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BUSINESS DYNAMICS AND POLICIES

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INTRODUCTION

The creation of new businesses and the decline or market exit of less productive firms are often regarded as key to business dynamism and economic growth in OECD economies. New firms are thought to be especially innovative and to play an important role as job creators. Based on these ideas, policy makers often believe that institutions which foster firm entry may ultimately enhance the overall economic performance of their country. This study uses a new cross-country data set on firm entry and exit, growth and survival from Eurostat to take a closer look at patterns of business demographics across countries and at the relationship between regulation, firm entry and survival.

The data set from Eurostat employed in this study covers nine European Union countries[1] over the period 1998-2000. As a unique feature, the data are available at a very fine sectoral breakdown, particularly for Information and Communication Technology (ICT) related industries. The data therefore lend themselves to a close look at firm dynamics in younger industries, which have played an important role in driving technological change in recent years.

This study is organised as follows. The first section analyses patterns of firm entry across different countries and industries with a special emphasis on ICT-related sectors. A closer look at young firm survival and growth is taken in the second section.[2] The third section analyses the link between policies, firm entry and survival using OECD indicators which summarise aspects of countries' regulatory and institutional settings.[3] Conclusions and some policy considerations are presented at the end.

PATTERNS OF FIRM ENTRY

In accordance with the firm learning models discussed in Box 1, entering firms are generally very small. Figure 1 shows the average number of employees of entering firms derived from the Eurostat data and, as a comparison, the same measure calculated with data gathered earlier as part of an OECD firm level data project (Scarpetta *et al.*, 2002, Bartelsman *et al.*, 2003, OECD, 2004). While both data sets suggest that firms enter the market very small, the average entrant size is noticeably lower according to the Eurostat data for all of the countries investigated. It should be noted that the sample periods of the two data sets do not

Box 1. **Firm entry and exit in economic theory**

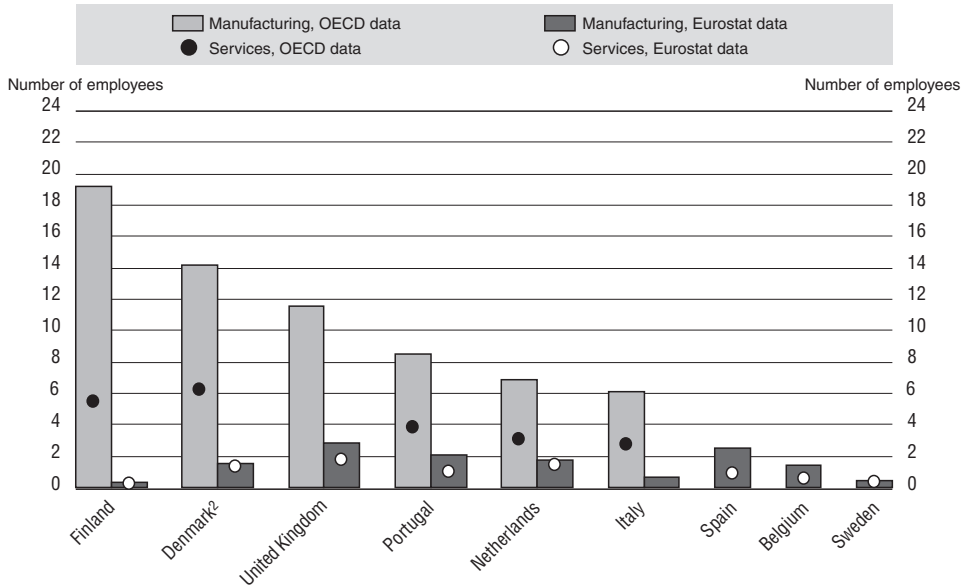
Firm entry and exit are ascribed an important role in theories that stress the process of "creative destruction" as a mechanism which facilitates innovation or new technology adoption, helping to shift resources from less productive units to more productive ones.

One class of Schumpeterian models focuses on the role of entrepreneurial learning under uncertainty. In the passive learning model (Jovanovic, 1982), entering firms can observe market incumbents' costs, but they have no knowledge about their own potential profitability. Upon investing the – unrecoverable – entry costs, they start to learn about the distribution of their profitability based on noisy information from realised profits. Drawing on this constantly updated learning process, new firms may decide in any one period to expand, contract or exit the market. The active learning model (Ericson and Pakes, 1995) is similar, but firms explore their economic environment actively. Faced with competitive pressure both within and outside the industry, they invest to enhance their profitability. Both potential and actual profits of each firm change over time as a result of its own investments, those of other actors in the economy and changes in the economic environment.

These models imply some testable characteristics of firm dynamics. Firm creation and destruction are part of a process of experimentation, where new firms first make their initial investments unsure of their potential success. Because of this initial uncertainty, firms do not start out positioning themselves at a unique optimal size, but they may decide to grow, once they have learned more about their chances of being profitable. The models of firm learning under uncertainty suggest that while many new firms may not survive for long, those who do should grow very fast to reach the average incumbent size. Approaching the minimum efficient scale, gaining experience and accumulating assets, successful survivors increase their chances of staying in the market over time. Both average firm growth and its variability, but also the likelihood of failure, should be expected to decrease with firm age and size according to firm learning models.

Some variants of vintage models of technological change stress the role of firm turnover for the adoption of new technologies. These models are based on the idea that new technology is often embodied in the most recent vintages of capital. These, however, do not only involve direct investment costs, but also costs of reorganising existing production processes and retraining workers to adopt the new technologies (see *e.g.* Solow, 1960; Cooper, Haltiwanger and Power, 1997). Some variants of these models ascribe to new firms an important role in the process of technology adoption (Caballero and Hammour, 1994; Campbell, 1997), because unlike incumbents they do not have to retool their production processes when implementing new technologies. Entering firms that replace outpaced incumbents thus play a crucial role in productivity growth. Related to these ideas are creative destruction models of economic growth (Aghion and Howitt, 1992), according to which new firms play a crucial role in developing innovations. Innovators replace old firms and earn monopoly profits until a new innovation comes along. At this point, the knowledge underlying the rents becomes obsolete.

Figure 1. **Average size of entering firms – Eurostat vs. OECD data**[1]
Average number of employees per firm



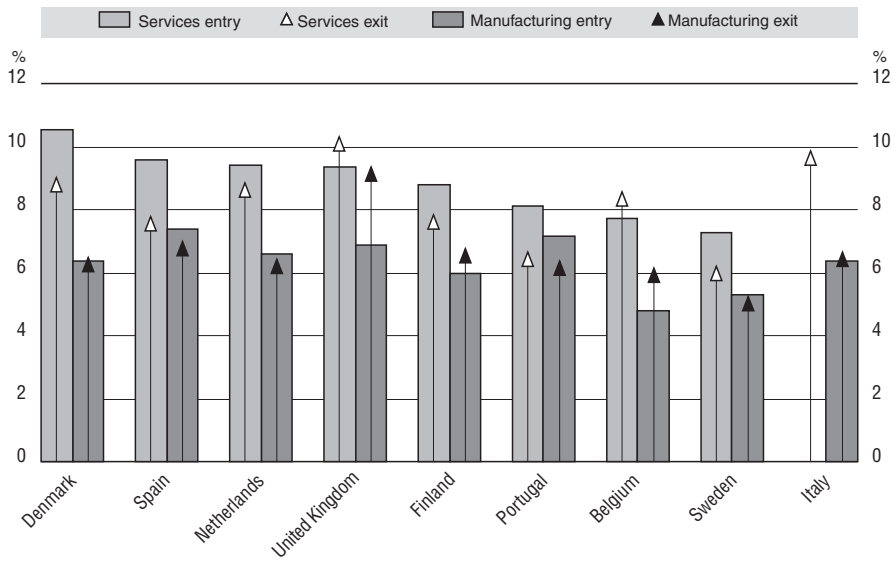
1. While the Eurostat data cover 1998-2000 for most countries, in some cases one of the years is missing. The longest available sample period in the 1990s has been used to calculate average entrant size with the OECD data. The sample period reaches 1998 only for Finland and Portugal.
2. The average firm size for Denmark is based on total employment rather than on the number of employees to match the OECD data, which is based on total employment for this country.

