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Comparative Analysis of Firm Demographics and Survival: Micro-Level Evidence for the OECD Countries

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ABSTRACT/RESUMÉ

Comparative Analysis of Firm Demographics and Survival: Micro-Level Evidence for the OECD Countries

This paper presents evidence on firm demographics and firm survival for a group of ten OECD countries. For each country a dataset of sectoral indicators of firm dynamics has been created using information from business registers. The patterns of firm entry, exit, survival and employment growth are described and analysed across countries, sectors, and over time. We find that both sectoral and country effects are important in determining firms demographics. We also find that entry and exit rates are fairly similar across countries, while post entry performance differ markedly between Europe and the US, a potential indication of the importance of barriers to firm growth as opposed to barriers to entry. Further, the paper provides a discussion of how these data may be used to gain a better understanding of the process through which economic policy and institutions may affect aggregate patterns of employment, output, and productivity growth.

JEL classification: L11, G33, M13
Keywords: entry, exit, survival, firm size, micro data

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Analyse comparative de la démographie et de la survie des entreprises : évidence micro-économique pour les pays de l'OCDE

Ce papier propose une analyse des données démographiques et de survie d'entreprises d'un groupe de dix pays de l'OCDE. Pour chaque pays, une base de données d'indicateurs sectoriels sur la dynamique des entreprises a été crée, en utilisant des informations provenant de registres d'entreprises. L'évolution de l'entrée, de la sortie, de la survie des entreprises et de la croissance de l'emploi est décrite et analysée selon les pays, les secteurs et le temps. Il ressort où à la fois les effets sectoriels et les effets pays jouent un rôle important dans la démographie des firmes. Nous trouvons également que les taux d'entrée et de sortie sont assez similaires selon les pays, bien que la performance après entrée diffère sensiblement entre l'Europe et les États-Unis, suggérant potentiellement l'importance des barrières à l'expansion des entreprises plutôt que des barrières à l'entrée. De plus, cet article fournit une discussion sur la façon dont ces données pourraient être utilisées pour améliorer notre compréhension du processus par lequel la politique économique et les institutions affectent les tendances globales de l'emploi, de la production et des gains de productivité.

Classification JEL : L11, G33, M13
Mots-Clés : entrée, sortie, survie, taille des firmes, micro-données.

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COMPARATIVE ANALYSIS OF FIRM DEMOGRAPHICS AND SURVIVAL: MICRO-LEVEL EVIDENCE FOR THE OECD COUNTRIES[1]

Eric Bartelsman*, Stefano Scarpetta and Fabiano Schivardi***.**

Introduction

1. A rapidly growing number of studies have recently provided evidence of a large heterogeneity in firm's behaviour, even within narrowly-defined industries or markets (see Caves, 1998; Bartelsman and Doms, 2000; and Ahn, 2001 for surveys). Moreover, in all countries, there is evidence that the population of firms undergo significant changes over time. Many firms lose the battle each year, while a similar number of firms enter the fray. Within the population of firms, chances of survival for many tiny and few large firms change over time, and the position of individual firms within this distribution may vary as well. As a result, even in expanding industries, many firms experience substantial decline, and in contracting industries it is not uncommon to find rapidly expanding units. Likewise, business-cycle upturns and downturns do not necessarily involve a synchronised movement of all, or even most, firms or establishments. Some of these firms will be responsible for a disproportionate share of employment, or employment growth. Yet others may be the major contributors to output growth. The description and analysis of these movements of- and within- the population of firms is the main topic of this paper.

2. The analysis of firms' behaviour has often been constrained by the lack of cross-country comparability of the underlying data. While many studies exist for the United States, evidence for most other countries is often scattered and based on different definitions of key concepts or different unit of measurement. The construction of a consistent firm-level database is, thus, a necessary first step to explore the mechanisms shaping firms' behaviour and to assess whether policy and institutions have a role to play. Especially, the differences across countries in size, entry and exit rates as well as in post-entry survival rates may be revealing. Because it is not a priori clear whether higher firm entry rates or lower entry rates are preferable, or whether high average firms size or low average firm size should be pursued, cross country comparisons are indispensable to provide the proper 'metric' for evaluating these indicators. In

1 The authors would like to thank the participants of the firm-level project co-ordinated through efforts of the OECD. We are also grateful to John Haltiwanger, Jacques Mairesse, Stephen Nickell and Paul Geroski for their comments at the "OECD Technical Meeting on the OECD Firm-level Study", 12 January, 2001. Special thanks are due to Philip Hemmings for illuminating discussions and help in assembling the database. We also acknowledge many useful comments on previous drafts from Mike Feiner, Jørgen Elmeskov, Ignazio Visco and Sanghoon Ahn. The results presented in this paper derive from analysis of non-confidential data that were tabulated by participant teams working with national sources in compliance with national statistical disclosure rules. The views expressed in the paper are our own and should not be held to represent those of the organisations of affiliation.

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turn, the indicators will provide a useful gauge for policy makers to understand how their economy is functioning 'under the hood'.

3. The contribution of this paper is twofold; first, we describe the new dataset, constructed within a research project co-ordinated by the OECD;[2] second, we study the main characteristics of firm demographics, presenting some general results and showing the great potentiality of this dataset for cross-countries analyses. The remainder of the paper is organised as follows. First, we briefly review the reasons behind firms' heterogeneity and the importance of experimentation and learning by doing. Next, we look at the empirical distribution of firm size, and how this varies across countries and sectors. Following this, the patterns of entry and exit are explored. Finally, we examine post-entry behaviour of firms across industries and countries using non-parametric survivor and hazard functions. In the final section, we draw some preliminary conclusions and propose a research agenda to start exploring the links between policy and firm dynamics.

2 The firm-level database is available on line at : http://www.oecd.org/EN/document/0,,EN-document-33-nodirectorate-no-1-35177-33,00.html.

1. Firm heterogeneity and the role of economic policy

Why are firms so heterogeneous?

4. Several theories have been developed to explain the heterogeneity of firms within and industry. They generally relate to the process of 'creative destruction' (usually ascribed to Joseph Schumpeter).[3] The distinguishing element of Schumpeter's theory from 'standard' theories of firm behaviour is that it recognises heterogeneity amongst producers and that the continual shift in the composition of the population of firms through entry, exit, expansion and contraction is essential in developing and creating new processes, products and markets.

5. Various formal models have been developed which describe Schumpeterian-type processes. One class of models focuses on the learning process (either active or passive) due to experimentation under uncertainty. In the *passive learning model* (Jovanovic, 1982) a firm enters a market without knowing its own potential profitability. Only after entry does the firm start to learn about the distribution of its own profitability based on noisy information from realised profits. By continually updating such learning, the firm decides to expand, contract, or to exit. One of the main implications of this model is that smaller and younger firms should have higher and more variable growth rates. In the *active learning model* (Ericson and Pakes, 1995) a firm explores its economic environment actively and invests to enhance its profitability under competitive pressure from both within and outside the industry. Its potential and actual profitability changes over time in response to the stochastic outcomes of the firm's own investment, and those of other actors in the same market. The firm grows if successful, shrinks or exits if unsuccessful.

6. There are a number of stylised facts from firm dynamics that are consistent with the predictions of models of both experimentation and passive/active learning.[4] In particular, cohorts of entrants consist of quite heterogeneous firms: each entrant starts business with a different initial size reflecting differences in their own perceived ability. Because of the inherent uncertainty in this experimentation, even an entrant who is very successful, *ex post*, has to begin with a smaller size at the initial stage of this experimentation. This provides an explanation why small and young survivors show rapid growth (see below). Competition continuously separates winners and losers with unsuccessful firms exiting the market relatively rapidly, and successful survivors growing and adapting. The accumulation of experience and assets, in turn, strengthens survivors and lowers the likelihood of failure.

7. One variant of the creative-destruction process is described by vintage models of technological change. These models stress that new technology is often embodied in new capital which, however, requires a retooling process in existing plants (see *e.g.* Solow, 1960; Cooper, Haltiwanger and Power, 1997). Related to this idea are models (*e.g.* Caballero and Hammour, 1994; Mortensen and Pissarides, 1994; Campbell, 1997) that emphasise the potential role of entry and exit: if new technology can be better harnessed by new firms, productivity growth will be dependent upon the entry of new units of production that displace outpaced establishments. Moreover, the existence of sunk costs implies that new firms using the "state-of-the-art" production technology coexist with older and less productive firms generating the observed heterogeneity.

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3. Amongst others, see Aghion and Howitt (1992) and Caballero and Hammour (1994, 1996). Foster, Haltiwanger and Krizan (1998), Caves (1998) and Bartelsman and Doms (2000) offer further discussion of this literature.

4. Various empirical papers have attempted to identify passive and active learning processes. For example, using US data, Pakes and Ericson (1998) claim that manufacturing firms are more consistent with the active learning model whilst retailing firms are more consistent with the passive learning model.

Is there a role for policy and institutions?

8. Evidence on substantial heterogeneity in firms' behaviour within each industry and over the business cycle has important implications for the assessment of aggregate output and productivity performance, and for the setting of growth-enhancing policies and institutions. If differences in individual firms' behaviour are not random, they do not necessarily cancel out at the aggregate level. This highlights the limits of the "*representative agent"* hypothesis and suggests that the assessment of aggregate patterns may require knowledge of the cross-sectoral distribution of activity and changes at the firm level.

9. Quite independently of the effects on aggregate patterns, the continuous process of reallocation of resources across firms involves substantial frictions (*i.e*. it is time and resource-consuming for workers and other agents) and aggregate patterns are likely to be influenced by how these frictions interact with the pace of reallocation. Moreover, the magnitude of reallocation, and the ability of the economy to accommodate it, are likely to depend on institutional and regulatory settings as well as on technological progress and changes in the sectoral composition of the economy. Knowledge of the nature of adjustment costs for firms and workers at the micro level, and how these are affected by policy interventions, may contribute to the understanding of how the aggregate economy evolves and reacts to exogenous shocks. Furthermore, if technological developments are embodied in new capital and new firms, then policies affecting intellectual property rights will be important, as will be the financing of new innovative enterprises and, more generally, market contestability.

10. Policy and institutions may also have a role in shaping firm size. Indeed, one of the dimensions of firm heterogeneity is with respect to size: there is a persistent dispersion of the size of firms within an industry and a certain stability in the stochastic pattern of evolution of firm size (*Gibrat's law* of independent increments). These findings have challenged the classical approach to the study of firm size,[5] and prompted the formulation of theories to account for the empirical regularities. Modern theories posit that the shape of the production function at the firm level is only one of the factors determining the equilibrium structure of the industry, which will also depend on such other factors as regulation, level of economic development, size of the market and so on.[6] This implies that national differences in terms of institutions, such as regulation in the product and the labour markets, taxation and development of the financial sector can lead to substantial differences in the size distribution of firms, even in the presence of similar production technologies.

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5. Classical theories of size structure concentrated on technical factors, stressing returns to scale and efficient scale of operation as the fundamental determinants of size (Viner, 1932). Such theories had no role for both dynamic aspects of firm size evolution and for size heterogeneity in the steady-state, given that the efficient scale of production is unique.

6. In Lucas (1978), the size of a firm is determined by the ability of the entrepreneur, with more able entrepreneurs optimally choosing a larger scale of operation and with entrepreneurial ability distributed randomly in the population. He shows that if the elasticity of substitution between capital and labour is less than one, average size is positively correlated with the level of development (i.e. capital per-capita) of the economy. Jovanovic (1982) builds a model in which the optimal size of the firm is determined by a productivity parameter drawn upon entering and unknown to the firm, which learns about it during its life cycle. The model delivers a series of predictions in line with empirical evidence both on the evolution of firm size at the individual level and on the size distribution. Hopenhayn (1992) considers a similar model in which the productivity parameter is known, but evolves as a random process over time. He relates the exogenous characteristics of the industry, such as the entry cost, total demand and the stochastic process for the productivity parameter to the steady-state distribution of firms and to the process of entry and exit. Ericson and Pakes (1995), Pakes and McGuire (1994) endogenize the productivity parameter, assuming that its evolution is (stochastically) determined by the investment choices of the firms, and study the interaction of firms in determining the stochastic distribution of firms' size, the evolution of the industry and of the firm at the individual level.

2. Building up a consistent international dataset: the OECD firm-level study

11. Empirical studies based on micro-level longitudinal data have rapidly increased in number over the recent past (see Ahn, 2001 for a survey). Most of them, however, focus on the United States and results for other countries are often difficult to compare because of differences in the underlying data and/or in the methodology used by researchers. This makes it difficult to assess the impact of differences in institutions and policy settings across countries on observed performance.

12. The firm-level project described here involves ten OECD countries (United States, Germany, France, Italy, United Kingdom, Canada, Denmark, Finland, the Netherlands and Portugal) and, with the active role of experts in these countries, draws upon a common analytical framework. This involves the harmonisation, to the extent possible, of key concepts (*e.g.* entry, exit, or the definition of the unit of measurement) as well as the definition of common methodologies for studying firm-level data.

13. The analysis of firm demographics is based on business registers (Canada, Denmark, France, Finland, Netherlands, United Kingdom and United States) or social security databases (Germany and Italy). Data for Portugal are drawn from an employment-based register containing information on both establishments and firms. These databases allow firms to be tracked through time because addition or removal of firms from the registers (at least in principle) reflects the actual entry and exit of firms.[7] The research protocol used to work within this restriction is described below. But first, a summary of the collected indicators and a description of the underlying data sources are given.

Indicators collected

14. Using these register-based data, time-series indicators on firm demographics were generated for disaggregated sectors of the ten economies. The classification into about 40 sectors (roughly the 2-digit level detail of ISIC *Rev3*) coincides with the OECD Structural Analysis (STAN) database.[8]

15. The use of annual data on firm dynamics implies a significant volatility in the resulting indicators. In order to limit the possible impact of measurement problems, it was decided to use definitions of continuing, entering and exiting firms on the basis of three (rather than the usual two) time periods. Thus, the tabulations of firm demographics contained the following variables:

> **Entry**: The number of firms entering a given industry in a given year. Also tabulated, where available, was the number of employees in entering firms. Entrant firms (and their employees) were those observed as (out, in, in) the register in time (t – 1, t, t + 1).
>
> **Exit**: The number of firms that leave the register and the number of people employed in these firms. Exiting firms were those observed as (in, in, out) the register in time (t – 1, t, t + 1).
>
> **One-year firms**: The number of firms and employees in those firms that were present in the register for only one year. These firms were those observed as (in, out, in) the register in time (t – 1, t, t + 1).

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7 . In most countries, these data are confidential and cannot leave the confines of the statistical agency. See below under the heading “Research Protocol”.

8. See www.oecd.org/data/stan.htm

Continuing firms: The number of firms and employees that were in the register in a given year, as well as in the previous and subsequent year. These firms were observed as (in, in, in) the register in time (t – 1, t, t + 1).

16. In practice, a number of complications arise in constructing and interpreting data that conform to the definitions of continuing, entering and exiting firms described above. In particular, the "one-year" category, in principle, represents short-lived firms that are observed in time *t* but not in adjacent time periods and could therefore be treated as an additional piece of information in evaluating firm demographics. However, in some databases this category also includes measurement errors and possibly ill-defined data. Thus, the total number of firms in the analysis for the main text excludes these "one-year" firms.

17. Given the method of defining continuing, entering and exiting firms, a change in the stock of continuing firms (C) relates to entry (E) and exit (X) in the following way:

$$C_t - C_{t-1} = E_{t-1} - X_t \qquad [1]$$

This has implications for the appropriate measure of firm "turnover". Given that continuing, entering, exiting and "one-year" firms (O) all exist in time t then the total number of firms (T) is:

$$T_t = C_t + E_t + X_t \qquad [2]$$

From this, the change in the total number of firms between two years, taking into account equation 1, can be written as:

$$T_t - T_{t-1} = E_t - X_{t-1}. \qquad [3]$$

Thus, a turnover measure that is consistent with the contribution of net entry to changes in the total number of firms should be based on the sum of contemporaneous entry with lagged exit.

