-up ratio



Panel D. Average size at entry

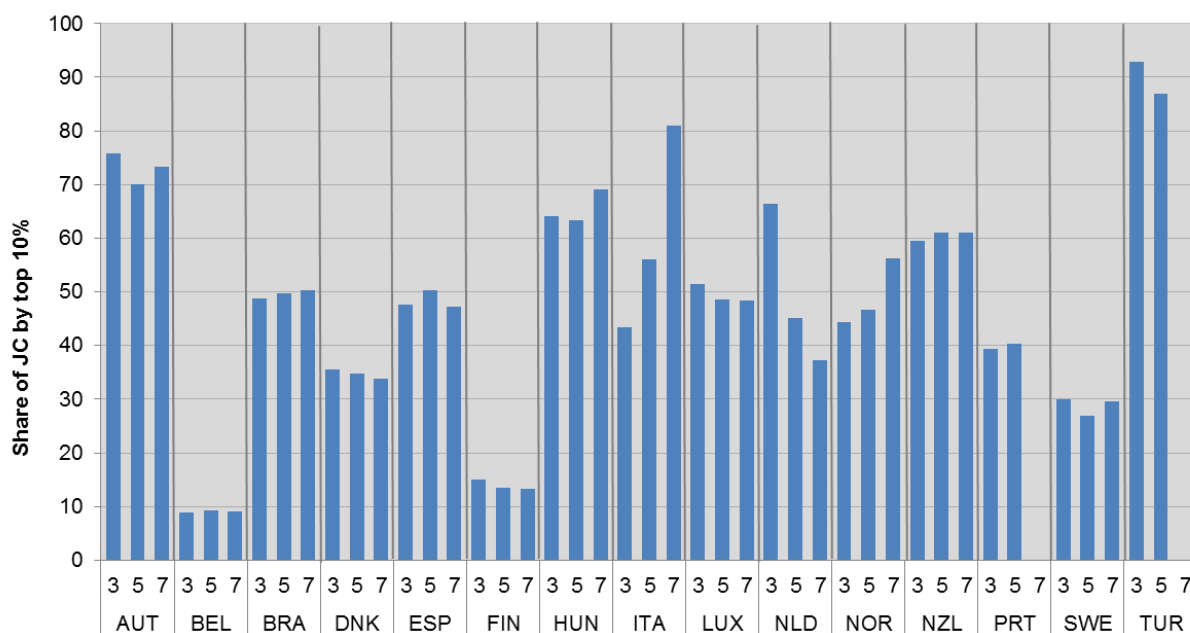


Notes: the graph illustrates the four components of the growth decomposition. Panel A: ratio between total employment at  $t + 5$  over total employment of surviving 0-49 entrants; Panel B: survival share of 0-49 entrants, expressed as number of 0-49 entering units surviving over total number of 0-49 entrants per cent; Panel C: start-up ratio, expressed as total number of entering units over total employment of units with 0-49 employees (per 1.000 employees); Panel D: average size of surviving 0-49 entrants expressed as total employment of 0-49 surviving entrants over number of 0-49 surviving entrants. Figures report the average for different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. Sectors covered are: manufacturing, construction and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

\* Specific confidentiality rules enforced in this country might affect the comprehensiveness of the reported statistics, which could be therefore substantially different from the real value.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure B8. Job creation by surviving entrants - Top 10%**