Source: Eurostat; OECD firm-level data project .

overlap for the majority of countries. However, the characteristics of the two data sets also differ concerning size thresholds, as the Eurostat data includes zero-employee firms while the OECD data does not, and the concept of firm entry regarding mainly the distinction between genuine firm births and deaths and demographic events involving third parties, such as take-overs, mergers and acquisitions.[4] Yet, despite the different data characteristics, the qualitative result that firms enter small remains the same across the two data sets. This lends some support to the models discussed in Box 1, indicating that firm entry is part of an experimentation process, where firms confronted with uncertainty enter small, expanding later if they turn out to be profitable.

A large number of firms are involved in the process of firm turnover (the sum of firm entry and exit). In the manufacturing sector between 5 and 7 per cent of all

Figure 2. **Firm entry and exit rates in selected EU countries**[1]
Average over 1998-2000

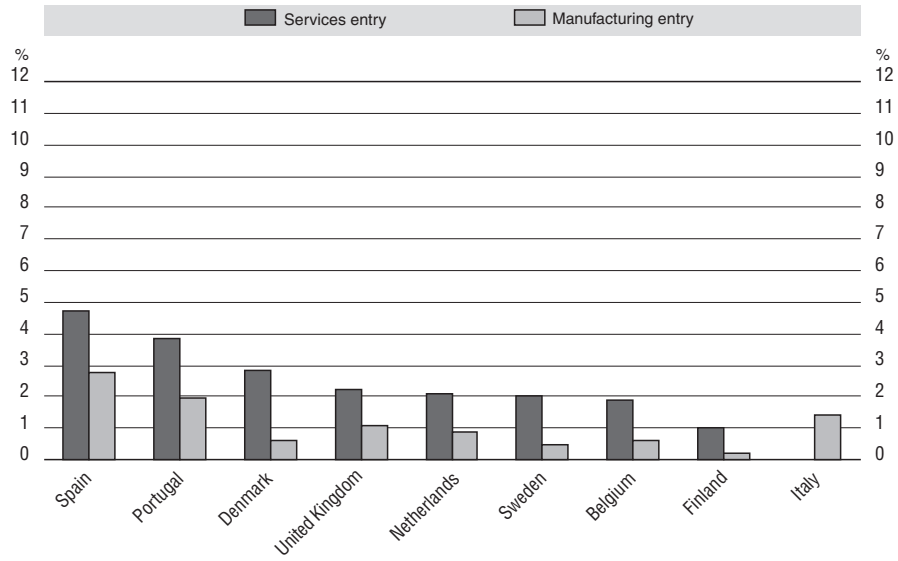


1. Entry and exit rates are calculated as the number of entering and exiting firms, respectively, as a proportion of the total number of firms in the same sector in a given year.
Source: Eurostat.

firms are new to the market on average every year (Figure 2). Exit rates vary in a similar range. Both firm entry and exit rates tend to be higher in services than in manufacturing industries. While there are some differences in firm entry and exit across countries, these do not seem large.

Reflecting the small average size of entrants relative to incumbents, job creation rates associated with firm entry are significantly lower than firm entry rates. The number of persons employed in firms created the same year amounts to less than 1 per cent of total employment in Finland (Figure 3). For most other countries, job creation associated with firm entry is well below 3 per cent of total employment on average, reaching a maximum of only 4.7 per cent in Spain. Job creation rates are calculated as total employment in entrant firms in relation to overall employment in their sector. Unless there are large and systematic differences between entrants and incumbent firms concerning their part-time employment, the comparability of job creation rates associated with entry should not be affected too much by the fact that the employment data for Finland, Denmark and the Netherlands are based on full-time equivalents.

Figure 3. **Job creation rates associated with firm entry**[1]
Average over 1998-2000



1. The job creation rates associated with entry are calculated as the total employment in entrant firms as a percentage of total employment in all active firms. The data for Finland, Denmark and the Netherlands are based on full-time equivalents.
Source: Eurostat.

Studies on firm dynamics consistently reveal that high rates of firm entry and exit coincide at all times even within narrowly-defined sectors of the economy. Entry and exit rates are positively correlated across industries, as can be seen in Table 1. This correlation is high and significant in all of the countries investigated. Figure 2 suggests that net entry accounts for only a tiny fraction of gross entry and exit rates. This also holds for more narrowly-defined sectors of the economy. As a result of this, changes in the total number of active firms are generally small despite high rates of gross entry and exit. This finding defies the hypothesis that firm entry and exit occur as a response to profits attainable in a market. According to that interpretation, supra-normal profits should prompt market entry, while firms should exit from markets where profitability does not reach normal market rates. However, if this was the main driving force of firm turnover, it should have a sizeable effect on the total number of firms active in a market. Firm entry and exit should be negatively correlated in that case. Rather than occurring primarily as a response to sub- or supra-normal profits, firm turnover seems to be part of a

Table 1. **Correlation between entry and exit rates across 63 industries**
Average entry and exit rates, 1998-1999

	Correlation	t-statistic	Observations
Denmark	0.81***	10.98	64
Finland	0.65***	6.65	64
Belgium	0.52***	4.36	54
Netherlands	0.65***	6.77	64
Sweden	0.39***	2.95	49
Spain	0.50***	2.88	27
Portugal	0.60***	5.93	64
Italy	0.78***	9.48	61
United Kingdom	0.70***	7.77	64

*** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.
Source: OECD calculations based on Eurostat data.

process of search and experimentation. This is in line with theories of firm learning under uncertainty discussed above.

To explore the influence of countries' industry composition, firm entry rates from the Eurostat dataset have been analysed with a regression technique that helps measure differences in average entry rates across different industries and different countries at the same time. The technique thus controls for countries' specific industry composition when comparing their average firm entry rates. This is achieved by estimating industry and country-specific constants, referred to as "fixed effects". Industry fixed effects help assess sector-specific entry patterns, while controlling for countries' industry composition. The estimated country fixed effects capture cross-country differences in entry rates that remain after the sectoral structure has been taken into account. For the interpretation of the results, it is important to keep in mind that the fixed effects do not measure the average entry rate in an industry or a country. For technical reasons, they measure its difference from the average entry rate in a reference sector or a reference country, respectively.

Results of entry rate regressions are shown in Table 2.[5] The dependent variable is the industry firm entry rate. In the manufacturing sector, the entry rate data cover in most cases the sub-section industry level. However, for a few sub-sections further detail is available, allowing for a closer look at narrowly-defined sectors related to ICT, *e.g.* detailed computer services industries and manufacturing of office machinery and computers.