18. The above indicators were computed for all firms as well as for each of the 5 firm-size classes.

19. Available data also allowed to track entering firms over time and to assess the contribution of firm demographics to the overall job turnover by industry and over time. In particular, the following indicators were constructed:

- **The analysis of survival:** The number of continuing and exiting firms by birth-year. Also information was collected on the employment of these firms by birth-year, both in the year of tabulation and in the year of birth. Given the fixed time-span available in the register data in most countries, both left and right censoring occurs.

- **Job creation and destruction:** Because employment at entering and exiting firms was already tabulated, completing the information on gross job flows entailed collecting the sum of positive and negative employment changes at continuing firms.[9]

9. It should be noted that the gross employment flows tabulated from the statistical register files do not necessarily coincide with gross job flow data tabulated from production surveys, such as those used by Davis, Haltiwanger and Schuh (1996).

20. Other components of the OECD project concern productivity distributions and correlates of productivity, and are presented in detail in Barnes, Haskel and Maliranta (2001). In short, information is provided on the distributions of labour and/or total factor productivity by STAN industry and year, on the decomposition of productivity growth into within-firm and reallocation components. Further, information is provided on the means of firm-level variables by productivity quartile, STAN industry, and year. The variables on which these means are collected vary according to availability by country, but generally include such items as payroll per employee, materials intensity, labour intensity by labour type, and other available correlates in the individual countries.

Description of the data

21. The key features of the data retained for this study are as follows:

Unit of observation: Data used in the study refer to the firm as the unit of reference, with the exception of Germany where data are only available with reference to establishments. More specifically, most of the data used conform to the following definition (Eurostat, 1995) “an organisational unit producing goods or services which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources”. Generally, this will be above the establishment level. However, firms that have operating units in multiple countries in the EU will have at least one unit counted in each country. Of course, it may well be that the national boundaries that generate a statistical split-up of a firm, in fact split a firm in a ‘real’ sense as well. Also related to the unit of analysis is the issue of mergers and acquisitions. Only in some countries does the business register keep close track of such organisational changes within and between firms. In addition, ownership structures themselves may vary across countries because of tax considerations or other factors that influence how business activities are organised within the structure of defined legal entities.

Size threshold: While some registers include even single-person businesses (firms without employees), others omit firms smaller than a certain size, usually in terms of the number of employees (businesses without employees) (see Annex Table A1), but sometimes in terms of other measures such as sales (as is the case in the data for France and Italy). Data used in this study exclude single-person businesses, although the data were tabulated for all firms in countries where available. However, because smaller firms tend to have more volatile firm dynamics, remaining differences in the threshold across different country datasets should be taken into account in the international comparison.

Period of analysis: Firm-level data are on an annual basis, with varying time spans covered, as shown in Figure 1. The German, Danish and Finnish register data cover the longest time periods, while data for the other countries are available for shorter periods of time or, although available for longer periods, include significant breaks in definitions or coverage.

[Figure 1. Demographics: Data availability]

Sectoral coverage*:* Special efforts have been made to organise the data along a common industry classification (ISIC Rev.3) that matches the STAN database. In the panel datasets constructed to generate the tabulations, firms were allocated to one STAN sector that most closely fit their operations over the complete time-span. In countries where the data collection by the statistical agency varied across major sector (e.g., construction, industry, services), a firm that switched between major sectors could not be tracked as a continuing firm but ended up creating an exit in one sector and an entry in another. Most countries have been able to provide firm demographic data across most sectors of the economy, with the exception that public services are often not included (the United Kingdom is a special case where data only refer only to manufacturing).

Unresolved data problems: Despite efforts to harmonise the definitions of indicators and sectors, the underlying databases have not been collected in the same way across countries. Also, within countries changes in data sources over time may make comparisons difficult. The first issue relates to unit of observation. Within the EU, statistics offices are harmonising their business registers to be based on the smallest 'autonomous' reporting units. Generally, this will be above the establishment level. However, firms that have operating units in multiple countries in the EU will have at least one unit counted in each country. Of course, it may well be that the national boundaries that generate a statistical split-up of a firm, in fact split a firm in a 'real' sense as well. Also related to the unit of analysis is the issue of mergers and acquisitions. No attempt has been made to follow these in a systematic and comparable manner. In some countries, the business registers have been keeping track of such organisational changes within and between firms in the most recent years, but this information is not used in the present study.

Research Protocol

22. The construction of longitudinal firm-level data is often complex, and requires specialised knowledge and experience of the data sources. For example, tracking firms through business registers requires an in-depth understanding of how registers are designed and changes that occur to them over time. Firm-level data are also subject to various protocols (often embodied in legal requirements) relating to the protection of information. The data are typically only accessible to designated individuals and output prepared for wider circulation usually has to be vetted before being released. Sometimes certain output data has to be suppressed because they do not pass rules which are aimed at protecting individual firms from being identified.

23. In order to work within these constraints, the firm-level project consisted of country experts taking part in a network.[10] All experts participated in the design of the analytical framework of the study and, in particular, each of them co-led one of the teams in which the study is organised. The other task was to collect and analyse national data for all themes according to common procedures. At an early stage in the process, meta-data were collected describing the data available in the various countries. At a face-to-face meeting hosted by the OECD, the basic policy questions were confronted with the data realities and choices were made regarding the exercises that could be done on a consistent basis in all, or most, countries.

24. For the sub-themes firm demographics and survival analysis, pseudo-code was developed and coded into programmes that could be adopted by the country experts into computer code to run on their own databases. Where possible the input datasets were standardised to ease the adaptation of programmes. The output datasets were completely standardised and shared among team members. In appendix 1 the pseudo-code for demographics and survival are presented.

10 . The experts involved in the study are in addition to the authors of this paper: John Baldwin (Statistics Canada); Tor Erickson (Ministry of Finance and Aarhus School of Business); Seppo Laaksonen, Hohti Satu, and Mika Maliranta (Statistics Finland and Research Institute of the Finnish Economy); Bruno Crépon and Richard Duhautois (INSEE, France); Thorsten Schank (University on Mannheim); Jonathan Haskel and Matthew Barnes (Queen Mary and Westfield College); Ron Jarmin (Center for Economic Studies, US Census Bureau); Pedro Portugal Dias (Bank of Portugal).

3. The size of firms across industries and countries

25. Firm size distribution has attracted a great deal of attention in the recent policy debate (see for example Eurostat, 1998). Its role has been analysed with reference to a very diverse range of topics, such as the process of job creation and destruction (Davis, Haltiwanger and Schuh, 1996), country specialisation models (Davis and Henrekson, 1999), and the response of the economy to monetary shocks (Gertler and Gilchrist, 1994).

26. More to the point of this study, firm size distribution might be an important determinant of productivity growth at the macroeconomic level. Seminal contributions in the theory of growth (Solow, 1956; Romer, 1990) had no role for size structure, because the final goods sector displayed constant returns to scale. In reality, as the work of Schumpeter (1934) had shown, there might be important links between firm size distribution and growth, particularly through innovative activity. Recent work by Peretto (1999) formalises this idea in an endogenous growth model with a role for market structure. He shows that size distribution is not neutral with respect to growth, although the net effect cannot be signed a priori. Pagano and Schivardi (2001) tackle the issue empirically, and, using sectoral data for eight European countries in the 1990s, find that higher average size is associated with higher productivity growth. Moreover, they identify R&D as the relevant channel through which size influences growth. The positive association between size and growth is also found by Acs, Mork and Yeung (1999) for manufacturing in the United States.

27. As stressed above, most previous empirical work on firm size distribution has been undertaken within a single country, given the scarcity of internationally comparable datasets. Using new international datasets, some recent work has been done to consider systematically the issue.[11] The "stylised facts emerging from both single-country and cross-countries studies can be summarised as follows:

- Small enterprises constitute the vast majority of firms, but they account for proportionately less employment.

- There are important sectoral components of firms size; in particular, manufacturing firms tend to be larger than services firms.

- Less predictably, there are consistent country patterns, in the sense that the size distribution differs across countries in systematic ways even for narrowly defined sectors.

28. We start by checking if our data confirm these findings. Before going into the analysis, however, a word of caution about the data for two countries is warranted. First, as stated above, German data refer to the plant, so that the number understates the true size of German firms; second, contrary to the other countries, Frenchmailto:s.falconieri@kub.nl data are based on a sample, which might induce some bias in the results which cannot be determined a priori. From a sectoral perspective, acommunity services and utilities are more difficult to compare, given the important role of the public sector, whose coverage changes from country to country, and of regulation in these sectors.[12]

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11. Rajan and Zingales (1999) use a dataset of Eurostat (1998) with sectoral data on size for a set of European countries to study the determinant of average size. They find that both sectoral factors (such as size of the market, capital intensity, R&D intensity) and country factors (such as the level of human capital, judicial efficiency and accounting standards) have an influence of average firm size. Pagano and Schivardi (2001), using the dataset of Eurostat, find that average firm size tends to differ significantly across countries

12 See the data appendix for a more detailed description of the country data.

29. Previous findings are broadly confirmed in our data. The number of firms with fewer than 20 employees ranges from 86 per cent of the total number of firms (France, Portugal) to 96 per cent (Netherlands) The employment share of small firms is much lower and ranges from 16 per cent in the United States to 48 per cent in Finland (Table 1).

[Table 1. Small firms across broad sectors and countries, 1989-94]

30. The firm-size distribution differs across sectors. Small firms account for a larger share of employment in services than in manufacturing, arguably because technological factors and economies of scale play a more important role in the latter. The share of firms with fewer than 20 employees in the services sector is above or close to 90 per cent in almost all countries, while in manufacturing the shares range between 70 and 88 per cent (Table 1). Except for France, average firm size, calculated as total employment over total number of firms, is two to four times larger in manufacturing than in services. (Table 2).

[Table 2. Average number of employees per firm in broad sectors of OECD countries, 1989-94]

31. If technological factors are the predominant element in determining size, then we should find that, for narrowly defined sectors, size distribution is similar across countries. In this case, the analysis of firm size cannot be separated from that of sectoral specialisation. On the other hand, if we find that even narrowly defined sectors are characterised by different scales across countries, and that there are consistent patterns within countries, then size distribution is an independent issue, and it becomes important to understand both why it differs across countries and what are the potential economic effects of such differences.

32. In fact, there are significant differences in firm size across countries. If we consider average size again (Table 2), the sample of countries can be broadly divided in two subgroups, with the United States, France, Germany (West), and Portugal characterized by an average size for the total business sector above 15 employees and the rest around (or below) 10. If we restrict the attention to manufacturing, we find that the United Kingdom is also characterised by a large average size (50, compared with 78 for the United States and 14 for Italy), while France no longer ranks at the top of the size distribution (24). The high overall size of French firms is due to the large size of firms in the business service sectors, where the country has the highest average size (25 employees). Within manufacturing, high-tech firms tend to have a higher than average size in most countries.

33. To assess the role of specialisation versus that of within-sector differences we need to undertake a more disaggregated analysis. Table 3 carries out a within-sector comparison of size differences, taking 1993 as a reference year.[13] The first column gives the average size across the ten countries, calculated again as total employment over total number of firms, which should at least partially net out national peculiarities and therefore can be used as a benchmark. The other columns report, for each country, the size of broad industries relative to the cross-country average of column 1. Figures above unity indicate that the average firm size of a given sector in a given country is higher than the cross-country average and vice-versa.

[Table 3. Relative firm size across sectors and countries]

13. Given the low frequencies at which the size structure evolves, results are very similar if we take a different year or an average over more years.

34. In terms of cross-country average (column 1), the ranking of sectors is as expected, with "Construction" at the lower end of the distribution, followed by services and light manufacturing, while "Transport equipment", "Electricity, gas and water supply" and "Chemical, rubber, plastics and fuel products" at the upper end. In the non-agricultural business sector, between the smallest ("Construction") and the largest ("Transport equipment") there is a difference of a factor of almost 25. This is a clear signal that technological factors play an important role in determining differences in size across sectors, and indicates that an international comparison necessarily needs to take into account sectoral specialisation.

35. If technological factors were predominant in determining firm size across countries, we should find that the values in columns 2 to 10 in Table 3 are concentrated around one. If, on the contrary, the size differences were explained mainly by national factors inducing a consistent bias within sectors, then we would expect the countries with an overall value above (below) the average (i.e. in the "Total" category) to be characterised by values generally above (below) one in the sub-sectors. The table shows that intra-sectoral differences are important: indeed, the rows display large variations, indicating that the same sector can be characterised by very different size structures in different countries.[14] By computing the standard deviation by row, we find that the sectors that have the most highly dispersed size structure are "Electricity, gas and water supply", "Food products, beverages and tobacco" and "Finance, insurance, real estate and business services", while the lowest dispersion is found in "Wholesale and retail trade; hotels and restaurants", "Pulp, paper, paper products, printing and publishing" and "Chemical, rubber, plastics and fuel products".

36. A first indication of within-country differences is the standard deviation of sectoral entries in each country (not shown in Table 3). According to this indicator, the two countries with the lowest deviation are Denmark and Finland, with Portugal, France and the United States at the other extreme. Indeed, the countries with the largest overall size also display larger standard deviation, a point on which we will return later. These results lend support to the view that national characteristics are a fundamental determinant of the size structure *even controlling for sectoral specialisation*, but that the degree of within country homogeneity varies from country to country.

37. The analysis suggests that the overall differences in average firm size between countries do not solely reflect specialisation differences, but rather variations in size within sectors. This conclusion is supported be a more formal inspection. Table 4 presents fixed-effect regressions in which the share of small firms (fewer than 20 employees) in the total number of firms is expressed as a function of country- and sector-specific effects. Equation B in the table also controls for the presence of outliers in the sample.[15] In order to identify country and sectoral fixed effects, we omitted the textile, leather and footwear sector and the United States. Country coefficients should, thus, be read, relative to the United States. Controlling for sectors and countries explains more than two-thirds of the total variance in the sample. The coefficients of the country dummy variables suggest that the cross-country difference persist after controlling for the sectoral composition of the economy: all but one country (United Kingdom) have a positive coefficient, pointing to a higher share of small firms compared with the United States. The difference is particularly marked in the case of Italy and Finland. For the countries for which the distinction can be made, the table

14. One could argue that the differences are dictated by the fact that the sectoral subdivision is not disaggregated enough: for example, the "Metal, machinery and equipment" sector is rather broad in terms of technological characteristics. Indeed, our results hold true even when we use the finest sectoral disaggregation available in our dataset (two digit which, for some manufacturing sectors, cab be further split at three digits, see the methodological notes).

15. The outliers that have been removed from the sample are those with a *studentised residual* greater than 2.5. For each observation, the studentised residual was obtained by considering a mean-shift outlier model in which the basic equation is augmented by a dummy variable that has the *i-th* element equal to one and all other elements zero. The studentised residual is the t-statistics of the dummy variable.

also reports the interaction effect between country and industry dummies for the high-tech industries of manufacturing:[16] in all countries these interactions terms are negatively signed, *i.e.* high-tech industries tend to have a smaller-than average proportion of small firms, with a particularly strong effect in Italy, the Netherlands and, especially, Finland.