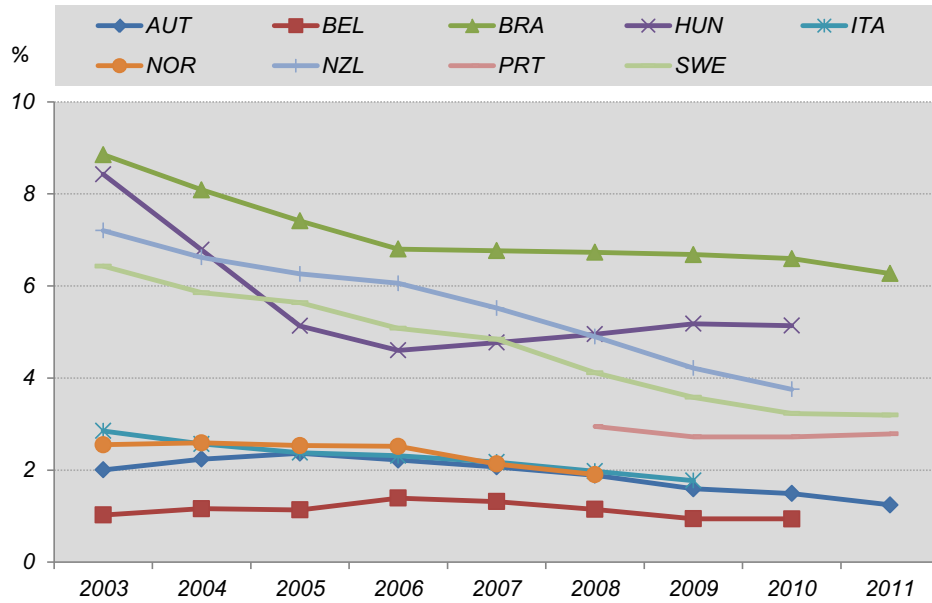


Notes: the graph shows the contribution to job creation by surviving entrants in the top 10% of the employment growth distribution. Figures are calculated as the ratio between gross job creation of surviving entrants in the top 10% of the employment growth distribution and total gross job creation by surviving entrants. Each time lag (3, 5 or 7 years from entry) is reported separately. Figures report the average for different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. Sectors covered are: manufacturing, construction and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

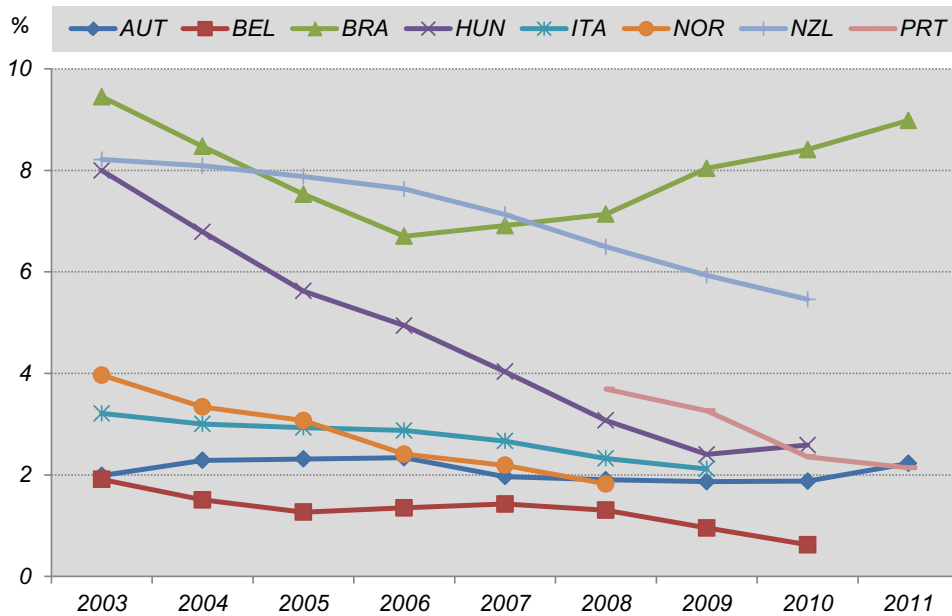
Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure B9. Start-up rates by 2-digit sector**

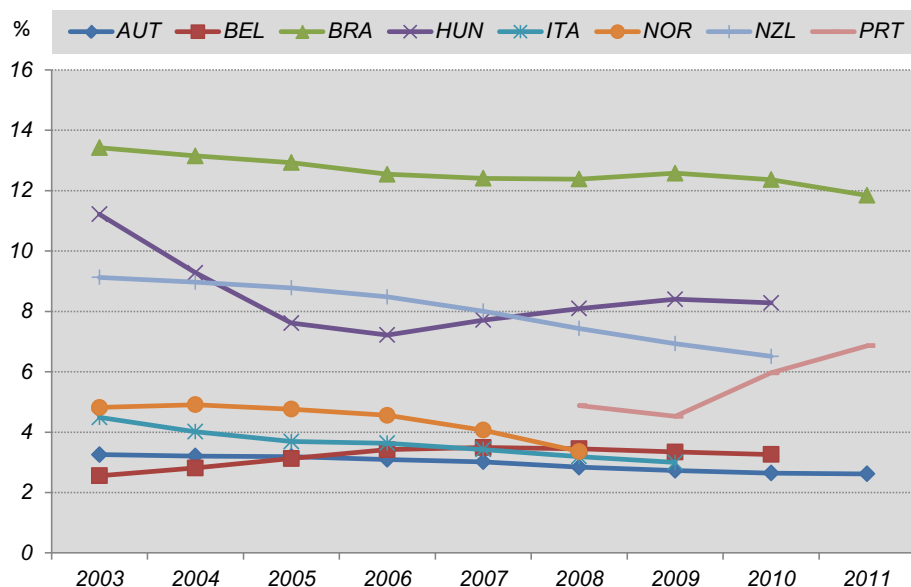
*Panel A. Wood and paper products, and printing*