Panel I of Table 2 shows the estimated country fixed effects stemming from a regression, where an output gap variable is included to capture the influence of the business cycle and time dummies control for non-cyclical macro shocks. The results have to be interpreted in relation to Denmark, which is the reference for

Table 2. **Entry rate regression**[1, 2]

Dependent variable: entry rate of industry j in country i estimated over 1998-2000; fixed effect estimator

	I	II
	With an output gap variable	Also ICT-specific country effects
Constant	7.26***	6.14***
	(0.89)	(0.85)
Finland	–2.18***	–0.94*
	(0.50)	(0.50)
Belgium	–2.45***	–1.49**
	(0.65)	(0.63)
Netherlands	–0.76	0.15
	(0.46)	(0.48)
Sweden	–2.88***	–0.93
	(0.68)	(0.66)
Spain	0.66	1.60**
	(0.84)	(0.80)
Portugal	–1.74***	–0.09
	(0.48)	(0.48)
Italy	0.32	1.36*
	(0.74)	(0.72)
UK	–1.33	0.28
	(0.59)	(0.58)
ICT effects by country:		
Finland		–7.91***
		(1.05)
Belgium		–6.14***
		(1.06)
Netherlands		–5.76***
		(1.17)
Sweden		–12.42***
		(1.09)
Spain		–0.94
		(2.44)
Portugal		–10.50***
		(1.05)
Italy		–6.55***
		(1.05)
UK		–10.24***
		(1.05)
DUM99	–1.42***	–1.42***
	(0.27)	(0.26)
DUM2000	–1.94***	–1.93
	(0.38)	(0.36)
GAP	0.38*	0.39**
	(0.21)	(0.20)
Adjusted R^2	0.59	0.63
No. of observations	1 516	1 516

1. The reference group is the food, beverage and tobacco industry in Denmark.
2. Standard errors in parentheses.
*** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.
Source: OECD estimations based on Eurostat data. Output gap variable from OECD (2002).

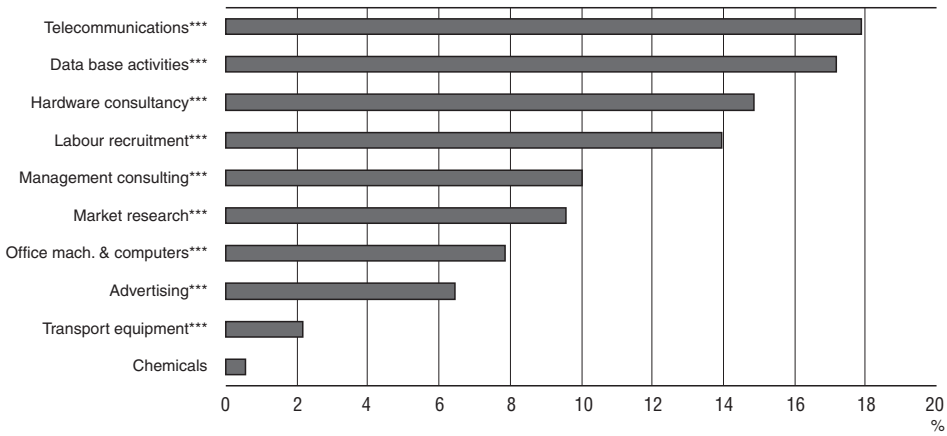
this estimation. The reference sector is the food, beverages and tobacco industry. Accounting for industry, country and time-specific effects, explains more than 50 per cent of the variation in entry rates. Fixed effects for four countries, Belgium, Sweden, Finland and Portugal are estimated to be negative and statistically significant. Thus, once the industry composition is taken into account, these countries seem to have lower firm entry on average than Denmark. To give a more concrete example, the country fixed effect of Sweden has to be interpreted in the following way: after accounting for differences in industry composition, the number of new firms in relation to all active firms is on average 2.88 percentage points lower in Sweden than it is in Denmark.[6] In contrast, country fixed effects for the Netherlands, Spain and Italy are insignificant.

To highlight some sectoral patterns of entry rates, Figure 4 displays fixed effects for some selected sectors.[7] They measure how much average entry rates in these industries differ from those in the food, beverages and tobacco industry after systematic cross-country differences have been taken into account with country fixed effects. Industry fixed effects are generally small and insignificant in the manufacturing sector, indicating that they do not differ much from those in the food and beverages industry. A notable exception is the office machinery and computers industry, where entry rates are on average almost 8 percentage points higher than in the reference sector (Figure 4). Entry rates are generally larger and significant in services industries. ICT-related industries, such as telecommunications and computer services, consistently stand out as having particularly large entry rates regardless of the specification of the estimation equation. Firm birth rates are also particularly high in some business services, such as labour recruitment and provision of personnel as well as management consulting.

The high birth rates in ICT-related industries fit into the findings of product life-cycle studies, which suggest that firm entry should be particularly high in young industries. Earlier studies of firm demographics have shown that while there are differences in firm turnover between industries, these often do not persist for long (Geroski, 1995). Micro studies covering specific products or markets suggest that entry and exit vary over the product life cycle. After commercial introduction of a new good, there tend to be high rates of firm creation. Net entry levels off after approximately a decade. This is often followed by a contraction phase at later stages of the product life cycle, during which more firms exit than enter the market (Gort and Klepper, 1982).

The high entry rates in ICT-related industries can also be interpreted as supportive evidence for vintage models of technological change as well as economic growth models which stress the importance of creative destruction for innovation. These theories imply that innovative activity and new technology adoption are associated with higher firm churning, as new and innovative units replace outpaced ones.

Figure 4. **Entry rate regressions: fixed effects for selected industries**[1]



1. The fixed effects shown in this graph measure the difference between the average entry rate in an industry and that of the reference sector, the food, beverages and tobacco industry. As an example, the estimated fixed effect of 17.9 per cent in telecommunications means that entry rates in this industry are on average 17.9 percentage points higher than in the reference sector.
*** indicates significance at the 1% level, ** at the 5% level and * at the 10% level, where the significance level corresponds to the probability that the hypothesis of the fixed effect being zero is rejected on the basis of the statistical test, when it is really true.

Source: OECD estimations based on Eurostat data.

To take a closer look at the characteristics of these sectors, the estimation was also performed with country-specific effects for ICT-related industries. Estimation results displayed in Panel II of Table 2 reveal that a sizeable part of Denmark's lead is in fact due to particularly high entry rates in ICT-related industries. Most of the estimated country fixed effects become insignificant or even positive and significant, once differences in terms of firm entry in these young and dynamic sectors are taken into account. With the exception of Spain,[8] the ICT-industry effects are statistically significant and negative for all countries. They are very large in absolute size when compared with the overall country fixed effects, and they differ considerably across countries.

Country fixed effects, although not large in any case, are quite sensitive to the specification of the estimation equation.[9] The fixed effects do not only change size, but even the ranking of countries in terms of entry rates is altered depending on the specification. Industry fixed effects are a lot larger in absolute size and they differ considerably more amongst each other than the country fixed effects. Regardless of the specification of the estimation equation, the general results concerning industry fixed effects remain robust. They are generally small and

insignificant in manufacturing industries, but larger and significant in services. ICT-related industries and some business services consistently stand out as having particularly high entry rates.

It could be argued that the moderate cross-country variation of entry rates might be a special feature of the group of countries investigated in this paper, which have all been subject to legislation related to the European Union and do not differ too much in terms of policies and institutions amongst each other. Yet, the OECD firm level data project which includes non-European countries, such as Canada and the United States, reveals equally moderate cross-country variation of entry and exit rates.