[Table 4. Fixed effect regressions of firm size]

38. To properly asses the role of sectoral specialisation *vs.* national peculiarities we also use a shift-and-share decomposition, which allows to disentangle the effects of each of the two components. We restrict our attention to the manufacturing sector. The idea behind this technique is to determine how much of the overall deviation of average size from a given benchmark (in our case the cross-country average) is due to the fact that a country is specialised in sectors with a certain average size and how much to the fact that average size within sector tends to be different from that of the benchmark. For example, it could be that overall larger size of manufacturing in the United States is mostly due to the fact that the United States has a productive structure specialised in sectors with large size. The decomposition exploits the following identity: $\bar{s}_j = \sum_i \omega_{ij} s_{ij}$, where $\bar{s}_j$ is the average firm size in manufacturing in country *j*, s_{ij} is the average firm size in sub-sector *i* and ω_{ij} is the share of firms in sub-sector *i* with respect to the total number of firms in manufacturing.[17] Define now $\bar{s}$ as the overall mean in manufacturing across countries and $\overline{\omega}_i$ as the share of overall number of firms in sub-sector *j*. Then the difference between country *j* and overall mean can be decomposed as follows:

$$\bar{s}_j - \bar{s} = \sum_i \omega_{ij} s_{ij} - \sum_i \overline{\omega}_i \bar{s}_i = \sum_i (\omega_{ij} - \overline{\omega}_i)\bar{s}_i + \sum_i (s_{ij} - \bar{s}_i)\overline{\omega}_{ii} + \sum_i (s_{ij} - \bar{s}_i)(\omega_{ij} - \overline{\omega}_i) =$$

$$= \Delta_\omega + \Delta_s + \Delta_{\omega s} \qquad [4]$$

39. The first term accounts for differences in the sectoral composition of firms, the second for differences within sectors and the last an interaction term, that can be interpreted loosely as an indicator of covariance: if it is positive, size and sectoral composition deviate from the benchmark in the same direction. The results are reported in Table 5. The most important finding of the decomposition is that the within sector differences play the most important role in explaining differences is size across countries: this component is much larger (in absolute value) that the sectoral composition one in almost all cases. Second, there seems to be no strong correlation between the sectoral composition and differences within sectors: the interaction term is negative in seven out of ten cases, and the sign of the sectoral composition and within sector terms is equal in five cases. This results lends very limited support to the idea that if a country has an institutional setting that favours a certain size structure, say large firms, it should be

16. The *high-tech* group includes the following manufacturing industries: “pharmaceuticals”; “office accounting and computing machines”; “radio television and communication equipment”; and “aircraft and spacecraft”. See Hatzichronoglou (OECD-STI Working Papers, No. 1997/2).

17 The identity can be obtained as follows: form $s_{ij} \equiv \frac{e_{ij}}{f_{ij}}$, where *e* is employment and *f* is the number of firms, it follows that $\bar{s}_j \equiv \frac{e_j}{f_j} = \frac{\sum_i e_{ij}}{f_j} = \frac{\sum_i \frac{e_{ij}}{f_{ij}} f_{ij}}{f_j} = \sum_i \omega_{ij} s_{ij}$.

characterised both by large firms within sector and a sectoral specialisation tilted towards productions naturally characterised by large firms (Davis and Henrekson, 1999).

[Table 5. Shift and share analysis of firm size]

40. For seven countries (Finland, France, United Kingdom, Italy, the Netherlands, Portugal and the United States), we also have information on higher moments. Table 6 reports the sectoral standard deviation, again normalised by the overall cross-country standard deviation. In the business sector, the sectors with the largest standard deviation are "Electricity, gas and water supply", arguably because this utility sector is heavily regulated and is characterised by legal monopolies in many countries, and "Transport equipment". These are also those with the highest average size, a point on which we will return shortly. The "Wood and products of wood and cork" industry is the least dispersed, followed by other traditional manufacturing sectors, in which the technology might be dictating a more uniform optimal size. In terms of differences across countries, the United States show a much larger dispersion in firm size: for example, for total manufacturing the dispersion is more than four times larger than that of the cross country average. As far as we know, this finding is new in the literature and deserves further consideration.

[Table 6. Within industry standard deviation of firm size]

41. The previous analysis, both at the sectoral and at the country level, suggests that dispersion of size across industries might not be independent from the average size: the sectors (country) with larger size also displayed higher standard deviation.[18] To account for this, we also calculate the coefficient of variation (the standard deviation divided by the mean). When we do this, we find that both the across-sector and the across country dispersion is reduced (Table 7). The most noticeable changes are that Italy appears to be characterised by a relatively high dispersion, while the contrary is true for Portugal. For the United States, the higher dispersion result still holds. To further investigate the relationship between the average and the standard deviation, we regress the log of the standard deviation on the log of the average, including country and sector dummies. The coefficient is .56 (standard error 0.035), which means that the elasticity is larger than zero, as the previous analysis suggested, but smaller than unity, as a pure statistical model of size distribution as a random variable with a proportional shifter would predict.

[Table 7. Within industry coefficient of variation of firm size]

42. Summing up, we find that firm size distribution, as summarized by average size and dispersion, has both an important sectoral and a country component. In terms of overall differences in average firm size, the evidence suggest that they are mostly due to cross-country differences rather than to sectoral specialization patterns: indeed, average size differs markedly across countries even for narrowly defined sectors.

4. The demographics of firms

43. Micro data also allow to characterise the demographics of firms across sectors and countries and thus shed light on the dynamism behind sectoral or aggregate patterns. Moreover, Barnes *et al.* (2001), amongst others, have shown that the entry of new firms -- and especially the exit of low productivity units -- make a significant contribution to sectoral productivity growth in all countries.

18 Indeed, if size were drawn from a random variable with a distribution that changes between country-sector according to a multiplicative factor, then mean size and standard deviation should be positively correlated.

44. Our data confirm previous findings suggesting that a large number of firms enter and exit most markets every year (Figure 2). Data covering the first part of the 1990s show the firm turnover rate (entry plus exit rates)[19] to be between 15 and 20 per cent in the business sector of most countries: *i.e*. a fifth of firms are either recent entrants, or will close down within the year.

[Figure 2. Turnover rates in broad sectors of OECD countries, 1989-94]

45. The process of entry and exit of firms involves a proportionally low number of workers: only about 10 per cent of employment is involved in firm turnover, and in Germany and Canada, employment-based turnover rates are less than 5 per cent (bottom Panel of Figure 2). The difference between firm turnover rates and employment-based turnover rates arises from the fact that entrants (and exiting firms) are generally smaller than incumbents. For most countries, new firms are only 40 to 60 per cent the average size of incumbents.

[Figure 3. Average firm size of entering and exiting firms relative to total firms]

46. The relatively small size of entrants in Canada and especially the United States reflects both the large size of incumbents (see above) and the small average size of entrants compared to that in most other countries (in the United States, about 2.5 employees in the total economy and about 5 in manufacturing). In other words, entrant firms are further away from the efficient size in the United States than in most other countries for which data are available. There are a number of different possible explanations for this. First, the larger market of the United States may partly explain the larger average size of incumbents.[20] Second, the wider gap between entry size and the minimum efficient size in the United States may reflect economic and institutional factors, *e.g.* the relatively low entry and exit costs may increase incentives to start up relatively small businesses.[21] We will return to this issue later.

47. Turnover rates vary significantly across sectors in each country. In particular, the variability of turnover rates for the same industry across countries is comparable in magnitude to that *across industry* in each country. In other words, both country-specific and sector-specific effects contribute to the observed variability of firm "churning" in the country sample.[22] A typical finding is that turnover rates (especially if weighted by employment) are somewhat higher in the service sector than in manufacturing. However, in Italy and especially Finland, there appears to be only small differences in churning between manufacturing and services. In the case of Italy this is particularly evident for the employment-weighted turnover and likely reflects the small differences in average size of firms between manufacturing and services.[23] For

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19. The entry rate is defined as the number of new firms divided by the total number of incumbent and entrants firms producing in a given year; the exit rate is defined as the number of firms exiting the market in a given year divided by the population of origin, *i.e*. the incumbents in the previous year.

20 . Geographical considerations may also affect the average size of firms: firms with plants spreading into different US states are recorded as single units, while establishments belonging to the same firm but located in different EU states are recorded as separate units.

21. As discussed in Nicoletti *et al.* (1999), regulations affecting the start up of firms are generally much less stringent in the United States than in most of Europe, with the notable exception of the United Kingdom.

22. Two sectors stand out as clear outliers*: agriculture*, where some countries have very high turnover rates in absolute and relative terms; and *electricity, gas and water*, where turnover is very low in some countries. This latter result is perhaps not surprising given that this industry is often dominated by public utilities.

23. As discussed above, turnover is negatively correlated with average firm size in most countries, and the smaller scale of the Italian manufacturing firms can at least partially explain a relatively higher degree of churning.

Finland, the high turnover in manufacturing is likely the result of major restructuring, which took place in the aftermath of the deep recession of the early 1990s.[24]

48. The sectoral dimension allows us to compare entry and exit rates and characterise turnover. If entries were driven by profits being relatively high in given industries, and exits were driven by profits being relatively low, one should observe a negative cross-sectional correlation between entry and exit rates. However, confirming previous evidence (*e.g.* Geroski, 1991*a*; Baldwin and Gorecki, 1991) entry and exit rates are generally positively correlated across industries in different countries, and this is particularly so when the rates are weighted by employment (Table 8). This finding, which is consistent with the process of "creative destruction", suggests that entries and exits are part of a process in which a large number of new firms displace a similar number of obsolete firms, without affecting significantly the total number of firms in the market at each point in time.[25] Two countries seem to require a somewhat different interpretation: Finland and France where the correlation between entry and exit is not statistically significant. The lack of any significant correlation between entry and exit in Finland is likely to be due to the fact that the crisis of the early 1990s hit specific industries very badly (*e.g*. those exposed to the Eastern market), while other areas of manufacturing actually expanded during the 1990s. For France, we do not have a clear-cut interpretation for this result.

[Table 8. Correlation between entry and exit rates across industries, 1989-94]

49. Table 9 explores various influences shaping entry and exit rates *via* fixed-effect regressions. The reference sector is "*food, beverage and tobacco*", the reference size class is 20-49 and the reference country is the United States. Equation A includes year dummies to control for specific time effects, while equation B uses a country-specific measure of the business cycle. Equation (C) includes both, in order to test for common and country-specific time patterns of entry. Since the inclusion of the business cycle variable in a specification with time dummies does not significantly affect the results, this variable is not included in the other specifications. Finally, equation (D) controls for the presence of outliers in the data and equation (E) replicates it without size dummies to identify the overall country-specific effects, including those related to differences in the size structure of firms.[26]

[Table 9. Entry rate regressions]

50. The country dummies indicate the same picture as that presented on the basis of Figure 2 above, i.e. differences in aggregate turnover rates are not strongly affected by differences in the composition of the economy. Thus, with the exception of western Germany and Italy, all countries have higher entry rates than the United States. In Portugal, Finland and the manufacturing sector of the United Kingdom, entry rates are between 1.5 and more than 2.5 percentage points higher than in the United States, while in the other countries differences are within one percentage point. Moreover, if the different size structure of

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24 . The lower turnover rate in the French service sector compared with that in manufacturing is likely to depend on the existence of a size threshold in the French data (see Annex 2), which tends to be more binding in the service sector than in manufacturing. As an indication, the French data also suggest a higher average size of firms in the service sector than in manufacturing, in contrast with all other countries.

25. Dunne *et al*. (1988) suggest that entry and exit rates are correlated with a lag in the United States. However, even then the entry rate in a given five-year period is positively correlated with exit rates in the following five years. For an extensive discussion on this issue see Caves (1998). Caves also signals that in early and late phases of products' life cycle, the correlation between entry and exit reverts to negative.

26 . All equations exclude a number of outlier observations identified on the basis of the DFIT and COVRATIO statistical tests. These observations significantly increase the standard error of the regression, or affect the estimated coefficients. The same observations have been excluded in all entry equations to ease comparisons of results across the different specifications.

firms across countries is taken into account (*i.e.* not included in the country fixed effects), then the differences are even smaller, and not statistically significant, in the case of Finland and the Netherlands. All in all, it can be concluded that cross-country differences in entry rates are not very large for the countries observed.

51. Entry rates decline with size of entrant, although the effect is not linear: small firms (below 20 employees) have a significantly higher entry rates than the reference group (20-49), ceteris paribus, while larger firms (50 and more) have only marginally lower entry rates.

52. Fixed effect regressions also allow examination of differences in entry rates across industries, once country and size effects are controlled for (Figure 4). Values in the figure are relative to the overall business sector (un-weighted) average. Notably, high technology manufacturing industries and some business-service industries, and in particular those related to information and communication technologies (ICT), have higher entry rates than average.[27] The main element emerging from the figure is the higher than average entry rates in industries related to information and communication technologies (ICT). This is particularly true within manufacturing, where ICT industries (referred to as high tech in the figure) tend to have significantly higher entry rates, but also in some service industries (e.g. “post and communication”, and the “computer and related activities” as well as the “research and development” within “business activities”). This evidence lends some support to the vintage models of technological changes whereby rapid technological changes are associated with greater firm churning with new innovative units replacing outpaced ones. More generally, the figure suggests that, even controlling for size and country-specific effects, firms in the business service sector tend to have higher than average entry rate, although they are characterised by a large variability.

[Figure 4. Industry fixed effects from the entry rate equation]

53. Sectoral details give us the opportunity to shed some light on the evolution of entry and exit over time and market life cycle. Previous micro evidence suggests that part of the observed differences in entry rates across industries is due to a sporadic pattern of entry over time which tends not to be correlated across industries (see Gort and Klepper, 1982; Geroski, 1995). Thus, very low or very high entry rates do not tend to persist over time. At the same time, it seems likely that part of the ‘sporadic’ pattern of entry as well as other features of firm-level data are likely a reflection of links between firm demographics and product cycles. Studies of specific products or markets broadly confirm the notion that following commercial introduction there is an initial phase of rapid entry, followed by levelling off and then contraction in the number of firms.[28] Thus, for example the observation of ‘waves’ of entry at different points in time across industries may reflect initial phases in the product cycle. Available data do not permit specific products to be followed over time. Rather they focus on detailed industries that still include a variety of products and markets. Nevertheless, Table 10 sheds some light on the persistency of entry rate differentials across industries by displaying the (Spearman) rank correlations of industry entry rates over different time spans. The correlation is often above 0.5 in the five-year cross-sections, but tends to decline over longer time spans. Moreover, the correlation of employment-based entry penetration rate is even lower and declines more rapidly over longer time spans. Hence, high-entry industries at a point in time are not necessarily at the top of the entry industry ranking ten or even five years later. Albeit indirect, this observation is interesting because it throws additional light on cross-sectional differences in market conditions. While

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27 . The very high positive dummy for *post and telecommunication* is likely to be due to two factors: *i)* the privatisation of telecoms in a number of countries that has led to the entry of a number of new private operators; and *ii)* the rapid increase in the number of firms operating in the communication area, related to the spread of Internet and e-commerce activities.

28. For example, a study of 46 products in the United States by Gort and Klepper (1982) found a typical initial phase of entry of about 10 years and a phase of contraction of about five years.

most structural indicators of industry competitiveness indicate broadly stable cross-sectional differences, entry rates (which could also be considered as a proxy for competitiveness) display much wider fluctuations, hinting at the need for considering the “maturity” of each industry.

[Table 10. Spearman rank correlation of industry entry rates between different years]

5. Which firms survive and which expand?

54. The high correlation between entry and exit across industries in a given year raises the question of the “life expectancy” of those firms that survive infancy. This can be assessed by looking at the survivor and hazard functions. Figure 5 presents non-parametric (graphic) estimates of both of them for firms that entered the market in the late 1980s and early 1990s. The survivor function specifies the probability that a firm from a cohort of entrants will have a lifetime in excess of a given duration, while the hazard function corresponds to the conditional probability of leaving the market after a certain life span.[29]

[Figure 5. Hazard and survival functions for broad sectors]

55. In the United States and to a minor extent in Italy and the UK manufacturing, there is some evidence of a non monotonic hazard function: especially in the former, the probability of exiting the market increases somewhat from the first to the second year. This provides some evidence of a “honeymoon” effect, whereby the firm’s initial stock of assets affords it some insurance against failure in the early life. In the other countries, the probability of failure declines steeply with age in the first years and then stabilises to fairly constant values.