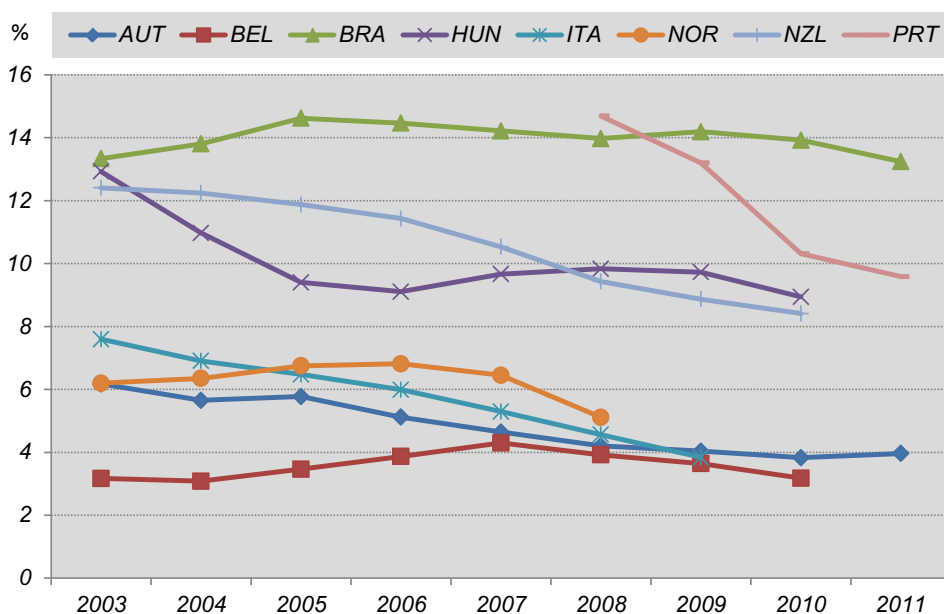
*Panel B. Manufacture of machinery and equipment n.e.c.*



Panel C. Wholesale and retail trade and repair of motor vehicles and motorcycles



Panel D. IT and other information services

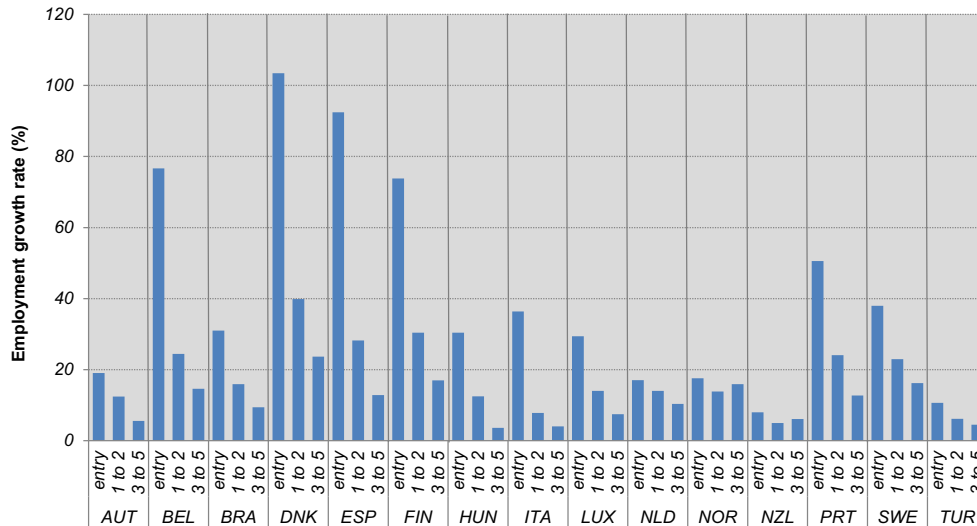


Notes: the graphs show entry rates for all entrants in four different 2-digit sectors (namely Wood and paper products, and printing in Panel A; Manufacture of machinery and equipment n.e.c. in Panel B; Wholesale and retail trade and repair of motor vehicles and motorcycles in Panel C; IT and other information services in Panel D) between 2003 and 2011, conditional on availability. Entry rates are calculated as number of entering units with positive employment in the sector over total number of units with positive employment in the sector. Figures report 3-years moving averages. Each line reports a country in the database. Statistics for countries in which the number of units in a particular year and sector is missing or blanked are not reported for that particular year and sector. Owing to methodological differences, figures may deviate from officially published national statistics.