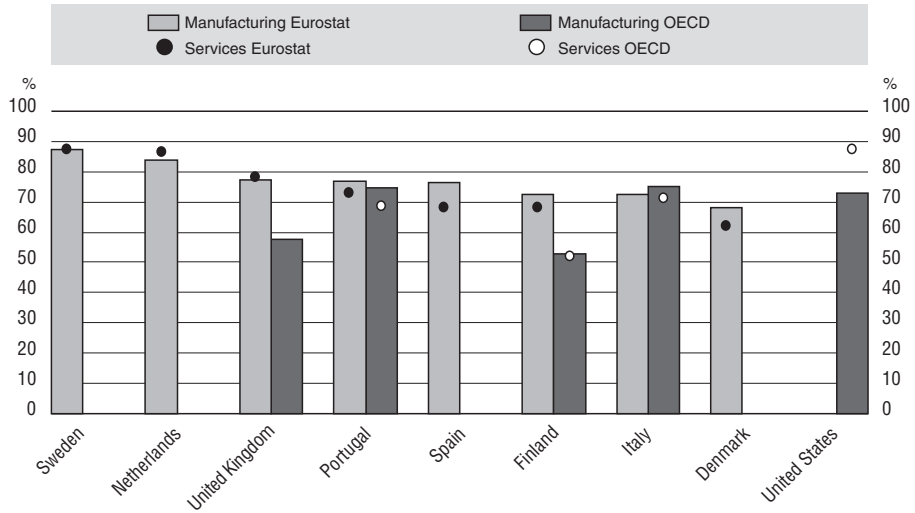
Since entry and exit rates are highly correlated, the results of exit rate regressions essentially mirror those for entry rates (Brandt, 2004a). However, the industry fixed effects of the young and dynamic industries are much higher in the entry than in the exit rate regressions, implying that these industries are expanding. The observed high correlation between entry and exit rates may be due to new and innovative firms mainly driving old and outpaced ones out of the market. However, it may also simply be a result of high "infant mortality" among start-up firms. This raises the question how long newly-created firms survive.

SURVIVAL AND GROWTH

It is a frequently reported finding in the firm demographics literature that most new firms do not survive for long. Chances of survival are especially low for firms that start small, as they usually do. Unfortunately, the Eurostat series are not long enough to study firm survival over a longer period of time. However, two-year survival rates for firms born in 1998 do confirm that there is a high risk of newly-created firms being forced to exit the market rapidly. Survival rates correspond to the number of firms of the same cohort that have survived a given number of years as a percentage of all firms that entered the same year with them. Figure 5 shows that according to the Eurostat data, in most countries between 12 and 38 per cent of all new firms had failed already after the first two years, as the survival rates vary roughly between 88 and 62 per cent. The Eurostat data suggest that survival rates are particularly high in Sweden and the Netherlands, where they reach almost 90 per cent.

Figure 5 also includes average two-year survival rates from the OECD firm-level data project. While these estimates confirm the general result that the probability of death in early life is high, the estimated two-year-survival rates differ quite substantially across data sets for some countries. It should be kept in mind, however, that, apart from the data differences mentioned before, the OECD data cover a considerably longer time period, including both economic upturns and downturns for a number of countries. In addition to this, they do not overlap with

Figure 5. **Firm survival**[1, 2]
Average two-year survival rates



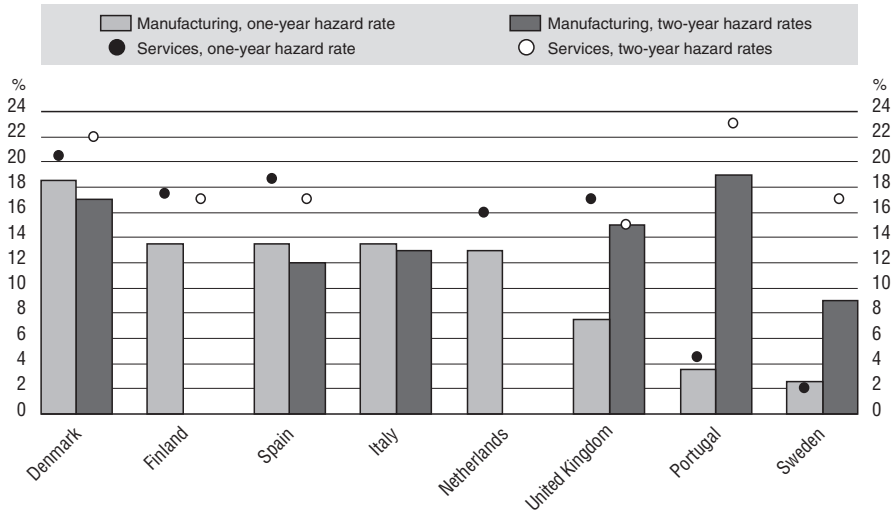
1. Survival rates in this figure are measured as the number of firms surviving at least until two years after entry as a share of all firms that entered the same year with them.
2. The Eurostat data concern firms that were born in 1998. OECD data refer to average survival rates estimated for different cohorts of firms that entered the market from the late 1980s to the 1990s.

Source: Eurostat; OECD firm-level data project.

the sample period covered by the Eurostat data for most countries. This may account for some of the differences in results. Moreover, Bartelsman et al. (2003) were able to study longer term survival. Their results show that conditional on surviving the first two years, prospects of survival seem to improve a little bit after this. Firms that remained in business after the first two years had a 50 to 80 per cent chance of surviving five more years. Yet, depending on the country, only 30 to 50 per cent of entering firms in a given cohort survived more than seven years.

Firm survival can also be assessed on the basis of hazard rates, which correspond to the conditional probability of leaving the market after a certain life span. These are calculated as the share of exiting firms in the number of survivors of the same cohort as of the previous year. While survival rates decline with firm age by construction, *a priori* there is nothing that precludes hazard rates from being comparable at different durations. Thus, hazard rates for different firm ages are more appropriate to be pooled for econometric analysis than survival rates. One- and two-year hazard rates shown in Figure 6 reveal that while entry rates tend to be

Figure 6. **One- and two-year hazard rates**[1, 2]



1. Hazard rates are calculated as the share of exiting firms in the number of survivors of the same cohort as of the previous year.
2. One-year hazard rates are averages for the cohorts born in 1998 and 1999. Two-year hazard rates are available for the cohort born in 1998 only.

Source: Eurostat.

higher in services than in manufacturing, the risk that these new firms have to exit the market early in life is higher in services, as well.

In the hazard rate regression (Table 3), very few industry fixed effects are significant. This indicates that industry characteristics are less important for young firms' prospects to survive than for entry and exit. In fact, the cross-country variation of hazard rates within each industry is significantly higher than it is for birth rates. Country-specific ICT-industry effects are not significant either, implying that although firms in these industries are exposed to a lot of turbulence, the risk of failure for very young firms in these sectors does not seem to differ a lot from that in other industries, or at least not in any systematic way across countries. Table 3 therefore shows only regression results without these dummies. Denmark is the reference country and the food, beverages and tobacco industry is the reference sector as in the entry rate regression.