56. Figure 6 suggests that hazard rates tend to decline monotonically with firm size characteristics.[30] Differences in hazard rates across industry size clusters are particularly evident in the early stages of firm’s life. As of the fourth- fifth year of life, hazard rates for all size groups tend to be fairly similar in most countries.

[Figure 6. Hazard functions by average entrant size]

57. Looking at cross-country differences in survivor rates, about 20 per cent (United States) to more than 40 per cent (in the manufacturing sector of the United Kingdom) of entering firms fail within the first two years (Figure 7). Conditional on overcoming the initial years, the prospect of firms improves in the subsequent period: firms that remain in the business after the first two years have a 50 to 80 per cent chance of surviving for five more years. Nevertheless, only about 40-50 per cent of total entering firms in a given year survive beyond the seventh year.

[Figure 7. Firm survival at different lifetimes, 1990s]

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29. The estimator for the hazard function is the ratio between the number of exits at duration t_j divided by the total number of firms that could have left then. Essentially, this estimator is obtained by setting the estimated probability of completion of a firm spell at t_j equal to the observed relative frequency of completion at t_j. Formally : $\hat{\lambda} = h_j / n_j$ where h_j is the number of firms which left the market and n_j is the total number of firms in the risk set. The corresponding estimator for the survivor function is: $S(t_j) = \prod_j (n_j - h_j)/n_j$.

30. Given data availability, industries are first grouped according to the average size of entrants and then averages of the hazard rates are calculated for each group (low, medium and high entry size) separately.

58. Figure 7 suggests significant cross-country differences in survival rates at different lifetimes. However, as discussed above in the case of firm turnover, differences in the sectoral composition across countries could partly cloud the international comparison. Table 11 presents fixed effect regressions on firms' hazard rates. Explanatory variables include the usual country and industry dummies plus duration and its square to account for the duration dependence of hazard rates. As in the previous cases, the identification is guaranteed by omitting the "Food, beverage and Tobacco" industry and the dummy for the United States. The first two equations (A and B) impose common coefficients on the duration variables. However, the homogeneity restriction on both variables is strongly rejected by the data (the F-test for the homogeneity of the coefficients of duration and duration squared are, respectively, 82.2 and 61.1). Thus, the last two equations consider country-specific duration effects. Taking into account the estimated coefficients in the last column (D), the differences (in percentage points) in the hazard rates after 2 and 4 years of life with respect to the United States are as follows:

	Difference in hazard rate at duration 2 years (in %)	Difference in hazard rate at duration 4 years (in %)
Western Germany	7.3	-2.8
France	1.4	-5.6
Italy	-0.6	-2.4
United Kingdom	11.2	2.9
Finland	13.8	-8.0
Portugal	1.1	-4.5

Finland and the United Kingdom stand with significantly higher infant mortality than the United States, while the other countries have broadly similar infant failure rates. However, hazard rates decline more steeply in most countries than in the United States (as shown by the differences in the duration coefficients in Table 11), the sole exception being the United Kingdom (manufacturing). The results for Finland are partially affected by the major restructuring taking place in the early 1990s (thus affecting firms entering the market over that period), while those for the United Kingdom are consistent with a view of significant dynamism and turnover as already indicated in the paper.

[Table 11. Fixed effect regressions of hazard rates]

59. There is substantial variation in survival rates at different life spans across manufacturing industries and the entire business sector. Overall, the variance of "infant mortality" (or failure within the first year) across industries is of the same order of magnitude as the variance of entry rates across industries (Table 12).[31] Furthermore, these industry differences in initial failure also are reflected in the variability of long-term survival rates (*i.e.* 5-7 years of age) which remains substantial. If the cross-industry variability is taken as an indicator of the different market barriers that affect young firms, the evidence reported in Table 12 may indicate a degree of commonality between industry characteristics that affect barriers to entry and those that condition firm survival (see also Geroski, 1995).

[Table 12. Variability of entry and first-year hazard rates across industries]

31. Table 12 presents the standard deviation of cross-industry entry rates and hazard rates, the latter by duration. It shows that the cross-industry variability of entry rates is similar to that of hazard rates, especially at the to ends of the duration distribution, that is in the first years of firm's life and amongst firms reaching the sixth or seventh year of life.

60. The negative link between firm size and failure found for broad sectors is also confirmed within each industry: failure rates in the early years of activity are highly skewed towards small units, while surviving firms are not only larger, but also tend to grow rapidly. Thus, in most countries the size of exiting firms is broadly similar to that of entering firms (see Figure 3 above). Moreover, the average size of surviving firms increases rapidly to approach that of incumbents in the market in which they operate.

61. Each given cohort tends to increase rapidly in the initial years because failures are highly concentrated amongst its smallest units and because of the significant growth of survivors. These facts are best presented by looking at survival rates expressed in terms of total employment of a given cohort and in terms of net employment gains amongst surviving firms (Figures 8 and 9). The time profile of the survivor function expressed in terms of employment is shifted upward and is flatter compared with the survival function of firms, due to the exit of predominantly smaller units. The United States is a major outlier in this respect, given the fact that on average a given cohort doubles its employment in the first two years of life, while in the other countries total employment remains in the 80-100 per cent range of its initial level. The corollary is that US firms experience a major increase in size during the initial years, while employment gains amongst surviving firms in Europe are in the order of 10-20 per cent (Figure 9).[32] This could reflect the greater opportunities offered to small US firms, even though their failure rate is high.[33]

[Figure 8. Employment-based survival rates at different lifetimes, Total employment, 1990s]

[Figure 9. Net employment gains among surviving firms, 1990s]

62. Net employment growth amongst surviving firms vary significantly across sectors. In particular, surviving firms in *high technology* industries are all characterised by larger than average post entry employment growth (Figure 10). In particular, firms in ICT-related industries (*office accounting and computing machinery* and *radio TV and communication equipment*) generally experience rapid post entry growth in Finland, Italy, Portugal and the United States. Given the large size of these industries in the United States compared with most other countries (Finland is an exception), this can, albeit only to a limited extent,[34] contribute to explain the overall higher post entry employment growth there.

[Figure 10. Net employment gains among surviving firms in high-technology industries, 1990s]

63. The marked difference in post-entry behaviour of firms in the United States compared with the European countries is partially due to the larger gap between the size at entry and the average firm size of incumbents, *i.e.* there is a greater scope for expansion amongst young ventures in the US markets than in Europe. In turn, the smaller relative size of entrants, can be taken to indicate a greater degree of experimentation, with firms starting small and, if successful, expanding rapidly to approach the minimum efficient scale.[35] However, there are other additional factors which could contribute to explain the observed differences in post-entry behaviour. These include:

32. The results for the United States are consistent with the evidence in Audretsch (1995). He found that the four-year employment growth amongst surviving firms was about 90 per cent.

33. This greater experimentation of small firms in the US market may also contribute to explain the evidence of a lower than average productivity of US firms at entry (see Barnes *et al.*, 2001).

34. In particular, ICT industries account for about 5 per cent of total GDP in the United States and even less in terms of employment.

35. This greater experimentation of small firms in the US market may also contribute to explain the evidence of a lower than average productivity at entry, as discussed above.

- In the available data, firms with plants spreading into different US states are recorded as single units, while establishments belonging to the same firm, but located in different EU countries are recorded as separate units.[36] Thus the expansion of a European firm that involves the creation of a new establishment in a different EU country will not be recorded as such, but rather as the creation of a new separate entity. However, this argument should not be over-emphasised: available evidence for the United States and Finland reveals only marginal differences in the average number of plants per firm in the two countries (1.2 and 1.1 in total business sector, respectively and 1.3 and 1.2 in manufacturing), despite their marked difference in terms of market size.

- Business-cycle influences possibly contribute to the distinct growth of surviving firms in the United States. The data refer to the early- to mid-1990s, when the US economy experienced rapid output and employment growth, while in Europe growth was, at best, feeble. However, estimates of post-entry growth in Italy and Portugal in an expansionary period (the second half of the 1980s) are only marginally higher than those in the early 1990s. Notably, however, initial firm survivor rates were generally higher in these two countries in the late-1980s, compared with the early 1990s. This could suggest that business cycle conditions affect the probability of surviving more than the expansion of those that succeed in staying in the market.

- Finally, as discussed above, in all countries post-entry employment growth was particularly high in ICT-related industries. Given the large size of these industries in the United States, compared with most other countries (with the exception of Finland), this can, albeit only to a limited extent,[37] contribute to the explanation of the overall higher post entry employment growth there.

6. Concluding remarks: the policy implications of firm-level results

64. This paper reviews cross-country evidence on firm demographics and post-entry developments in ten OECD countries. The novelty of our approach is in the harmonisation of firm level data across countries, which enables international comparisons and the identification of country-specific factors as opposed to sectoral and time effects. The paper is of a fact-finding nature and its main goal is to assess how certain stylised facts presented in the literature on firm demographics and post-entry growth -- largely relying on US data -- are corroborated by evidence on a broader range of countries, characterised by different economic structures, institutions and aggregate growth performances over the period analysed. Our main findings can be summarised as follows:

- The *average size* of incumbents varies widely across sectors and countries. It is generally smaller in most European countries than in the United States due to differences in both the sectoral composition of the economy and within-industry peculiarities. These two factors are also positively correlated: i.e. sectoral specialisation and within-sector characteristics both contribute to differentiate average firm size across countries.

36 . This may have implications for both measured employment growth of EU firms and entry rates. If a European firm extends its activity to a neighbouring EU country, rather than expanding at home, its growth in the home country will be lower but the entry rate in the other country will be higher.

37. In particular, ICT industries account for only about 7-8 per cent of total GDP in the United States and even less in terms of employment.

- The *dispersion of within-industry firm size* is generally associated with the size of the domestic market: countries with a greater domestic market also show greater variability in firm size across most sectors.

- *Firm turnover* is significant: about 20 per cent of firms enter and exit most markets every year. This process, however, involves only about 5-10 per cent of total employment because exiting and especially entering firms have a smaller-than-average size. These features of firm demographics suggest that the entry of small firms is relatively easy, while larger-scale entry is more difficult and, more importantly, many small firms exit the market before reaching the efficient scale of production.

- *Entry and exit rates are highly correlated across industries*, and this is particularly so when they are weighted by employment. This suggests that entries and exits are part of a process in which a large number of new firms displace a large number of obsolete firms (which may themselves be relatively new), without affecting significantly the total number of firms in the market at each point in time.

- Although there is a large cross-sectoral variation in entry rates, *differences between industries do not persist for very long*, *i.e*. high entry industries at one point in time do not necessarily rank at the top of the industry distribution five to ten years later. This results throws new light on cross-sectoral differences in market conditions: while most indicators of industry competitiveness suggest broadly stable across-industry differences, entry rates (another proxy for competitiveness) display much wider fluctuations and hint at the importance of product cycles in explaining industry dynamics.

- *Market selection is pretty harsh*: about 20 to 40 per cent of entering firms fail within the first two years of life. And, although failure rates decline with duration, only about 40-50 per cent of total entering firms in a given cohort survive beyond the seventh year.

- *The likelihood of failure in the early years of activity is highly skewed towards small units*, while surviving firms are not only larger but also tend to grow rapidly. The combined effect of exits being concentrated amongst the smallest units and the growth of survivors makes the average size of a given cohort to increase rapidly towards the efficient scale.

- *The cross-sectoral variability in infant mortality* is similar to the variability in entry rates and this can be taken as evidence that certain industry characteristics that as supposed to create entry barriers may, as well, create barriers to survival.

65. There are a number of policy implications that can be derived from these findings. In particular, our evidence seems to confirm that there is a lot of firm dynamism in all OECD countries, with many firms entering and exiting most markets. This process of “creative destruction” probably warrants closer attention by policy makers. Firm turnover depends on market characteristics (concentration, product diversification, advertising costs etc.) but also on regulations and institutions affecting start-up costs and the financing of new ventures. Allowing low-productive units to exit is an important part of this process, insofar as it frees resources that can be better used by other firms. Policies that foster market contestability and entrepreneurship as well as appropriate bankruptcy rules play a role in this context.

66. An interesting finding of our analysis is the similar degree of firm churning in Europe andin the United States. Controlling for industry and time effects, firm turnover rates in the United States actually are somewhat smaller than in most other countries, with the exception of Italy and Germany. Similarly, infant mortality in the United States is generally close to or even lower than that of other countries. The

main difference between the United States and most European countries lays in post-entry employment growth amongst surviving firms. Indeed, firms in the United States enter with a smaller (absolute and relative to industry average) employment size than they counterparts in Europe but, if successful, expand much more rapidly to reach a higher average size. Thus, US firms experience a major increase in employment during the initial years, while employment growth amongst surviving firms in Europe is much more modest.

67. These observed differences in post-entry growth amongst surviving firms firms' can only partly be explained by statistical technicalities or business cycle conditions, and seem to indicate a greater degree of *experimentation* amongst entering firms in the United States. In turn, a number of factors can contribute to an explanation. A predominantly market-based financial systems may lead to a lower risk aversion in project financing, with greater financing possibilities for entrepreneurs with small or innovative projects, often characterised by limited cash flows and lack of collateral. Moreover, if certain administrative costs at entry are fixed, then the higher these costs (as in a number of European countries compared with the United States and the United Kingdom) the greater the disincentives for relatively small units to enter the market and then expand in the initial years. Likewise, post entry adjustments in employment may be hindered by tight hiring and firing restrictions and the latter are more restrictive in a number of European countries than in the United States.

Table 1. **Small firms across broad sectors and countries, 1989-94**
(firms with fewer than 20 employees as a percentage of total)

	Firms				Employment[1]			
	Total economy	Non-agricultural business sector[2]	Manufacturing	Business services	Total economy	Non-agricultural business sector[1]	Manufacturing	Business services
Unites States	86.7	86.5	69.9	87.9	16.6	17.3	5.8	20.6
western Germany	87.9	87.1	77.9	90.2	23.6	23.6	11.3	33.8
France	78.6	78.8	73.6	78.8	13.9	14	17.0	12.1
Italy	93.1	93.0	87.5	96.5	34.4	38.1	30.3	46.3
United Kingdom	..	..	74.9	..	..	..	8.3	..
Denmark	90.0	88.1	74.0	90.8	30.2	30.2	16.1	33.4
Finland	92.6	92.6	84.8	94.5	25.8	25.8	13.0	33.0
Netherlands	95.8	96.0	86.7	96.8	31.2	34.2	16.9	41.9
Portugal	86.3	85.9	70.5	92.8	27.7	26.9	15.7	39.8

1. Share of total employment in firms with fewer than 20 employees.
2. This aggregate excludes agriculture (ISIC rev3: 1-5) and community services (ISIC rev3: 75-99).

Table 2. **Average number of employees per firm in broad sectors of OECD countries, 1989-94**

Average size

					Memorandum, Manufacturing industries[1] :			
	Total economy	Non-agricultural business sector[2]	Manufacturing	Business services	high technology	medium-high technology	medium-low technology	low technology
United States	26.4	25.6	80.3	21.4	305.2	89.9	57.5	68.6
western Germany	17.0	17.7	39.1	11.5	..	..	..	..
France	33.5	33.2	32.1	35.7	..	..	..	..
Italy	10.5	10.0	15.3	6.8	48.6	17.5	16.0	11.9
United Kingdom	..	..	40.7	..	115.8	60.9	26.8	33.2
Canada	12.7	15.2	40.5	12.0	85.7	68.3	29.1	40.0
Denmark	13.3	15.2	30.4	12.7	..	..	..	..
Finland	13.0	13.0	27.8	9.9	106.7	29.7	20.6	30.6
Netherlands	6.5	5.8	18.3	5.3	..	..	..	..
Portugal	16.8	17.4	31.0	11.4	97.7	47.5	21.1	34.1

1. See main text for definition of the groups.
2. This aggregate excludes agriculture (ISIC rev3: 1-5) and community services (ISIC3 rev3: 75-99).