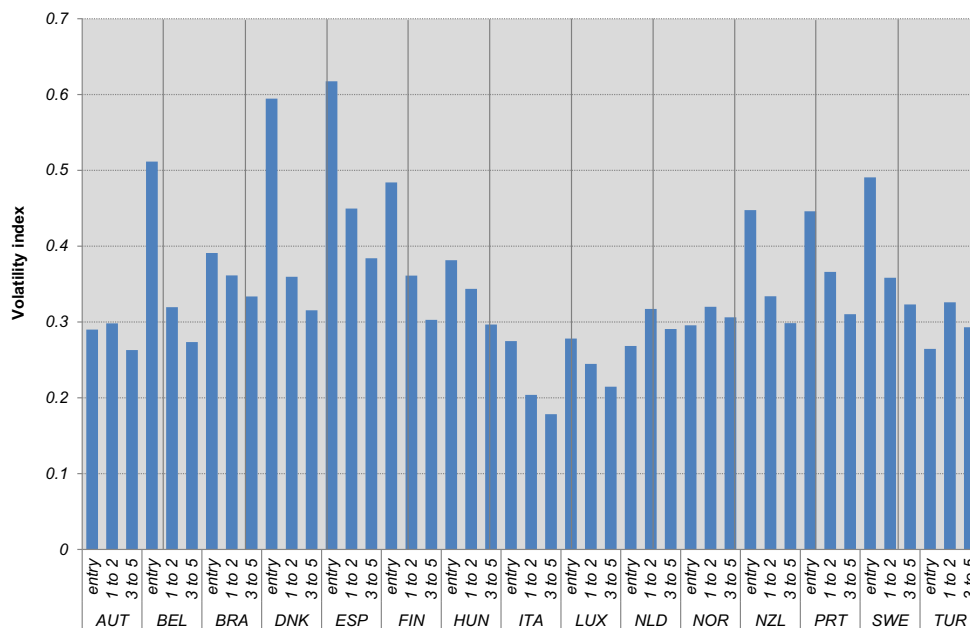
Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure B10. Focus on surviving micro units by age class**

*Panel A. Average employment growth rate*



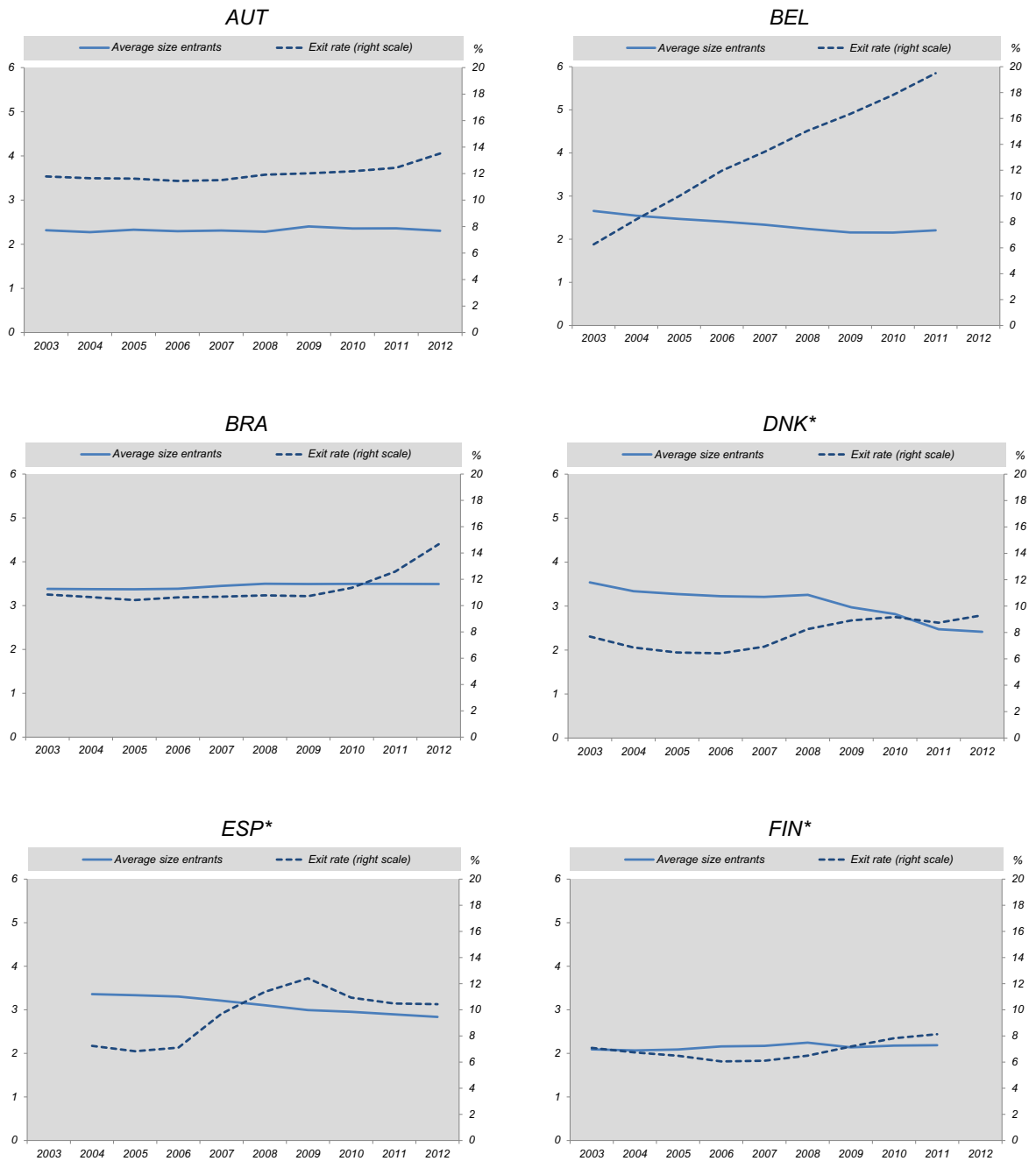
*Panel B. Average employment growth volatility*