The estimated country fixed effects are significantly negative for all countries. This implies that while entry is comparatively high in Denmark, especially in ICT-related industries, so is infant firm mortality. As Figure 5 suggests, the risk of

Table 3. **Firm survival: Hazard rate regressions**[1, 2]

Dependent variable: hazard rate of industry j in country i at different durations, 1999-2000, fixed effects estimator

	I	II
	With an output gap variable	Country-specific duration effects
Constant	21.44***	21.46***
	(1.70)	(1.62)
Finland	–6.47***	–6.24***
	(0.73)	(0.86)
Netherlands	–3.76***	–4.97***
	(0.95)	(0.92)
Sweden	–18.82***	–19.98***
	(1.05)	(1.10)
Spain	–9.46***	–7.10***
	(1.34)	(1.41)
Portugal	–13.56***	–17.41***
	(0.83)	(0.89)
Italy	–11.05***	–8.61***
	(1.44)	(1.45)
UK	–14.34***	–14.95***
	(1.11)	(1.14)
Duration:		
Two-year-dummy	5.69***	
	(0.44)	
By country:		
Denmark		1.57*
		(0.94)
Finland		2.31**
		(1.03)
Sweden		8.37***
		(0.98)
Spain		–0.82
		(1.38)
Portugal		15.45***
		(0.93)
Italy		0.19
		(0.94)
UK		7.47***
		(0.93)
GAP	–1.83***	–1.24***
	(0.39)	(0.38)
Adjusted R^2	0.43	0.51
No. of Observations	1 271	1 271

1. The reference group is the food, beverage and tobacco industry in Denmark.
2. Standard errors in parentheses.
*** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.
Source: OECD estimations based on Eurostat data. Output gap variable from OECD (2002).

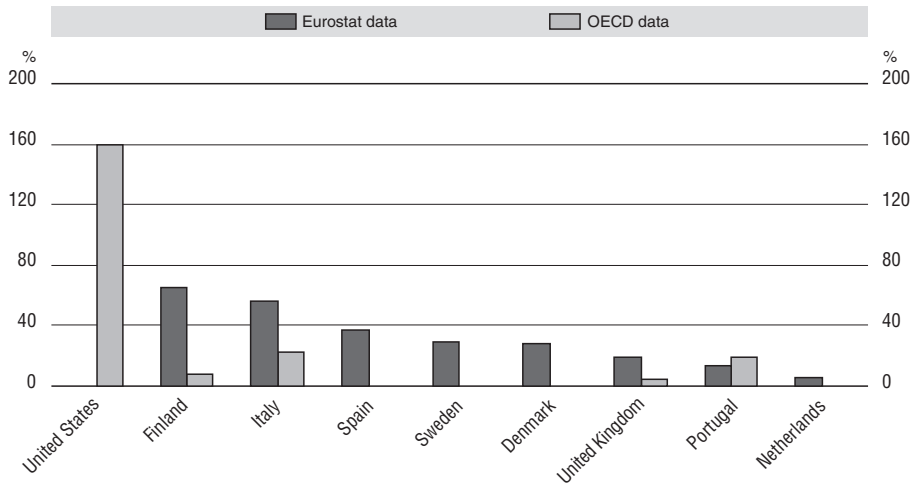
failure for young firms is especially low for Sweden. The country fixed effects in the hazard rate regression are significantly larger in size than in the entry rate regression and they vary considerably across countries. The output gap variable is significantly negative, indicating that in booming economies young firms face lower risks of failure.

Countries with relatively low entry rates tend to have low hazard rates as well and *vice-versa*. This could be interpreted tentatively as a pre-entry selection process taking place in countries where entry and exit barriers are high. In countries with low barriers, firms may be more prone to try and enter the market with little information, to discover their own profitability thereafter, exiting again when they turn out to be unprofitable. By contrast, firms may invest more in gathering information about market conditions, competitors and their own potential profitability prior to entering the market in countries where entry and exit is costlier. Firms which find out that they have little chance of survival might often refrain from entering the market, causing both lower entry and higher survival rates than in countries where trial and error is less costly. At the same time, the pattern of cross-country variation in entry and hazard rates identified in this paper might be related to different risk tolerance in different countries.

The estimated fixed effects for the two-year hazard rates indicate that the risk of failure is higher in the second year than in the first. This type of "honeymoon" effect has also been identified in Bartelsman *et al.* (2003) for the United States, and to a lesser degree for Italy and manufacturing in the United Kingdom. Similarly, Wagner (1994) found with a panel of German firms that hazard rates increase in the early years and decrease non-monotonically thereafter. Equation II estimates this effect separately for each country. As it turns out, it is not significant in Spain and Italy and only weakly so in Denmark, while it is large and significant in the United Kingdom, Portugal and Sweden.

Many studies have found that those firms that do survive generally grow very fast. The time period covered by the Eurostat data is too short to study the growth of new firms thoroughly. However, it does allow for a look at two-year employment gains to get a first impression. Figure 7 compares two-year growth rates of new firms for the Eurostat data and the OECD firm-level data. Growth is defined as total employment in all firms that have survived two years as a percentage of total employment in those same firms when they entered two years earlier. This means that the employment growth of each firm is weighted by the relative size of this firm in terms of initial employment, accounting for the concern that it is of course easier for small firms to experience very fast growth rates, since they start from a lower base. According to the Eurostat data new firms increased their employment by between 20 and 70 per cent in most countries in the first two years of their life. The earlier OECD firm-level data project suggested that new firms in the United States even grew by more than 160 per cent on average.

Figure 7. **Two-year employment gains of surviving firms**[1, 2, 3]
OECD vs. Eurostat data



1. The data report net employment gains as a percentage of initial employment.
2. Data for the United Kingdom, the Netherlands and Italy cover the manufacturing sector only.
3. OECD data are averaged across different cohorts born in the 1990s, while Eurostat data cover the cohort born in 1998 only.

Source: Eurostat; OECD firm-level data project.

Partly, the fact that the Eurostat data suggest higher new firm employment gains for Finland, Italy, and the United Kingdom than the OECD data can probably be explained by the exclusion of single person firms from the latter. It is a frequently documented finding that smaller firms tend to grow faster, and in many studies this is also found to be true when employment growth rates are somehow weighted with firm size. Consequently, not covering the smallest firms is likely to result in lower estimated growth rates. Moreover, some of what is identified as new firm growth with the OECD firm level data may be due to younger firms merging with other enterprises. Earlier research on firm growth suggests that whether or not mergers and acquisitions can be distinguished from genuine firm growth may have substantial effects on results (Schreyer, 2000). In a Swedish panel of firms analysed in that study, only one-third of employment gains of a set of high-growth firms is due to internal growth, the rest being a result of mergers and acquisitions and related demographic events.

The analysis in this section, although only tentative due to a short time horizon of the data, suggests that there are considerable cross-country differences in new firm survival and growth. In particular, small new firms face a higher risk of failure.

Yet, if they do survive, they grow quickly and approach the average incumbent's size. These findings fit well into the theories of firm learning discussed in Box 1, if some scale effects are assumed to be present. Faced with an uncertain environment, firms enter at a smaller than optimal size. These young and small entrants have to grow fast to reach the minimum efficient scale. Before they have done so, they face a high risk of failure. Older firms that have already reached the minimum efficient scale are less likely to fail. The next section takes a closer look at the role of policies and institutions for firm entry and survival.