Table 3. **Relative firm size across sectors and countries**

(Ratios to cross-country averages)

	Cross-country average	United States	western Germany	France	Italy	United Kingdom	Canada	Denmark	Finland	Netherlands	Portugal
Agriculture, hunting, forestry and fishing	**5.48**	1.72	0.79	2.83	1.09	..	0.47	0.53	..	0.48	1.53
Mining and quarrying	**35.83**	1	2.42	0.44	0.43	..	0.98	0.3	0.29	0.42	0.63
Total manufacturing	**40.78**	1.83	0.93	0.78	0.37	1.05	0.93	0.74	0.71	0.44	0.7
Food products, beverages and tobacco	**41.04**	4.34	0.41	0.35	0.25	2.16	1.54	0.97	1.07	0.52	0.7
Textiles, textile products, leather and footwear	**33.48**	2.51	1.05	1.07	0.41	1.05	0.96	0.66	0.5	0.28	1.28
Wood and products of wood and cork	**15.47**	1.33	1.21	1.03	0.42	0.77	1.88	1.43	1.19	0.48	0.89
Pulp, paper, paper products, printing and publishing	**33.39**	1.41	0.88	0.63	0.41	0.75	1.03	..	1.39	0.43	0.69
Chemical, rubber, plastics and fuel products	**82.41**	1.58	1.14	0.5	0.36	1.02	0.7	0.53	0.76	0.59	0.53
Other non-metallic mineral products	**30.3**	1.5	0.99	0.9	0.52	2.4	1.03	0.86	0.81	0.67	0.92
Basic metals, metal products, machinery and equipment excluding transport	**39.42**	1.63	1.19	1.05	0.39	0.92	0.86	0.77	0.62	0.47	0.63
Transport equipment	**228.39**	1.7	1.21	0.48	0.48	0.79	0.53	..	0.16	0.08	0.32
Manufacturing, n.e.c; recycling	**20.27**	1.79	0.65	1.04	0.55	1.27	0.84	1.37	0.57	0.9	0.6
Electricity, gas and water supply	**97.07**	1.06	0.78	0.15	2.49	..	0.92	0.18	0.4	2.27	7.02
Construction	**9.76**	1.03	1.3	1.68	0.72	..	0.51	0.91	0.67	0.85	1.43
Business sector services	**16.27**	1.25	0.71	2.02	0.43	..	0.8	0.78	0.58	0.25	0.64
Wholesale and retail trade; hotels and restaurants	**14.45**	1.35	0.69	1.27	0.37	..	0.95	0.73	0.56	0.33	0.56
Transport, storage and communications	**26.93**	1.34	0.74	0.93	0.84	..	0.86	0.58	0.46	0.34	3.32
Finance, insurance, real estate and business services	**17.41**	1.12	0.73	3.47	0.49	..	0.54	0.95	0.59	0.17	1.47
Community, social and personal services	**23.46**	1.28	0.73	1.58	0.51	..	0.24	0.68	..	0.43	0.56
Total	**19.58**	1.29	0.86	1.59	0.53	..	0.62	0.7	0.64	0.32	0.78

Table 4. **Fixed-effect regressions of firm size**
(Dependent variable: the share of firms with fewer than 20 employees over the period 1989-94, fixed effect estimator)

	A		B		C		D	
			With correction for outliers				With correction for outliers	
Constant	**5.72**	**	**6.26**	***	**5.75**	**	**5.65**	**
	(2.62)		*(2.13)*		*(2.57)*		*(2.23)*	
Country:								
western Germany	**7.38**	***	**6.85**	***	**7.38**	***	**7.46**	***
	(0.84)		*(0.68)*		*(0.85)*		*(0.73)*	
France	**3.47**	***	**3.88**	***	**2.20**	***	**2.25**	***
	(0.79)		*(0.65)*		*(0.84)*		*(0.73)*	
Italy	**17.36**	***	**17.48**	***	**18.76**	***	**18.69**	***
	(0.83)		*(0.67)*		*(0.90)*		*(0.78)*	
United Kingdom	**-1.60**		**-2.44**		**-1.56**		**-2.04**	
	(7.13)		*(5.78)*		*(6.96)*		*(6.04)*	
Denmark	**8.33**	***	**7.94**	***	**8.32**	***	**8.52**	***
	(0.87)		*(0.70)*		*(0.87)*		*(0.76)*	
Finland	**24.73**	***	**23.18**	***	**26.62**	***	**26.46**	***
	(0.84)		*(0.69)*		*(0.89)*		*(0.77)*	
Netherlands	**11.25**	***	**10.64**	***	**11.53**	***	**11.44**	***
	(1.05)		*(0.85)*		*(1.06)*		*(0.92)*	
Portugal	**7.70**	***	**6.43**	***	**6.32**	***	**6.34**	***
	(0.74)		*(0.60)*		*(0.78)*		*(0.68)*	
Interactions (country/high- tech manufacturing industries):								
United States					**4.33**		**-8.99**	***
					(3.78)		*(2.12)*	
France					**12.25**	***	**-3.99**	*
					(3.79)		*(2.37)*	
Italy					**-1.40**		**-15.41**	***
					(3.73)		*(2.14)*	
Finland					**-4.65**		**-20.91**	***
					(3.68)		*(2.15)*	
Netherlands							**-16.35**	***
							(3.61)	
Portugal					**10.82**	***	**-7.65**	***
					(3.63)		*(2.05)*	
Adjusted R^2	0.69		0.77		0.71		0.76	

Note: Each equation includes industry dummies. The reference group is "food products, beverage and tobacco" in the United States.

Table 5. **Shift and share analysis of firm size, manufacturing**

	contribution coming from differences in :			
	Sectoral composition	Average size of firms	Interaction between sectoral comp. and size	Total
USA	0.03	0.99	-0.19	0.83
GEW	-0.02	0.02	-0.07	-0.07
FRA	0.06	-0.21	-0.07	-0.22
ITA	-0.06	-0.60	0.03	-0.63
GBR	0.04	0.11	-0.10	0.05
CAN	0.04	-0.06	-0.05	-0.07
DNK	-0.12	-0.37	0.23	-0.26
FIN	0.03	-0.28	-0.04	-0.29
NLD	0.11	-0.55	-0.12	-0.56
PRT	-0.11	-0.33	0.14	-0.30

The 'Total' represents the percentage deviation of average size from the cross-country average: the other columns decompose the total into its sub-components.

Table 6. **Within-industry standard deviation of firm size**

(as a ratio to cross-country sectoral averages)

	Cross-country average	United States	France	Italy	United Kingdom	Finland	Netherlands	Portugal
Agriculture, hunting, forestry and fishing	67.26	1.44	2.64	0.26	..		0.18	0.48
Mining and quarrying	152.31	3.5	0.73	0.66	..	0.2	0.53	0.38
Total manufacturing	350.77	4.27	0.67	0.58	0.59	0.41	0.25	0.25
Food products, beverages and tobacco	510.92	5.53	0.12	0.16	0.52	0.31	0.21	0.15
Textiles, textile products, leather and footwear	160.06	4.12	0.64	0.3	0.81	0.24	0.27	0.61
Wood and products of wood and cork	47.34	2.16	0.77	0.32	0.72	1.74	0.61	0.68
Pulp, paper, paper products, printing and publishing	176.47	3.52	0.38	0.45	0.44	1.51	0.39	0.3
Chemical, rubber, plastics and fuel products	416.03	3.61		0.39	0.59	0.73	0.35	0.32
Other non-metallic mineral products	158.53	3.12	0.76	0.49	1.25	0.46	0.51	0.42
Basic metals, metal products, machinery and equipment excluding transport	258.81	3.53	1.33	0.47	0.59	0.44	0.26	0.38
Transport equipment	1525.91	4.43	0.35	1.23	0.64	0.11	0.07	0.17
Manufacturing, n.e.c; recycling	105.25	3.18	1.38	0.32	0.51	0.35	1.05	0.21
Electricity, gas and water supply	1388.76	0.68	0.03	2.98	..	0.07	0.22	2.02
Construction	195.34	0.57	4.56	0.19	..	0.17	0.18	0.33
Business sector services	382.19	1.94	2.62	0.43	..	0.33	0.4	0.28
Wholesale and retail trade; hotels and restaurants	280.92	2.76	2.22	0.16	..	0.15	0.6	0.1
Transport, storage and communications	831.78	1.29	2.52	0.69	..	0.29	0.31	0.9
Finance, insurance, real estate and business services	398.05	1.54	3.09	0.43	..	0.21	0.22	0.51
Community, social and personal services	2184.7	0.15	4.74	0.05	..		0.04	0.02
Total	247.89	2.84	..	0.74	..	0.48	0.52	0.42

Table 7. **Within-industry coefficient of variation of firm size**
(as a ratio to cross-country sectoral average)

	Cross-country average	United States	France	Italy	United Kingdom	Finland	Netherlands	Portugal
Agriculture, hunting, forestry and fishing	**6.9**	1.57	1.87	0.45	..		0.45	0.65
Mining and quarrying	**7.52**	2.19	0.96	0.95	..	1.08	0.43	0.39
Total manufacturing	**9.75**	2.25	0.82	1.5	0.76	0.95	0.38	0.35
Food products, beverages and tobacco	**6.85**	2.53	0.65	1.27	0.69	0.82	0.62	0.41
Textiles, textile products, leather and footwear	**4.83**	1.89	0.66	0.79	1.25	1.17	0.69	0.55
Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials	**4.21**	1.28	0.57	0.61	0.93	2.3	0.67	0.65
Pulp, paper, paper products, printing and publishing	**6.46**	2.24	0.53	0.98	0.76	1.5	0.56	0.41
Chemical, rubber, plastics and fuel products	**6**	2.09		0.97	0.7	1.24	0.41	0.58
Other non-metallic mineral products	**5.12**	2.22	0.95	1.03	0.83	0.85	0.62	0.5
Basic metals, metal products, machinery and equipment excluding transport	**7.81**	1.96	1.18	1.11	0.76	1.06	0.37	0.57
Transport equipment	**9.85**	1.97	0.56	1.99	0.77	0.86	0.48	0.38
Manufacturing, n.e.c.	**5.19**	1.96	1.3	0.64	0.73	1.19	0.81	0.38
Electricity, gas and water supply	**6.81**	1.41	0.38	2.64	..	0.57	0.15	0.85
Construction	**13.57**	0.87	3.28	0.45	..	0.76	0.23	0.41
Business sector services	**25.54**	1.53	1.15	1.03	..	0.99	0.84	0.46
Wholesale and retail trade; hotels and restaurants	**20.97**	2.09	1.54	0.46	..	0.47	1.26	0.19
Transport, storage and communications	**31.77**	1.05	1.75	0.92	..	1.3	0.53	0.44
Finance, insurance, real estate and business services	**19.15**	1.71	1.07	1.17	..	0.87	0.65	0.54
Community, social and personal services	**27.82**	0.43	3.89	0.35	..		0.17	0.17
Total	**17.9**	1.69	..	1.12	..	1.04	0.7	0.44

Table 8. **Correlation between entry and exit rates across industries, 1989-94**[1]

	Total number of observations (industry * year)			Weighted by employment	
		Correlation	T-statistic	Correlation	T-statistic
United States	47	0.67	6.02	0.86	11.25
western Germany	22	0.73	4.72	0.87	8.03
France	41	-0.21	-1.36	0.73	6.74
Italy	43	-0.22	-1.47	0.53	3.97
United Kingdom	26	0.68	4.95	0.21	1.14
Denmark	23	0.80	6.17	0.75	5.16
Finland	44	0.15	0.99	0.38	2.69
Netherlands	49	0.44	3.36	..	..
Portugal	41	0.60	4.91	0.64	5.47

1. Correlations of average industry entry rates and average industry exit rates over the period 1989-94.

Table 9. **Entry rate regressions**[1]
(dependent variable = entry rate)

	A		B		C		D		E	
	With year dummies		With gap variable for the cycle[2]		With both year dummies and variable for cycle		… also with control for outliers		Without size effects	
Constant	**3.40**	**	**2.72**	**	**3.36**	**	**3.79**	**	**5.26**	**
	(0.55)		*(0.24)*		*(0.55)*		*(0.42)*		*(0.64)*	
Country:										
western Germany	**-1.27**	**	**-1.37**	**	**-1.26**	**	**-1.38**	**	**-0.56**	**
	(0.18)		*(0.18)*		*(0.18)*		*(0.14)*		*(0.21)*	
France	**1.39**	**	**1.40**	**	**1.39**	**	**1.09**	**	**1.35**	**
	(0.15)		*(0.15)*		*(0.15)*		*(0.12)*		*(0.18)*	
Italy	**-0.54**	**	**-0.15**		**-0.54**	**	**-0.65**	**	**-0.34**	
	(0.16)		*(0.15)*		*(0.16)*		*(0.12)*		*(0.19)*	
United Kingdom	**1.99**	**	**2.17**	**	**2.02**	**	**1.58**	**	**1.84**	**
	(0.19)		*(0.18)*		*(0.19)*		*(0.14)*		*(0.22)*	
Denmark	**0.89**	**	**1.22**	**	**0.86**	**	**0.74**	**	**0.89**	**
	(0.18)		*(0.16)*		*(0.18)*		*(0.14)*		*(0.22)*	
Finland	**0.53**	**	**0.75**	**	**0.38**		**0.12**		**1.91**	**
	(0.16)		*(0.19)*		*(0.20)*		*(0.15)*		*(0.24)*	
Netherlands	**0.46**	**	**0.58**	**	**0.47**	**	**0.19**		**1.29**	**
	(0.14)		*(0.14)*		*(0.14)*		*(0.11)*		*(0.16)*	
Portugal	**1.79**	**	**1.89**	**	**1.79**	**	**1.26**	**	**3.03**	**
	(0.15)		*(0.14)*		*(0.15)*		*(0.12)*		*(0.18)*	
Size:										
less than 20	**7.38**	**	**7.39**	**	**7.38**	**	**6.97**	**		
	(0.10)		*(0.10)*		*(0.10)*		*(0.08)*			
50 - 99	**-0.40**	**	**-0.40**	**	**-0.40**	**	**-0.45**	**		
	(0.11)		*(0.11)*		*(0.11)*		*(0.09)*			
100 - 499	**-0.32**	**	**-0.32**	**	**-0.32**	**	**-0.48**	**		
	(0.11)		*(0.12)*		*(0.11)*		*(0.09)*			
500 and more	**0.001**		**-0.02**		**-0.004**		**-0.59**	**		
	(0.17)		*(0.17)*		*(0.17)*		*(0.13)*			

Notes: See Annex 2 for details on the definition of entry rates.
Robust standard errors are in brackets. * : significant at 5 % level; ** at 1% level.

1. The textile, footwear and leather products industry with 20-49 employees in the United States is the reference group in these equations.
2. Output gap from OECD Analytical Database (ADB).