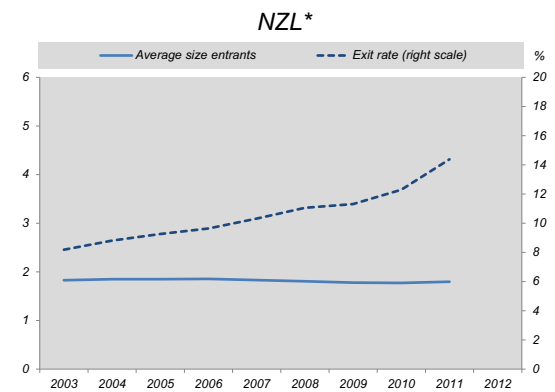
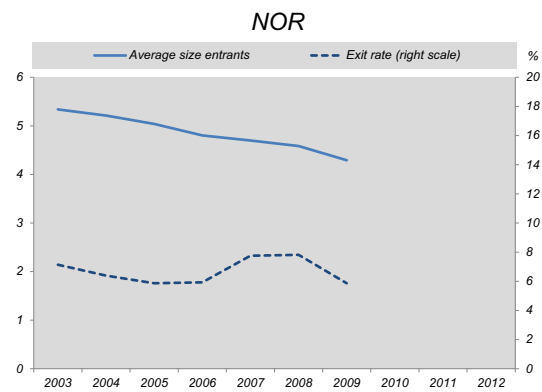
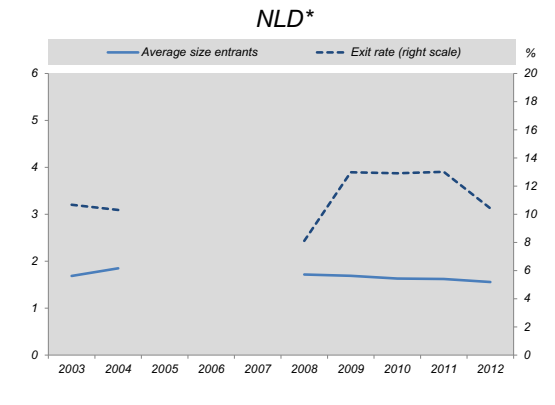
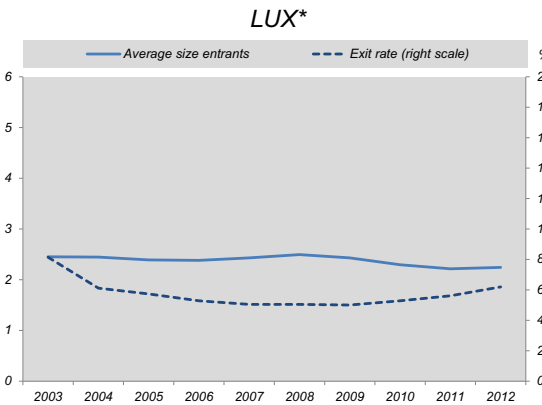
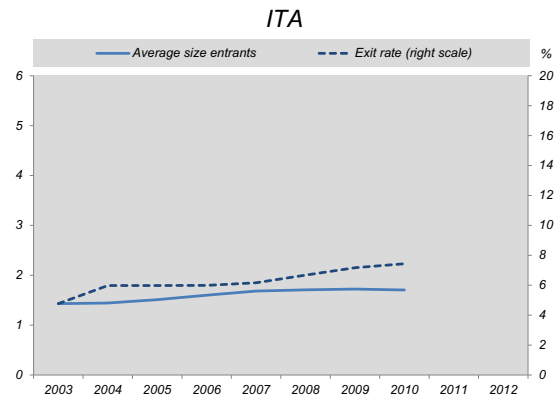
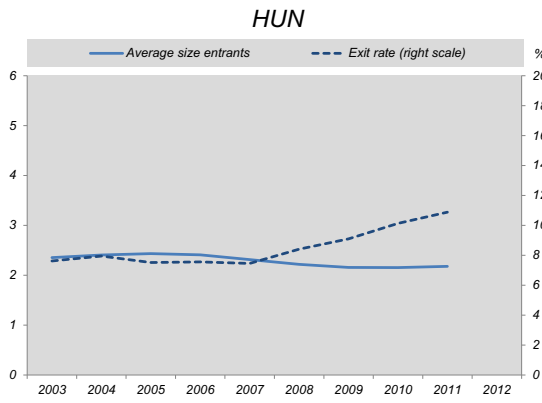
Notes: Panel A illustrates the average employment growth rate for units with 0-9 employees surviving at time  $t + 3$  by age class at time  $t$  (entry, 1-2 and 3-5 years old). Panel B represents the average employment growth volatility for units with 0-9 employees surviving at time  $t + 3$  by age class at time  $t$  (entry, 1-2 and 3-5 years old). Figures report the average for different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. Sectors covered are: manufacturing, construction and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