THE ROLE OF REGULATION FOR FIRM ENTRY AND SURVIVAL

While the cross-country variation in entry rates is moderate in general, as discussed above, it is quite considerable in ICT-related industries. This could suggest that policies and institutions might be more important for these young and dynamic sectors than for more mature ones. To gain further insights into this issue, this section investigates the relationship between the cross-country variation of firm entry and hazard rates with indicators summarising aspects of the regulatory framework. The OECD has developed product market regulation indicators summarising aspects of state control, barriers to entry, as well as barriers to trade and investment (for a detailed description, see Nicoletti *et al.*, 1999).[10] These indicators are themselves composed of more detailed indicators, ranking countries on a scale from 0 to 6 increasing with the stringency of regulation in different fields. The overall product market regulation indicator and its component which captures administrative barriers for start-up firms were found to have a negative impact on firm entry in an earlier OECD study (Scarpetta *et al.*, 2002). This section takes a closer look at the most detailed level of regulation indicators. It is important to note that these indicators summarise the stringency of regulation and institutional settings in or around 1998. While this is appropriate for the time period covered by the firm entry data, it does not necessarily reflect the stringency of regulation today, as a number of countries have made considerable efforts to reduce regulatory burdens and make business start-up procedures more transparent and easier.

A number of the regulatory indicators appear to have a significant impact on firm survival when they are included into regressions on industry hazard rates. Yet, standard errors are likely to be biased downwards when the effects of aggregate explanatory variables on individual-specific response variables are estimated (Box 2). When applying a more conservative two-step estimation method that essentially ignores the industry and the time dimension of the entry data, none of the estimated coefficients measuring the relation between regulation indicators and hazard rates are significant (Table 4). At the same time, it should be kept in mind that the estimation method used to obtain the results presented in Table 4 involves a high probability of finding no significant impact of a country level

Box 2. **Estimating the impact of regulatory variables on firm entry**

One difficulty in trying to assess the impact of aggregate country regulatory indicators on industry firm entry and hazard rates consists in obtaining valid standard errors. Moulton (1990) demonstrated that standard errors can be seriously biased downwards when the effects of aggregate explanatory variables on individual-specific response variables are estimated.

To obtain valid standard errors, an estimation procedure along the lines proposed by Bertrand *et al.* (2003) is applied, which consists of regressing industry firm entry rates on industry and time dummies and on country-specific ICT industry dummies in the first step to account for the cross-industry variation of entry rates and for specifics of the ICT sector. The residuals of this estimation are aggregated within groups (in this case countries) and regressed on different regulatory indicators in the second step. Because of the inclusion of country-specific ICT industry effects, the residuals of the first step estimation should mainly capture the cross-country variation of entry rates in non-ICT-related sectors. Country dummies are not included in the first step estimation because the idea is that the regulatory variables should "explain" the observed cross-country variation in entry and hazard rates in the second step. To examine the impact of policies and institutions on entry rates in ICT-related sectors, corresponding two-step estimations are applied to the group of ICT-related industries separately and to all industries, yet without including country-specific ICT industry effects in the first step, thus allowing the regulatory variables to "explain" the remaining variation in the second step, where the residuals are averaged by country only across ICT-related industries.

This method has been shown to perform well even when the number of groups is small. Its downside is that its power against the alternative is low and diminishes fast with sample size. In other words, it is quite likely that no statistically-significant impact of the regulatory variables can be found with the two-step estimation method, although regulation does have an impact. Another problem is that the small number of countries for which comparable entry data are available precludes estimating the influence of different explanatory variables at the same time and thus assessing their relative importance and their interaction appropriately.

As a robustness check, and to visualise the relationship between the cross-country variation of entry rates and aspects of regulation, an alternative two-step method based on an approach described in Wooldridge (2003) is applied as well. In the first step, industry entry rates are regressed on industry dummies, on country-specific ICT industry dummies and – diverging from the approach explained above – on country dummies. Since the country-specific ICT industry effects capture the cross-country variation of entry rates within this sector, the country fixed effects measure mainly the cross-country variation of entry in non-ICT-related industries. Therefore the approach allows for a distinction between the cross-country variations of entry rates within ICT-related industries on the one hand and within non-ICT-related industries on the other, potentially yielding some interesting insights into whether policies influence firm entry rates differently across different groups of industries. The country fixed effects and the country-specific ICT industry effects are related to the regulatory indicators to assess whether these can explain some of the observed cross-country variation of entry rates among the ICT-related and the non-ICT-related industries.

Table 4. **Firm entry rate regressions on indicators summarising aspects of barriers to entrepreneurship**[1, 2, 3]

Firm entry rates for manufacturing and services industries, 1998-2000

	Domain	Sub-domains		
	Barriers to entrepreneurship	Administrative burdens on start-up firms	Regulatory and administrative opacity	Barriers to competition
Entry rates	–0.34	0.12	–0.51**	0.01
	(0.46)	(0.25)	(0.16)	(0.62)
Hazard rates	1.01	0.53	–0.39	2.28
	(2.51)	(1.23)	(1.37)	(2.82)

1. A two-step estimation method described in Bertrand *et al.* (2003) is applied. The first step is an estimation of industry firm entry rates on industry and time dummies and on country-specific ICT industry dummies. The resulting error terms are then averaged for each country across industries and regressed on each indicator separately.
2. Standard errors in parentheses.
3. The estimations are based on nine observations for entry rates and eight for hazard rates.

*** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

Source: OECD calculations based on Eurostat firm entry data and indicators from the OECD regulatory database.

variable even when it really does influence entry or hazard rates. However, with the available data, employing this method is the best that can be done.

The aggregate "barriers to entrepreneurship" indicator is insignificant (Table 4), while among its components, only the indicator summarising regulatory and administrative opacity has a significantly negative impact on entry rates. A failure to find a significant impact of the indicators summarising administrative burdens on start-ups and barriers to competition may in some cases be related to the fact that they are themselves aggregates of a number of sub-indicators, the influence of which may have been obscured by aggregation. Therefore, the statistical impact of each of the sub-indicators is analysed separately. Results for some of those detailed indicators that were found to have a significant impact are summarised in Table 5.

The estimates presented in Table 5 reveal that the regulatory and administrative opacity indicator seems to be significant mainly because of its component summarising the stance of regulation concerning licenses and permit systems. This indicator scores countries depending on the transparency and simplicity of their license and permit system, which is judged based on the existence of one-stop-shops for information on and issuance of licenses and notifications. Another criterion is the existence of the "silence is consent rule" (licenses are issued automatically if the competent licensing office has not acted by the end of the statutory response period). The second component of the regulatory indicator is the country score describing the communication and complexity of rules and procedures. The scores are based on how easily citizens can obtain information on regulation and on whether or not governments have

Table 5. **Firm entry rate regressions on indicators summarising aspects of barriers to entrepreneurship II**[1, 2, 3]

Firm entry rates for manufacturing and services industries, 1998-2000

	Licenses and permits systems	Communication and simplification of rules and procedures	Administrative burdens for sole proprietor firms	Length of time creditors have claims on bankrupts' assets
Entry rates	–0.29***	–0.69	–0.14	–0.19***
	(0.09)	(0.55)	(0.23)	(0.02)
Hazard rates	–0.38	1.56	0.47	–0.39
	(0.77)	(2.79)	(1.35)	(0.57)

1. A two-step estimation method described in Bertrand *et al.* (2003) is applied. The first step is an estimation of industry firm entry rates on industry and time dummies and on country-specific ICT industry dummies. The resulting error terms are then averaged for each country across industries and regressed on each indicator separately.
2. Standard errors in parentheses.
3. The estimations are based on nine observations for entry rates and eight for hazard rates.

*** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

Source: OECD calculations based on Eurostat firm entry data and indicators from the OECD regulatory database and UNICE, 2000.

programmes to simplify rules and reduce the amount of licenses and permits required. The coefficient of this indicator is negative, but it is measured so imprecisely that it cannot be excluded that it has no impact.

As far as the "administrative burdens on start-ups" indicator is concerned, its component summarising administrative burdens on sole proprietorship firms appears most relevant, since firms without employees make up more than 80 per cent of all entrants in most countries (Brandt, 2004a). This indicator summarises the minimum number of procedures, the maximum delay and the minimum direct and indirect costs of starting a new business without employees. The estimated coefficient of this indicator is negative, as expected, but measured so imprecisely that it is statistically insignificant.

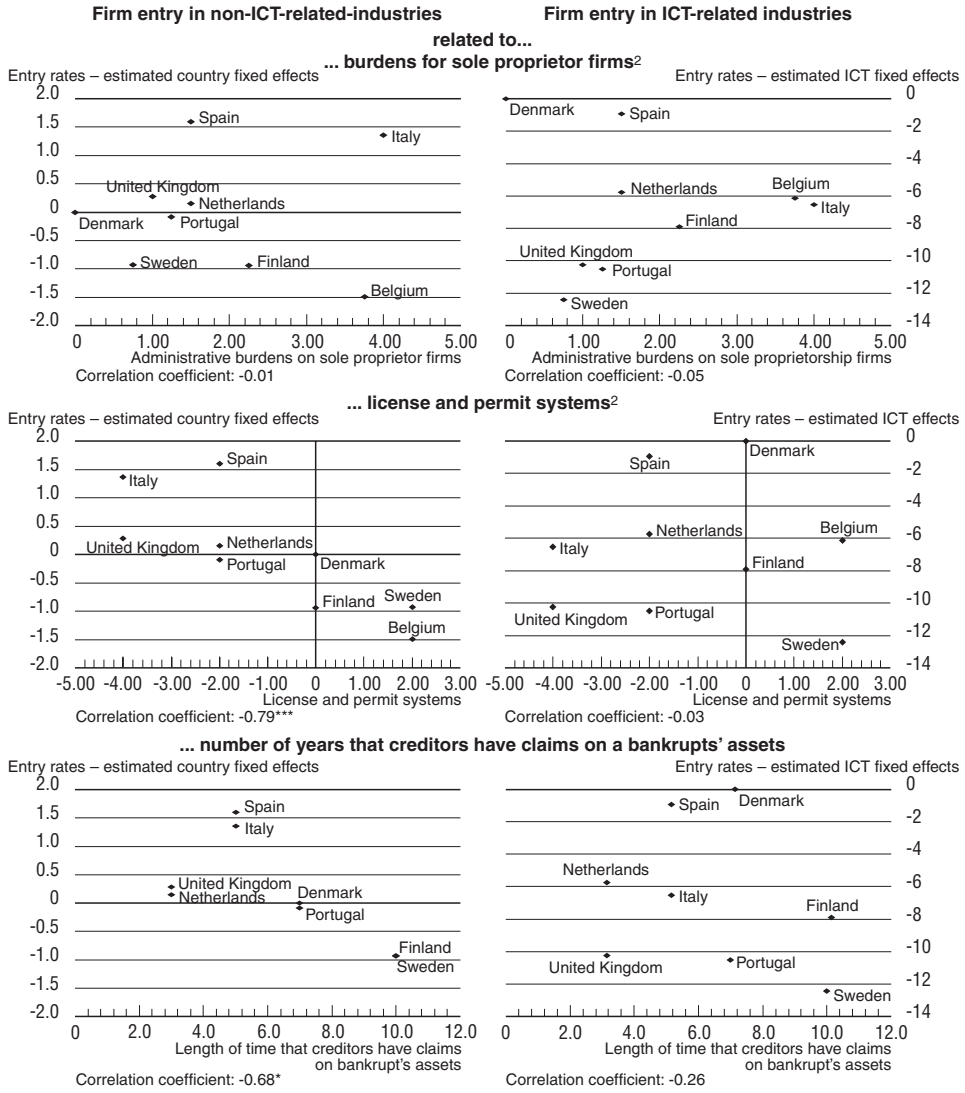
To shed some light on the role of exit barriers on firm entry, the impact of the number of years during which creditors have claims on a bankrupt's assets on firm entry and survival is investigated as well. As discussed above, many new firms fail trying to implement their new ideas. According to the Eurostat data in some countries up to 40 per cent of all new firms exit the market during the first two years of life. As new enterprises know little about their chances of staying in the market, high exit costs may prevent them from entering in the first place. In line with this argument, the results presented in Table 5 suggest that the length of time that creditors have claims on bankrupts' assets has a significantly negative impact on firm entry rates. As in the case of the more aggregate indicators, none of the detailed country scores describing different aspects of product market regulation have a significant impact on hazard rates.

Since the cross-country variation of entry rates is so much higher in ICT-related than in non-ICT-related industries, it is interesting to see whether there is any difference in the impact of the regulation indicators across these two industry groups. The results presented in Tables 4 and 5 capture mainly the effects in non-ICT-related industries (Box 2). Corresponding two-step estimations have been applied to the group of ICT-related industries separately. However, none of the indicators proves to have a significant effect on entry rates in ICT-related sectors. At least with the policy indicators at hand, the idea that institutional frameworks are especially important in the youngest and most dynamic industries cannot be confirmed. It should be kept in mind, however, that only a limited number of aspects of countries' overall institutional settings are explored in this section, excluding among others the access to high-risk capital and to skilled labour, which are likely to be very important in the technology-intensive ICT industries.[11]

The results presented in Tables 4 and 5 are confirmed when applying an alternative two-step estimation method based on Wooldridge (2003) (see Box 2 for details). The regulatory indicators are related to estimates of how much the average entry rates of each country differ from those in Denmark. The impact of regulation is assessed separately for ICT-related and non-ICT-related industries. The scatter diagrams presented in Figure 8 visualise how the cross-country differences in entry rates are related to the regulation indicators, which are expressed as deviations from the level for Denmark for convenience, except the number of years during which creditors have claims on bankrupts' assets. While it is hard to see a relationship between firm entry in non-ICT-related industries and the indicator summarising administrative burdens on sole proprietor firms, the relationship with both the indicator for license and permit systems and with the length of time creditors have claims on a bankrupt's assets appears to be negative. Both indicators are strongly and negatively correlated with the country fixed effects, although the correlation with the claims on bankrupts' assets is significant only at a 10 per cent level. None of the other detailed indicators is correlated with the country fixed effects. Among the more aggregate indicators, only the one measuring regulatory and administrative opacity is significantly and negatively correlated with country fixed effects (results not shown). The country-specific ICT industry effects measuring the cross-country variation of entry rates in these industries are not correlated with any of the available indicators. These results correspond very much to what has been shown in Tables 4 and 5.