Table 10. **Spearman rank correlation of industry entry rates between different years**

	Interval	Based on firm entry rates	Based on employment-weighted entry rates
United States	1990, 95	0.86	0.79
western Germany	1990, 98	0.94	0.60
	1993, 98	0.88	0.26
France	1991, 95	0.59	0.59
Italy	1988, 93	0.73	0.58
Denmark	1984, 94	0.82	0.56
	1989, 94	0.77	0.02
Finland	1990, 97	0.27	-0.02
	1993, 97	0.20	-0.02
Netherlands	1994, 97	0.59	0.31
Portugal	1985, 94	0.55	0.36
	1989, 94	0.75	0.3

Table11. **Fixed effect regressions of hazard rates**

(Dependent variable: the hazard rates of industry *i* in country *j* at different durations estimated over the period late 1980s to mid 1990s, fixed effect estimator)

	A	B	C	D
		With correction for outliers		With correction for outliers
Constant	**0.29** ***	**0.28** ***	**0.13** ***	**0.13** ***
	(0.01)	*(0.01)*	*(0.02)*	*(0.01)*
Country effects:				
western Germany	**0.01** **	**0.01** ***	**0.25** ***	**0.24** ***
	(0.01)	*(0.005)*	*(0.04)*	*(0.03)*
France	**-0.01** **	**-0.01** ***	**0.14** ***	**0.13** ***
	(0.00)	*(0.004)*	*(0.03)*	*(0.02)*
Italy	**0.0001**	**0.00**	**0.04**	**0.04** *
	(0.00)	*(0.004)*	*(0.03)*	*(0.02)*
United Kingdom	**0.07** ***	**0.07** ***	**0.27** ***	**0.26** ***
	(0.01)	*(0.004)*	*(0.03)*	*(0.02)*
Finland	**0.02** ***	**0.02** ***	**0.44** ***	**0.45** ***
	(0.005)	*(0.004)*	*(0.03)*	*(0.02)*
Portugal	**0.002**	**-0.01** **	**0.14** ***	**0.11** ***
	(0.005)	*(0.004)*	*(0.03)*	*(0.02)*
Duration	**-0.06** ***	**-0.06** ***		
	(0.004)	*(0.003)*		
Duration ^2	**0.005** ***	**0.004** ***		
	(0.0004)	*(0.0003)*		
Durations by country:				
United States			**0.01**	**0.01**
			(0.01)	*(0.01)*
western Germany			**-0.09** ***	**-0.09** ***
			(0.01)	*(0.01)*
France			**-0.06** ***	**-0.06** ***
			(0.01)	*(0.01)*
Italy			**-0.02** **	**-0.02** ***
			(0.01)	*(0.01)*
United Kingdom			**-0.08** ***	**-0.08** ***
			(0.01)	*(0.01)*
Finland			**-0.17** ***	**-0.17** ***
			(0.01)	*(0.01)*
Portugal			**-0.05** ***	**-0.05** ***
			(0.01)	*(0.01)*
Durations^2 by country:				
United States			**-0.002** **	**-0.002** ***
			(0.001)	*(0.001)*
western Germany			**0.01** ***	**0.01** ***
			(0.001)	*(0.001)*
France			**0.005** ***	**0.004** ***
			(0.001)	*(0.001)*
Italy			**0.002** *	**0.002** ***
			(0.001)	*(0.001)*
United Kingdom			**0.01** ***	**0.01** ***
			(0.001)	*(0.001)*
Finland			**0.01** ***	**0.01** ***
			(0.001)	*(0.001)*
Portugal			**0.004** ***	**0.004** ***
			(0.001)	*(0.001)*
Adjusted R^2	0.38	0.49	0.49	0.67

Note: Each equation includes industry dummies. The reference group is "food products, beverage and tobacco" in the United States.

Table 12. **Variability of entry rates and hazard rates, 1989-94**
(Non-agricultural business sector, standard deviations of entry and hazard rates across industries)

	standard deviation of :							
	entry rates	**hazard rates** at duration:						
		1	2	3	4	5	6	7
United States	4.52	1.96	2.78	2.34	3.25	3.45	2.76	2.26
western Germany	2.77	3.98	3.54	3.53	2.57	3.51	2.08	3.29
France	5.29	2.68	3.14	4.12	3.18	2.91	3.52	7.8
Italy	4.98	2.99	2.23	3.33	4.48	2.19	2.59	4.15
United Kingdom	7.14	3.49	3.22	4.33	2.94	2.84	4.64	..
Finland	3.72	6.97	4.55	4.36	4.72	4.16	7.52	11.15
Portugal	6.37	8.72	8.95	9.63	4.07	4.39	6.9	8.27

Figure 1. Demographics: Data availability

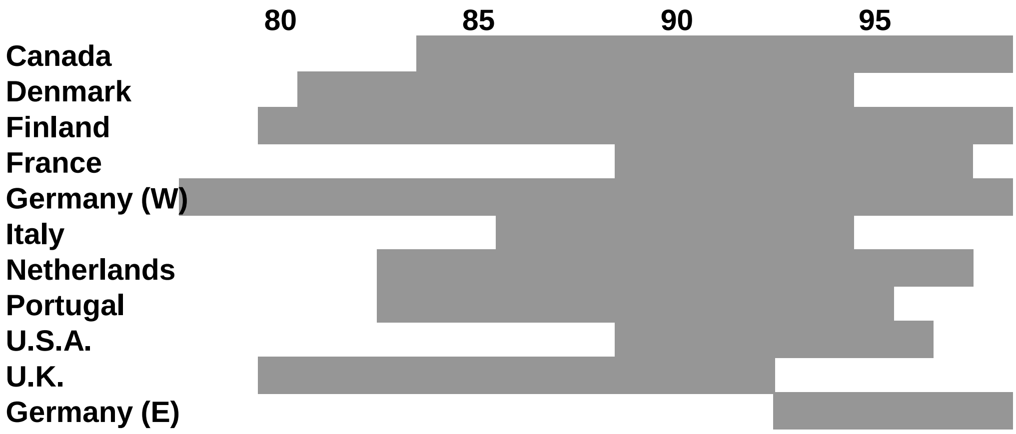
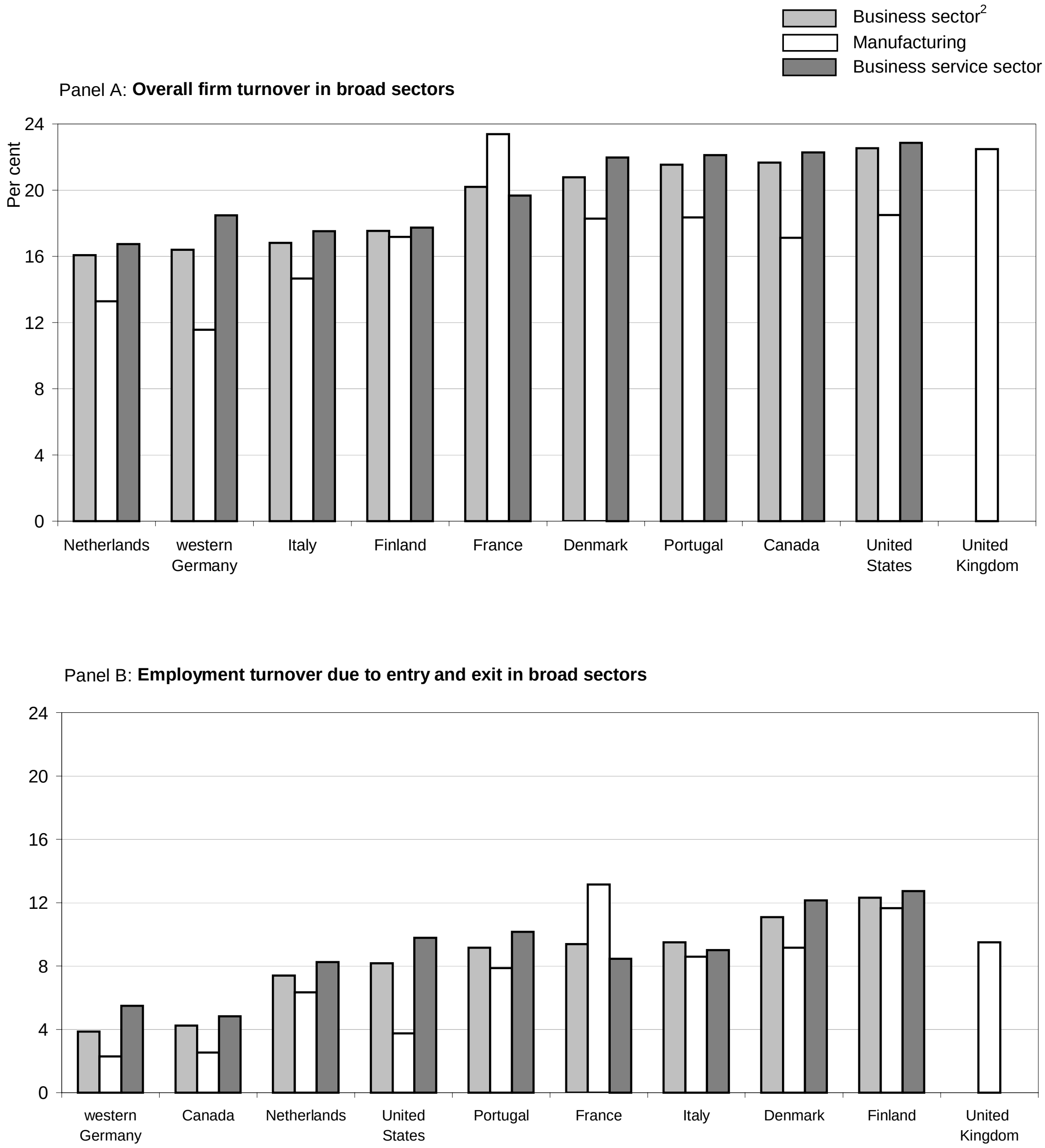
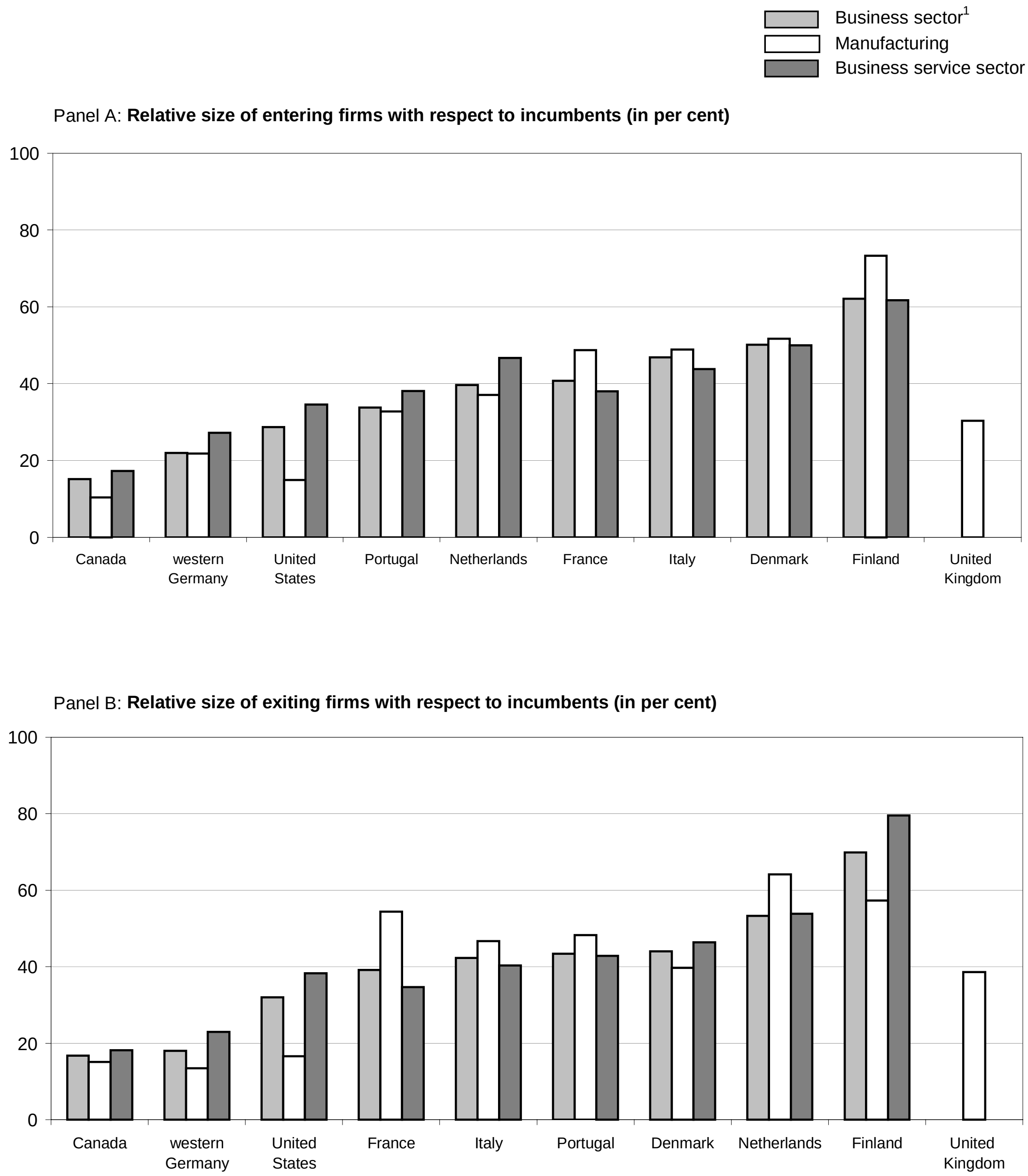


Figure 2. **Turnover rates in OECD countries, 1989-94**
(entry and exit rates, annual average)[1]



1. The entry rate is the ratio of entering firms to the total population. The exit rate is the ratio of exiting firms to the population of origin. Turnover rates are the sum of entry and exit rates.
2. Total economy minus agriculture and community services.

Figure 3. **Average firm size of entering and exiting firms, 1989-94**
(firm size based on the number of employees per firm)



1. Total economy minus agriculture and community services.

Figure 4. **Industry fixed effects from the entry rate equation** [1]

1. Equation C in Table 9. The industry fixed effect are normalised to the industry average entry rate.
* indicates signifiance at 10%; ** at 5%; *** at 1%.