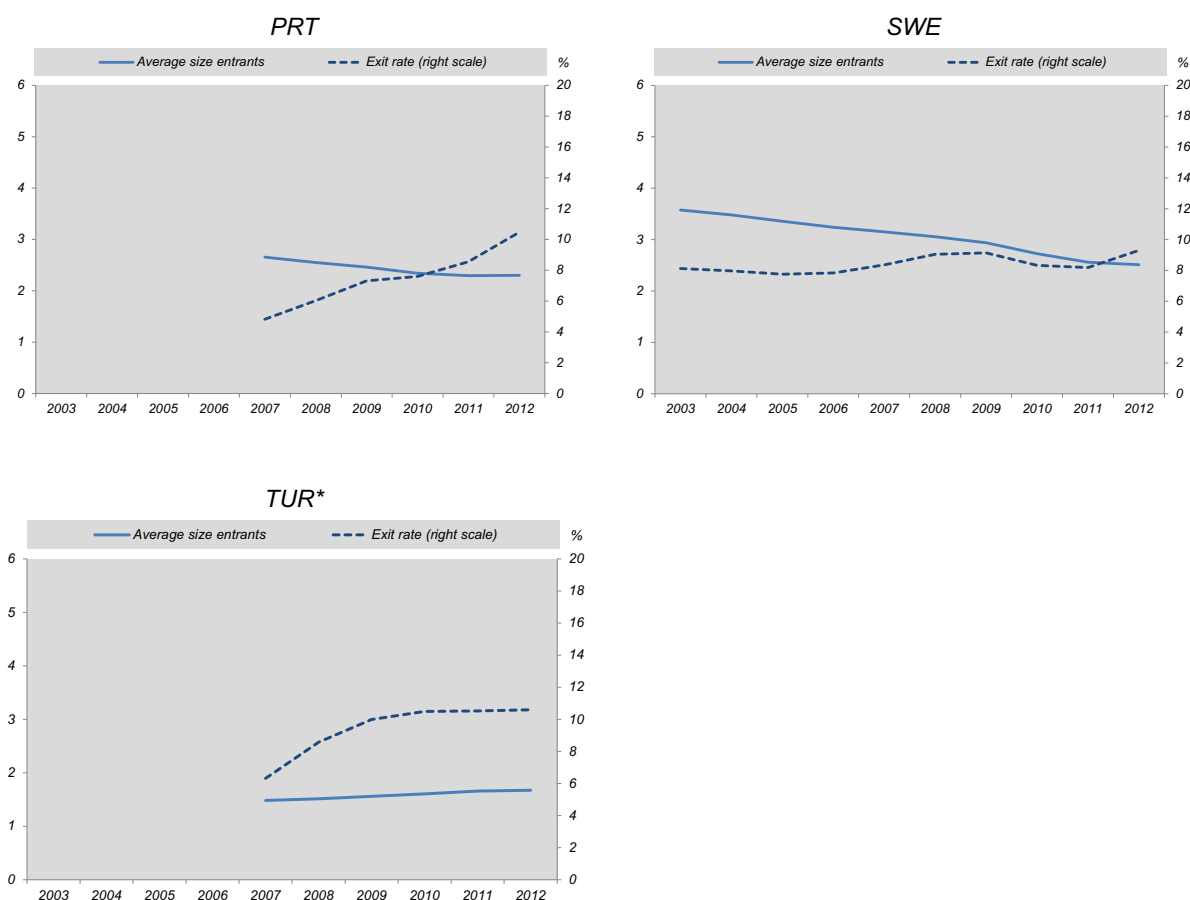
Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure B11. Focus on small entrants: Average size at entry and exit rate of firms less than 3 year old**