This analysis of the impact of policies and institutions on firm entry and survival is subject to several caveats. First of all, indicators summarising aspects of the regulatory framework are rather crude. They can help capture quantitative aspects such as the number of years that creditors have claims on assets of bankrupt companies, the number of procedures necessary to start a new firm and whether or not there are convenient one-stop-shops for information on and issuance

Figure 8. **Firm entry and regulatory indicators across countries**[1]



1. Regulation indicators are from Nicoletti *et al.*, 1999. The length of time creditors have claims on bankrupts' assets is from UNICE, 2000. *** indicates significance of the correlation at the 1%, ** at the 5% and * at the 10% level.
2. Administrative burdens on sole proprietor firms and license and permit systems are expressed as deviations from the level for Denmark.

of licenses. Yet, they can hardly be used to assess the quality of different types of regulation in place. Second, while the Eurostat data on entry and survival provide a rich industry dimension with a sufficiently large number of observations, "explaining" the observed cross-country variation of these data with country variables that do not vary across industries or over time is notoriously difficult. The risk of seriously underestimating standard errors and thus of accepting the hypothesis that some of the indicators have an impact when they really do not is very high. The estimation methods underlying the results presented in this section are based on a more appropriate method, but with data on only nine countries at hand, the possibilities of conducting a robust policy analysis are limited.

Two of the indicators stand out as having a significantly negative impact on entry rates. This is robust to changes in the methodology.

- A complicated system of licenses and permits necessary to start a new enterprise seems to depress firm entry. This underlines the need for transparent regulation and procedures that are not overly expensive to avoid establishing barriers to entry.
- If creditors have claims on assets of insolvent firms for a long time, this seems to discourage firms from entering the market. This result should draw attention to the importance of exit barriers. Since there is little knowledge about individual chances of survival at the time of entry, making it very costly to exit can discourage start-ups altogether.

The indicator that measures administrative burdens on sole proprietor firms, such as the number of procedures to go through and direct as well as indirect costs of entry, is not found to have a significant impact. This may partly be related to the fact that the methods employed in this article result in very conservative estimates, making it very difficult to detect statistically-significant effects even if in reality there is a relationship between the two variables. The small number of countries available precludes estimating the impact of several regulatory indicators simultaneously. Therefore, it is unfortunately impossible to say whether some of them might simply pick up the influence of the others, because regulatory indicators are correlated among themselves, or whether some of the insignificant indicators would become significant once the influence of other aspects of the regulatory framework had been taken into account.

Much work remains to be done, most of which will only be possible when comparable firm entry and survival data for more countries are available. It would be desirable to estimate the impact of different regulatory indicators simultaneously and to include further variables capturing for example the characteristics of the financial system, *e.g.* the availability of high-risk capital. Much of this depends on the availability of comparable business dynamics data for more countries. Some of these aspects may be explored in the future when more countries are added to the Eurostat data set.

CONCLUSIONS

The analysis of firm demographics with a new Eurostat data set confirms a number of stylised facts, while also revealing some features that have not been discussed in the existing literature:

- Firm turnover is considerable. In any given year, it involves 10 to 15 per cent of manufacturing firms. In services industries it is even higher, reaching almost 20 per cent on average in a number of countries. This involves less than 1 per cent of total employment in some countries, however, reflecting the fact that entrants are a lot smaller on average than incumbents. The lion's share of firm entry is due to firms that have no employees at all.
- While the average size of entrant firms suggests that entry is easier for small firms, the risk of failure is higher for them as well. Only few new firms survive for long, but those who do survive often grow very fast. This pattern is in line with learning models à la Jovanovic (1982), according to which firms learn about market conditions and their own efficiency only upon entering the market. To minimise costs in the case of failure, they prefer entering at a small size. If they turn out to be profitable and stay in the market instead, they have to grow fast to reach the minimum efficient scale, otherwise they risk failing.
- Entry and exit rates are highly correlated across industries and net entry constitutes only a tiny fraction of gross entry and exit rates. This suggests that firm entry and exit are an element of a process of search and experimentation, where new firms replace outpaced incumbents without affecting much the total number of enterprises in the market.
- Firm entry and exit vary significantly across industries. They seem to be closely linked to the maturity of sectors. Market entry is relatively low in mature industries, many of them belonging to the manufacturing sector. In contrast, a large number of firms enter in young markets; during the late 1990s this was the case especially in sectors related to ICT. This suggests that the experimentation process associated with firm entry and exit is important for the development and adoption of new products and technologies. Shifting resources to new and promising markets involves a large amount of firm turnover, as many young firms fail trying to implement their ideas.

Moreover, the analysis gives some insight into the role of policies and institutions for firm entry and survival:

- Results presented in this article reveal that average cross-country differences in entry rates in a given industry are significantly lower than differences across industries. Taken at face value, this seems to imply that technological factors and the maturity of industries are more important as determinants of

firm entry than country-specific factors. Yet, some indicators analysed in this study which capture aspects of countries' regulatory frameworks stand out as having a very robust, significant relationship with firm entry rates. The results suggest, as an example, that an overly complicated license and permit system discourages the creation of new enterprises. The same goes for an excessively long time during which creditors have claims on bankrupts' assets. This latter result should draw attention to the role of exit barriers.

- The cross-country variation of entry rates in young and dynamic industries, particularly those related to ICT is considerable while it is moderate in more mature industries. This seems to suggest that country-specific factors, including policies and institutions, might be more important as driving forces for the process of firm entry and exit in younger than in more mature industries. This conjecture cannot be confirmed with the regulatory indicators investigated in this paper, as their relationship with firm entry in ICT-related sectors is invariably insignificant. Yet, it should be kept in mind that the aspects of countries' policies and institutions which are investigated are far from exhaustive, excluding for example characteristics of the financial markets and the education system.
- None of the indicators investigated is found to have a significant relationship with firm survival in early life. However, that may partly be related to the method employed, which yields very conservative estimates, and the limited number of countries available for investigation. The same problem precludes a simultaneous investigation of the impact of several regulation indicators at the same time to appropriately assess their relative importance and their interaction. Much work has to be left to the future when comparable data on firm dynamics for more countries will be available.

NOTES

1. The countries are Belgium, Denmark, Finland, France, Italy, the Netherlands, Spain, Sweden and the United Kingdom.
2. These results are discussed in more detail in Brandt, 2004a.
3. Further detail can be found in Brandt, 2004b.
4. For details concerning the data differences, see Brandt, 2004a.
5. For more detailed regressions with some sensitivity analysis with respect to the specification, see Brandt, 2004a.
6. It should be noted that the merging of several administrative records in 1999 may have led to some over-coverage in Denmark in this year. This could have resulted in somewhat overstated birth rates. Yet, a 1999 dummy for Denmark is significant only at a 10 per cent level and changes estimates only slightly. Therefore, results obtained without the dummy variable are shown instead in Table 2.
7. For a representation of all industry fixed effects, see Brandt, 2004a.
8. It should be noted that data for Spain are not available for most of the detailed ICT-related industries. For this reason, the estimated ICT-industry effect for Spain rests solely on three observations for the manufacturing of office machinery and computer industry, so it has to be interpreted with some caution.
9. For more sensitivity analysis with respect to specification, see Brandt 2004a.
10. The indicators are based on the situation in or around 1998. Since 1998, many countries have implemented reforms in these regulations. An update of these indicators, with data for 2003, is in progress.
11. It should be noted that much of the observed difference in results across ICT and non-ICT-related industries concerning the estimated impact of regulatory variables seems to depend on the industry detail that is chosen for ICT-related industries. The results presented in Tables 4 and 5 are based on entry data with a very detailed industry breakdown for computer services. When abstaining from breaking down the entry data of computer services to more detail, the same qualitative results as those presented in Tables 4 and 5 emerge, without a need to account for ICT industry specifics with a dummy variable in the first step. Furthermore, with aggregate computer services data, the "claims on bankrupts' assets" variable does have a significantly negative impact also within ICT industries when these are investigated separately.

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