Figure 5. **Hazard and survivor functions**

Firms, cohorts from late 1980s to mid 1990s

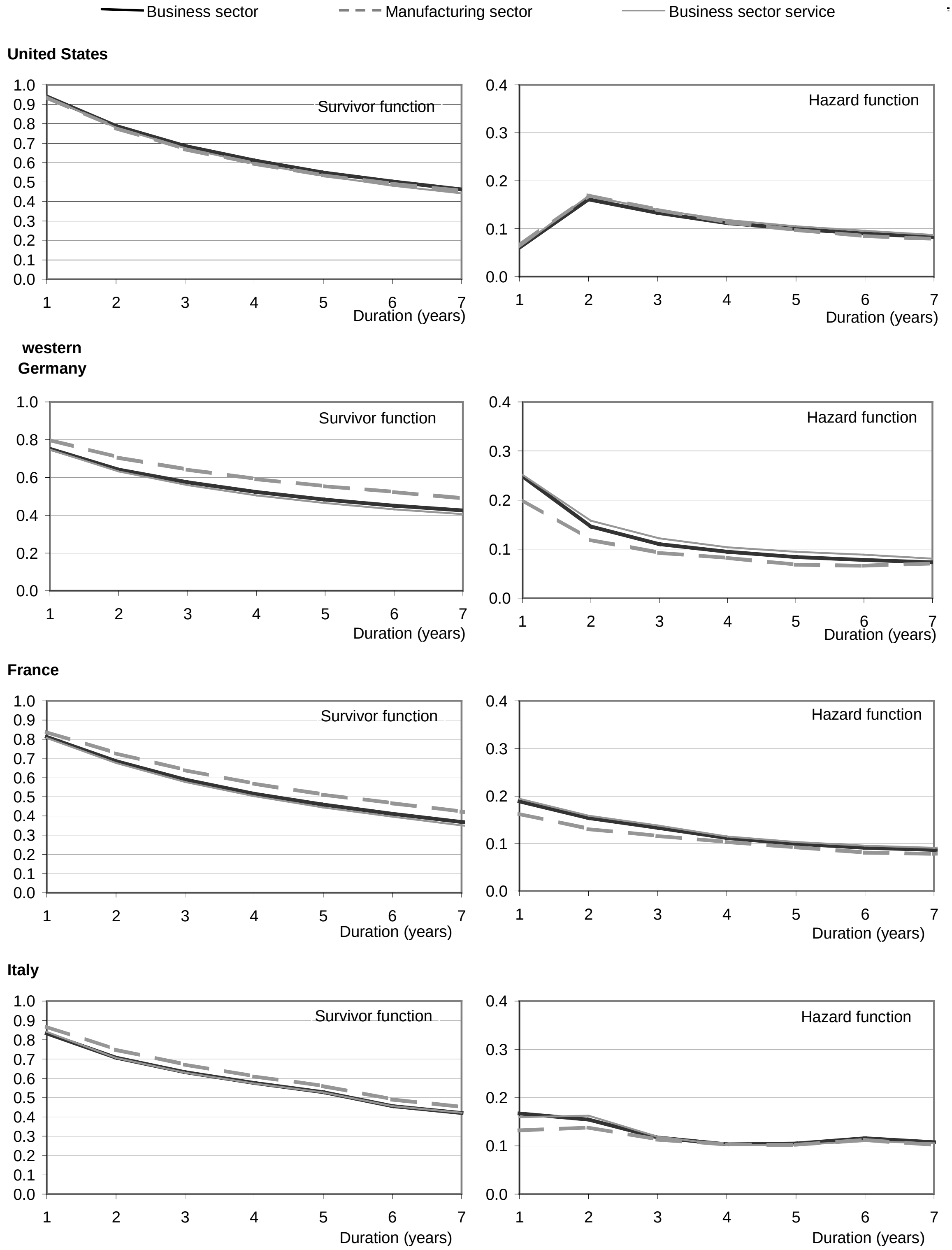


Figure 5. **Hazard and survivor functions** (continued)

Firms, cohorts from late 1980s to mid 1990s

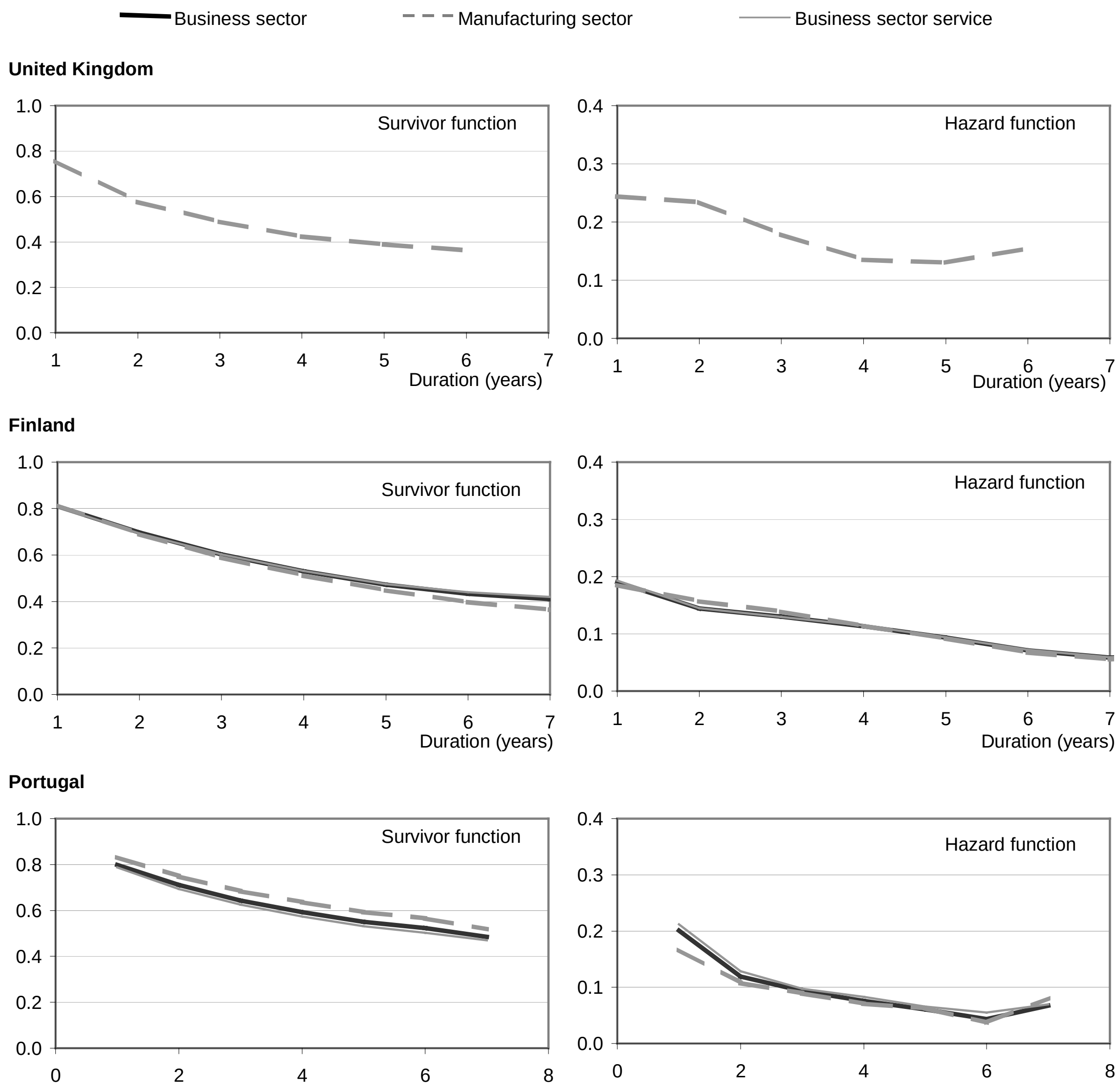
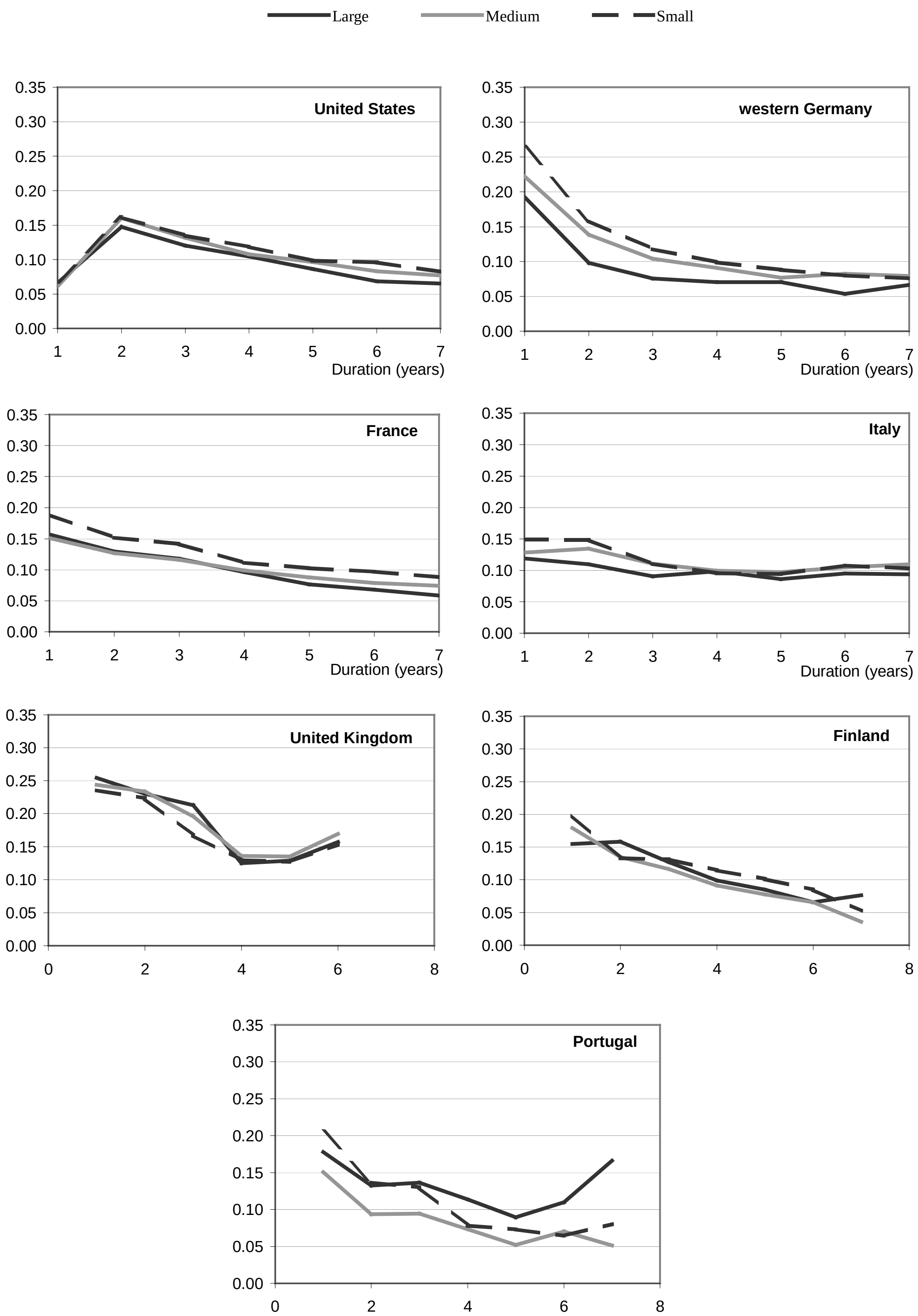


Figure 6. **Hazard functions by average size of entrants**[1]

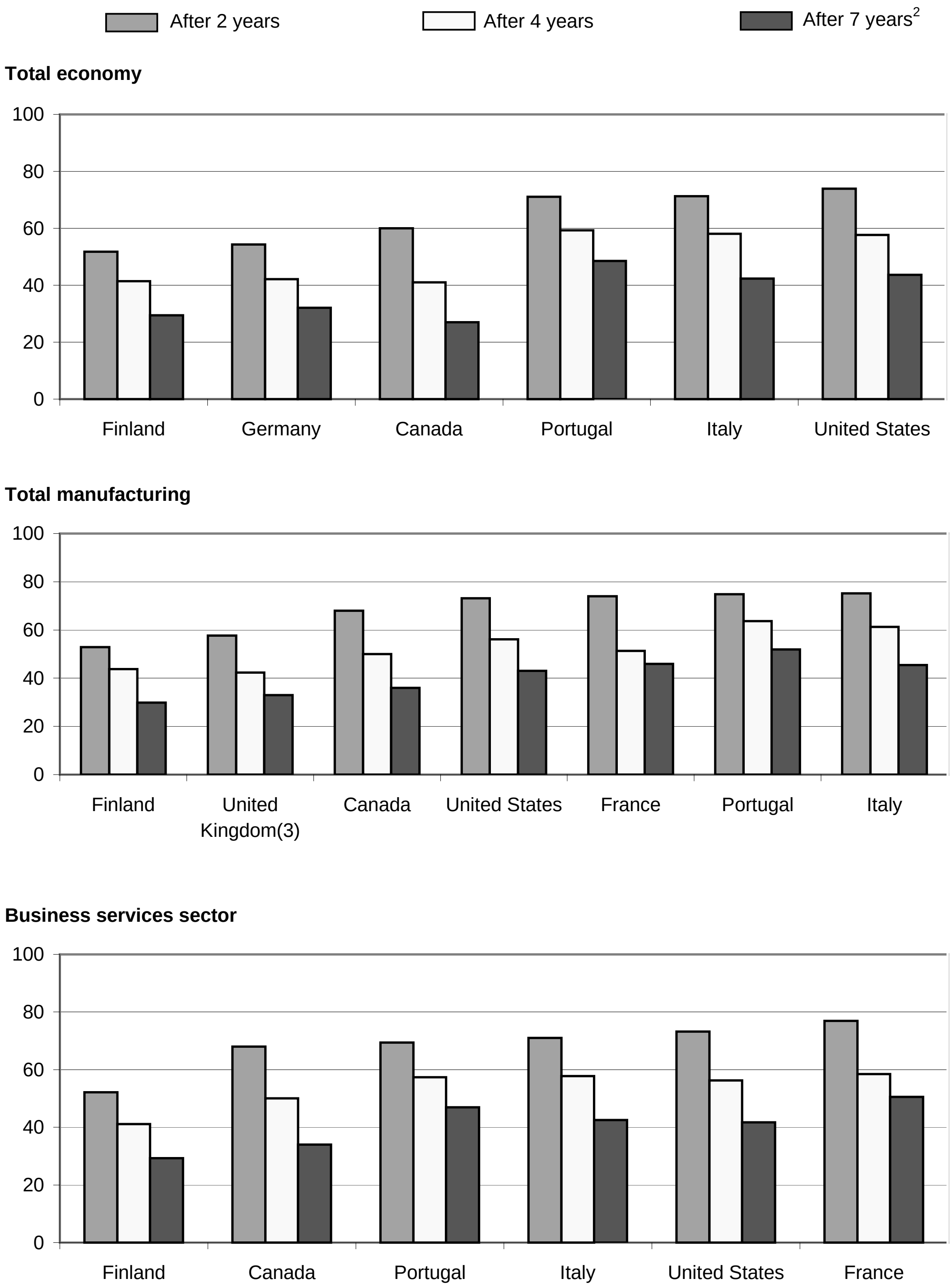
Firms, cohort from late 1980s to mid 1990s



1. For each country, industries are grouped according to the average size into small, medium and large size groups, and hazard functions are calculated separately for each of these three groups.

Source: OECD

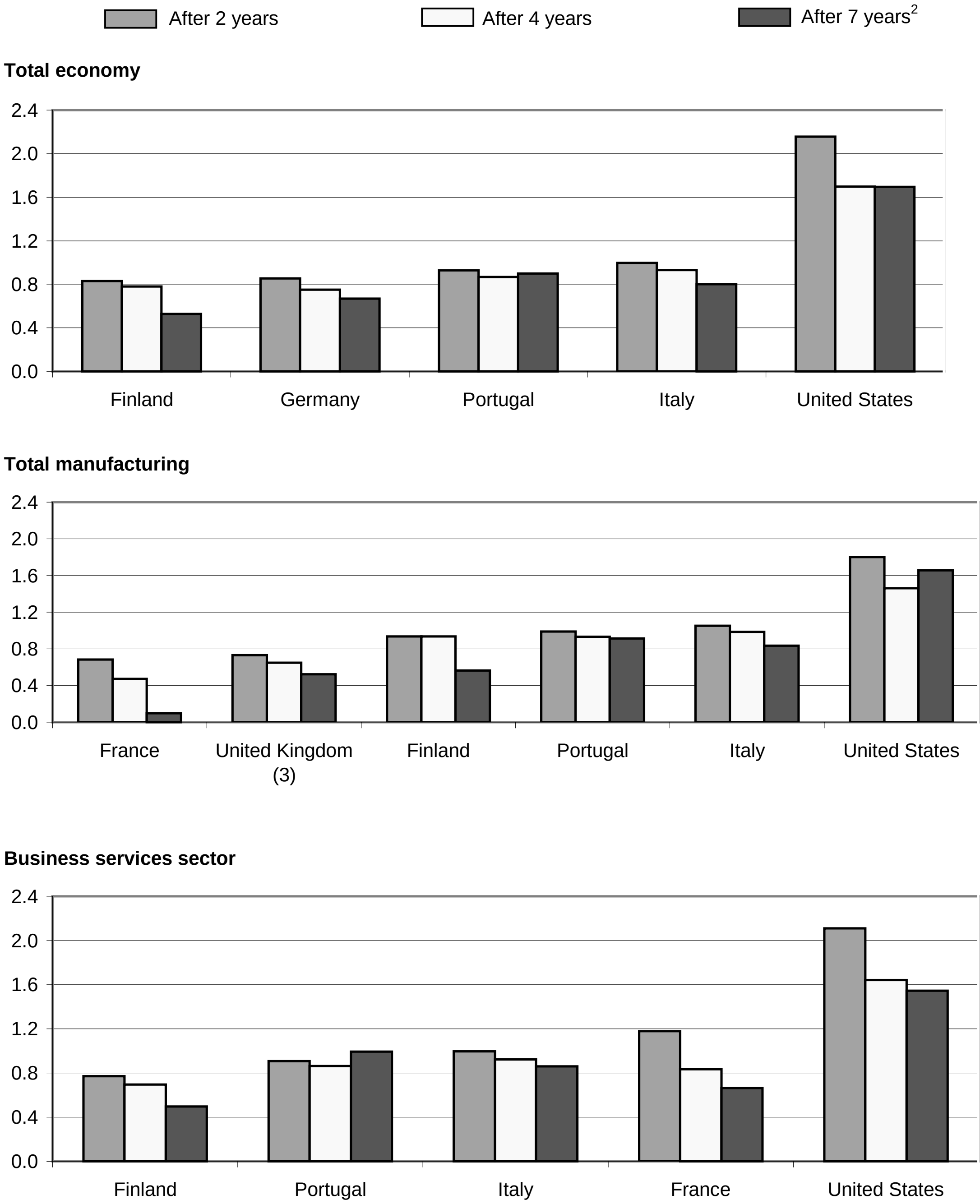
Figure 7. **Firm survivor rates at different lifetime[1], 1990s**



1. The survivor rate at duration (j) is calculated as the probability that a firm from a population of entrants has a lifetime in exess of (j) years. Figures refer to average survival rates estimated for different cohorts of firms that entered the market from the late 1980s to the 1990s.
2. After 6 years for the United Kingdom.
3. Data for the United Kingdom refer to cohorts of firms that entered the market in the 1985-90 period.