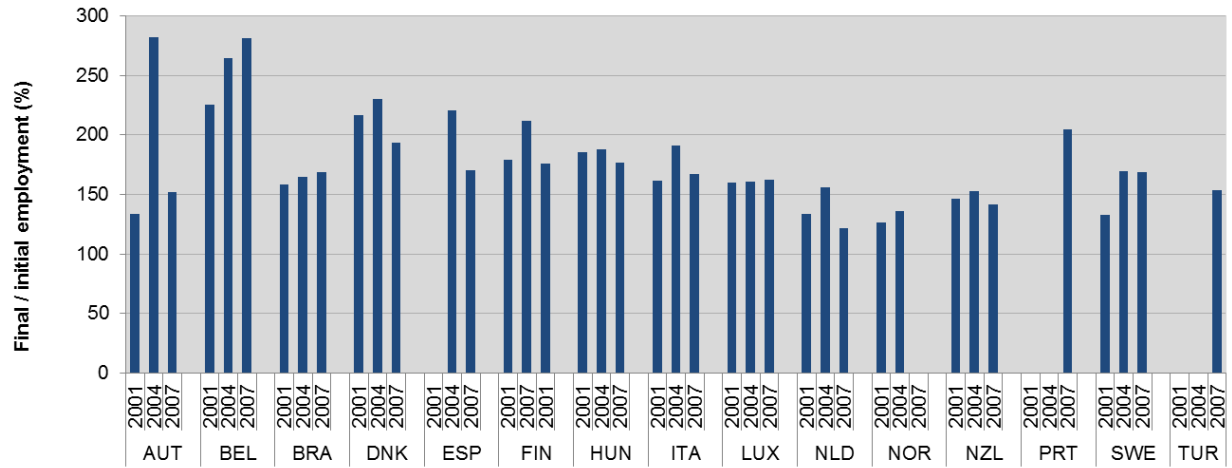
Notes: the graphs show average size of entering units and the exit rates of entrants aged 0-2 by country and year, between 2003 and 2012 (conditional on availability). The focus is on small (0-49 units only). Figures reported are 3-year moving averages. Average size of entrants is calculated as total employment of entering units over number of entering units with positive employment. Exit rates are calculated as number of exiting units with positive employment over total number of units with positive employment. Sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

\*Specific confidentiality rules enforced in this country might affect the comprehensiveness of the reported statistics, which could be therefore substantially different from the real value.

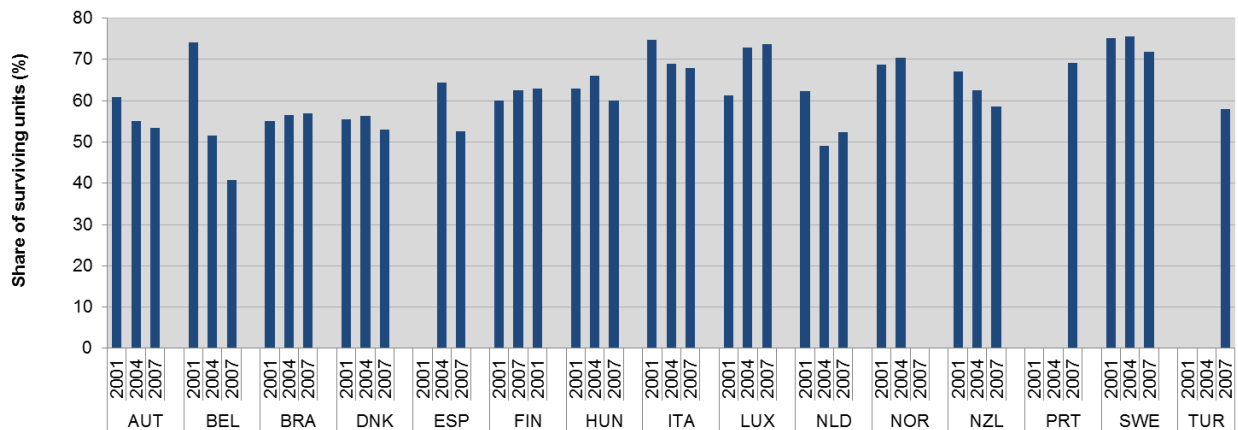
Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure B12. Focus on small entrants: Growth decomposition by cohort 2001; 2004; 2007 (j=3)**