Sources: OECD, and Baldwin *et al.* (2000) for Canada.

Figure 8. **Employment-based survivor rates at different lifetime[1], 1990s**



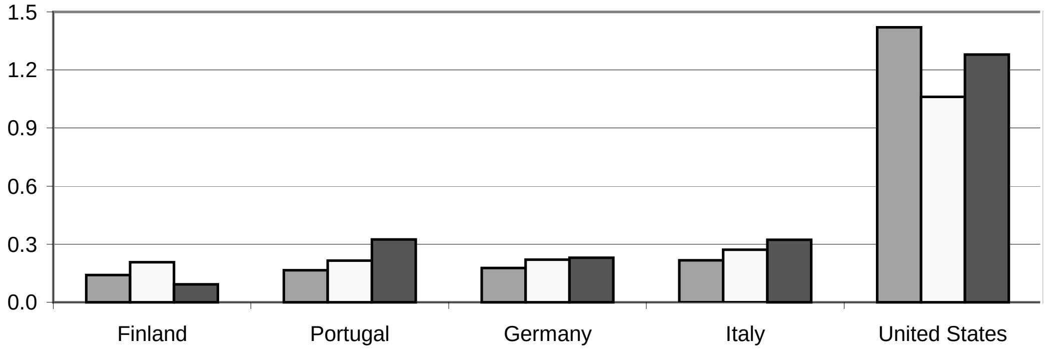
1. The survivor rate at duration (j) is calculated as the ratio of of the cohort's employment at age *j* over the cohort's initial employment. Figures refer to average survival rates estimated for different cohorts of firms that entered the market from the late 1980s to the 1990s.
2. After 6 years for the United Kingdom.
3. Data for the United Kingdom refer to cohorts of firms that entered the market in the 1985-90 period.

Figure 9. Net e**mployment gains among surviving firms at different lifetimes**[1]

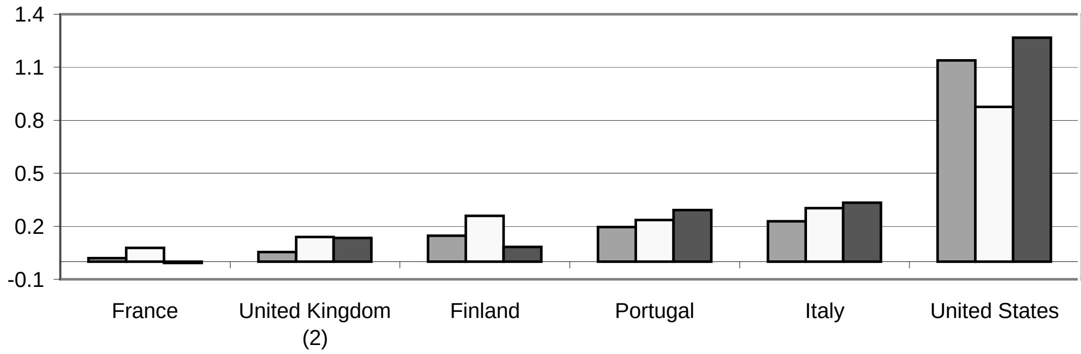
(net gains as a ratio of initial employment)

After 2 years After 4 years After 7 years[3]

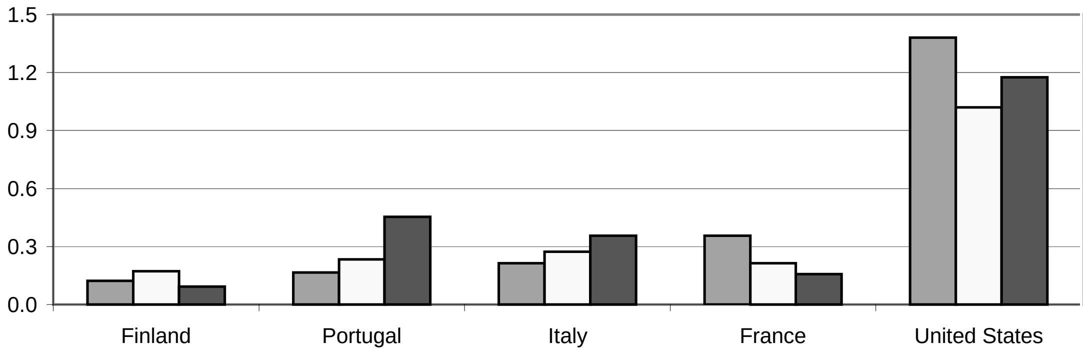
Total economy



Total manufacturing

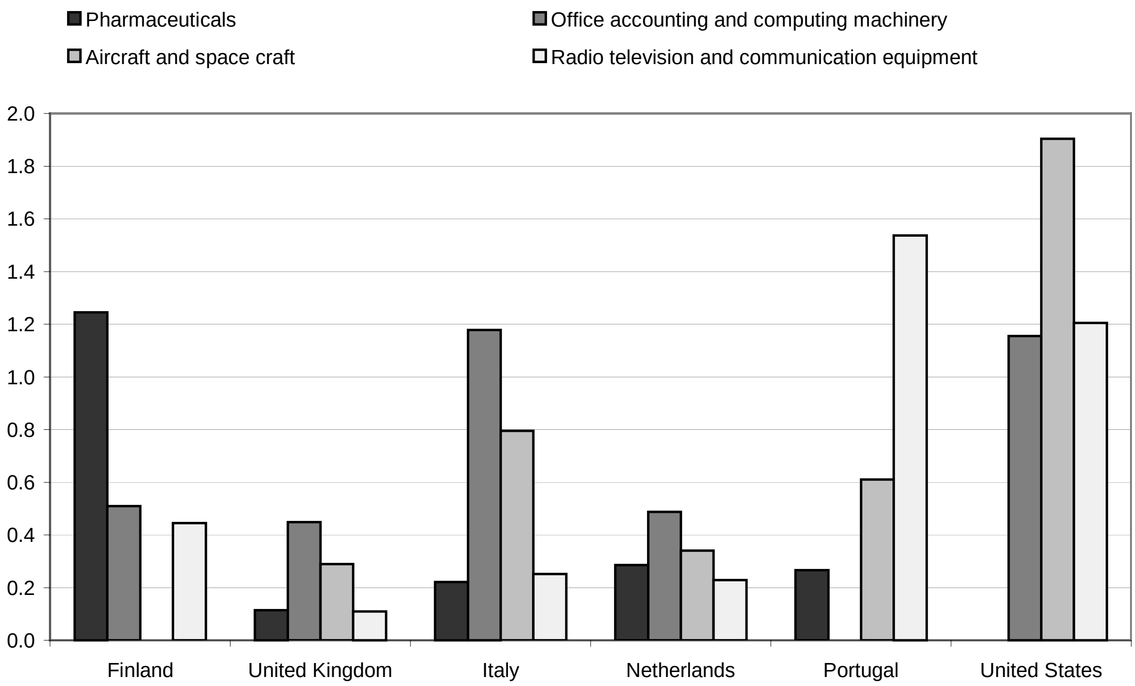


Business services sector



1. The net employment gains at the lifetime j is calculated as the percentage increase in employment of surviving firms with respect to their employment at entry.Figures refer to average net employment gains estimated for different cohorts of firms that entered the market from the late 1980s to the 1990s.
2. Data for the United Kingdom refer to cohorts of firms that entered the market in the 1985-90 period.
3. After 6 years for the United Kingdom.

Figure 10. **Net employment gains amongst surviving firms in high-tech industries, 1990s**
(net gains as a ratio of initial employment)



APPENDIX 1

Details on demographics data

The main characteristics of the demographics data used in this paper are in Annex Table A1. The following section provides supplementary notes for some countries.

France

The register for the manufacturing sector has expanded to cover an increasing number of businesses over time. In order to prevent this expansion being reflected as firm entries only a subset of the register data are used. As a result the employment figures for manufacturing in the data fall short of those from other sources; although of course they may well still be representative with regard to the productivity decompositions and analysis of firm demography.

Italy

There are a couple of issues worth noting about the nature of entries and the extent to which entries and exits reflect mergers and acquisitions. For entry, the date registered is when the first hiring occurs. Thus, for example, the 'entries' may reflect cases where (usually small) enterprises decide to employ individuals on an official basis. Mergers and acquisitions cannot be identified across the data as whole, but there has been some estimation of their importance in certain regions and sectors. According to some studies using INPS data for particular regions and periods: between 10 and 15 per cent of entry is a change of legal status, 20 per cent involves a substantial change of pre-existing firms, and 65-70 per cent is 'pure' entry (equivalent figures are likely to hold for exiting firms).

In addition, there are some minor problems in conforming to the OECD STAN sector classification. The INPS data are based on the Italian classification Ateco81: although most matches are accurate, some are more problematic. The Ateco81 sector 'Metals and machinery nec', is attributed to the STAN 'Machinery and Equipment nec'. The Ateco81 sector 'Measurement and Telecomm. Equipment', is placed in the STAN sector 'Communication Equipment'. Ateco81 330, which includes both the production and repair and maintenance of computing machines, is attributed to the STAN 'Office, accounting and computing equipment', even though in theory part of it should be attributed to business services.

The United Kingdom

The analysis of firm demographics for the United Kingdom uses data for the end of the time span covered (1989 to 1993). It should be noted that early years of the data show some large changes in the number of firms over time.[38] These are attributable to a variety of

38. For example, the total number of continuing firms falls from around 75 000 to 20 000 between 1982 and 1993 and increases to about 85 000 in 1986.

factors including register and changes in reporting unit. For the more recent years of available data the sectoral distribution of the firm-level data is considered representative. In aggregate terms the employment data from the UK micro data is slightly below the reported employment for UK manufacturing, and this is consistent over time.

Table A1 **Description of data used in analysis of firm demographics**

	Canada	Denmark	Finland	France	West Germany
Type of data ('Register', 'Sample', or 'Other')	Register	Register	Register	Register	Register
Name of data source(s)	Statistics Canada Business Register	Pay and performance database	Business register	Fiscal database ('BRN' file) with additional information from the Enterprise survey ('EAE' file)	Social security data
Comment on register or sampling method			There are some changes in the business register: i) coverage was improved in 1994 for small and very small enterprises, ii) some technical changes in 1995 and 1996, but the effects are not very large.	For technical reasons not all observations could be used in constructing the longitudinal data in the manufacturing sector with the result that employment figures in manufacturing implied in the data fall short of those from other sources.	
Unit of observation	Firm	Firm and plant	Firm and plant	Firm	Plant
Comment on unit of observation					
Periodicity and timing	Annual	Annual (end of November)	Annual: units, which have survived 6 months, at minimum, are included in the statistical business register.	Annual (end of year)	Annual
First year	1984	1980 (firm and plant data)	1988	1989	1978
Last year	1998	1994 (firm data) 1993 (plant data)	1998	1997	1998

Table A1 **Description of data used in analysis of firm demographics** (continued)

	Canada	Denmark	Finland	France	West Germany
Breaks			1994-1995, change in coverage (see above), and in 1995 and 1996		No
Size threshold	At least one employee	At least one employee	At least one employee	'BRN' file covers firms with more than 3.8 million FFr turnover per year in manufacturing and 1.1 million FFr turnover in the service sector are covered. EAE file	At least one employee. *Note*: the civil service, the self-employed and certain other groups are excluded from making social security payments and are not included in the data.
Does employment data reflect employees only or 'total' employment?	Employees		Employees		Employees
Sectoral coverage	All sectors	All sectors	All sectors	All sectors	All sectors (except civil service, see size threshold).

Table A1 **Description of data used in analysis of firm demographics** (continued)

	Italy	Netherlands	Portugal	United Kingdom	United States
Type of data (‘Register’, or ‘Sample’, or ‘Other’)	Register	Register	Register	Register	Register
Name of data source(s)	Social security data	General Business Register	*Quadros do pessoal* (administrative establishment-based database)	CSO Business Register [also known as the ACOP Respondents Database (ARD)]	Longitudinal Business Database Prototype (Source data is the SSEL with CES value added)
Comment on register or sampling method	All firms in the private sector with at least one employee	All firms are included	Public employees and private services to households not included		All taxpaying employer businesses (EINs)
Unit of observation	Firm	Firm	Firm and plant	Firm. *Note*: the units conform to Eurostat enterprise definitions and represent the lowest autonomous units within a company	Establishment and firm
Comment on unit of observation	Observations are legal entities registered with the social security agency.			Change in definition of reporting unit in 1987. Impact not considered to be large. In 1994: New register, moved to Eurostat enterprise definitions. Almost total break in data series.	Firm level data supplied
Periodicity and timing	Monthly	Monthly	Annual. March (1983-1993), October (1994-1998)	Annual (timing varies)	Annual

First year	1986	1987	1983	1980. *Note*: data in fact date back to 1973, but incomplete employment data until 1980)	1989
Last year	1994	1997	1994	1992. *Note*: 1994-1997 are based on a new register and cannot easily be linked	1996

Table A1 **Description of data used in analysis of firm demographics** (continued)

	Italy	**Netherlands**	**Portugal**	**United Kingdom**	**United States**
Breaks		1993: change in industry classification	1995: change in SIC code	1984: significant change in register (due to inclusion of VAT register). "One-year" category large due to incorrect classification between the registers 1987: change in definition of reporting unit, impact not great. 1994: new register, comprehensive linking not yet achieved	No
Size threshold	At least one employee	At least one employee	At least one employee	At least one employee. *Note*: smaller observations may be older due to restrictions to protect small firms	At least one employee
Does employment data reflect employees only or "total" employment?	Employees	Employees	Employees	Employees	Employees
Sectoral coverage	All sectors (see main text)	All sectors	All but public administration	Manufacturing only	Private businesses
Other relevant comments	See main text	Employment data only available from 1993 onwards		Data show some considerable variation between some years of data. Most likely explanations lie in the various breaks described above. Protection from reporting requirements for small firms may mean they are under-represented compared to other databases	

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