*Panel A. Average post-entry growth rate*



*Panel B. Survival rate*

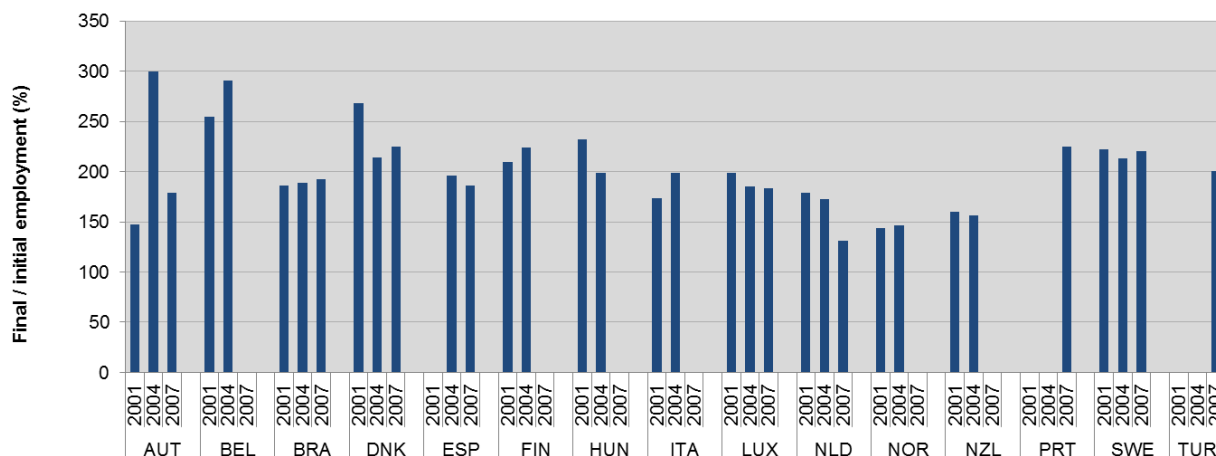


Notes: the graph illustrates the first two components of the growth decomposition by year. Panel A: ratio between total employment at  $t + 3$  over total employment of surviving 0-49 entrants. Panel B: survival share of 0-49 entrants, expressed as number of 0-49 entering units surviving over total number of 0-49 entrants per cent. Figures report different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. Sectors covered are: manufacturing, construction and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

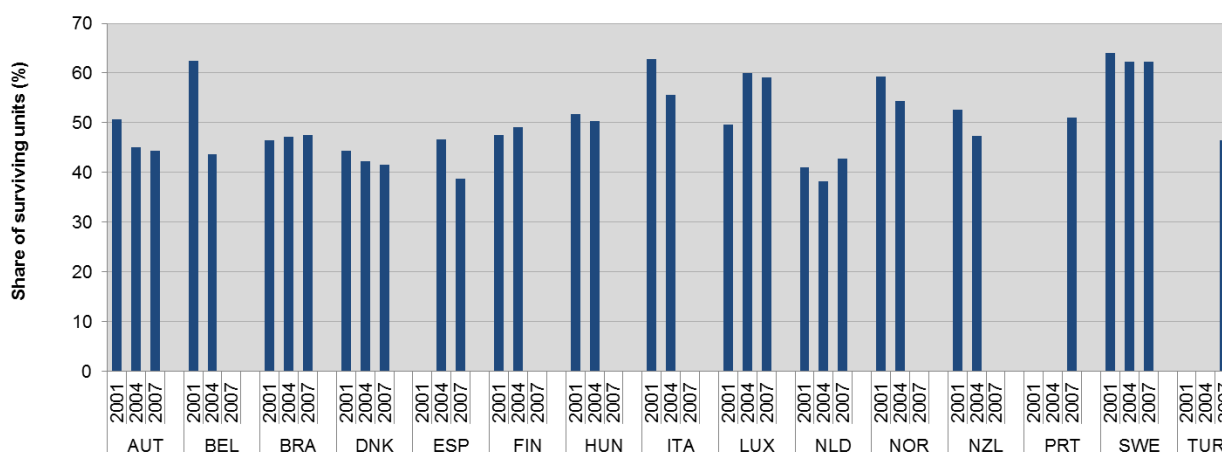
Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.

**Figure B13. Focus on small entrants: Growth decomposition (j=5)**

*Panel A. Average post-entry growth rate*



*Panel B. Survival rate*



Notes: the graph illustrates the first two components of the growth decomposition by year. Panel A: ratio between total employment at  $t + 5$  over total employment of surviving 0-49 entrants. Panel B: survival share of 0-49 entrants, expressed as number of 0-49 entering units surviving over total number of 0-49 entrants per cent. Figures report different time periods  $t = 2001, 2004$  and  $2007$ , conditional on their availability. Sectors covered are: manufacturing, construction and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database. Data for some countries are still preliminary.