**Unclassified** **DSTI/DOC(2004)3**

Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

**17-Mar-2004**

**English text only**

**DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INDUSTRY**

**DSTI/DOC(2004)3**
**Unclassified**

# BUSINESS DYNAMICS, REGULATION AND PERFORMANCE

**STI WORKING PAPER 2004/3**
**Statistical Analysis of Science, Technology and Industry**

**Nicola Brandt**

**English text only**

**JT00160186**

**Document complet disponible sur OLIS dans son format d'origine**
**Complete document available on OLIS in its original format**

**STI Working Paper Series**

The Working Paper series of the OECD Directorate for Science, Technology and Industry is designed to make available to a wider readership selected studies prepared by staff in the Directorate or by outside consultants working on OECD projects. The papers included in the series cover a broad range of issues, of both a technical and policy-analytical nature, in the areas of work of the DSTI. The Working Papers are generally available only in their original language – English or French – with a summary in the other.

Comments on the papers are invited, and should be sent to the Directorate for Science, Technology and Industry, OECD, 2 rue André-Pascal, 75775 Paris Cedex 16, France.

The opinions expressed in these papers are the sole responsibility of the author(s) and do not necessarily reflect those of the OECD or of the governments of its member countries.

***http://www.oecd.org/sti/working-papers***

# BUSINESS DYNAMICS, REGULATION AND PERFORMANCE

**Nicola Brandt**

**Abstract***

Building on an earlier study of patterns on firm entry, exit growth and survival based on new data from Eurostat covering nine European Union member countries (Brandt, 2004), this paper takes a closer look at the role of policies and institutions for firm entry and survival and at the link between new firm creation and economic performance. The earlier study revealed that firm entry rates, *i.e.* the number of new firms in a market in relation to all active enterprises, were particularly high in Information and Communication (ICT) related industries in recent years. This lends some support to the idea present in some theories of economic growth that new firms are important for the development and implementation of new technologies. This paper takes a closer look at the relationship between firm entry and economic performance. Results reveals that high rates of firm entry tend to coincide with rapid productivity, output and employment growth, especially in the ICT related services sectors and in some business services industries. This represents further empirical support for the notion that young firms play an important role for productivity growth and thus economic performance. However, in the more mature manufacturing industries marked by lower entry rates, expenditure on formal research and development (R&D) seems to be more important as a determinant of productivity growth. To gain some insights into the role of policies and institutions for firm entry, regulation indicators summarising different aspects of countries' institutional settings are related to firm entry and hazard rates, the latter summarising the probability that a firm has to exit the market at a given age, conditional on having survived so far. Although very conservative methodologies are employed, some indicators stand out as having significant statistical relationship with firm entry rates, suggesting that overly stringent regulation can impinge on firm entry. The results suggest 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.

* The author thanks Dirk Pilat and Andy Wyckoff for helpful comments and suggestions. Any errors that may remain are hers, as are the views and opinions expressed in this paper. They do not necessarily reflect the views of the OECD or its member countries.

# DYNAMIQUE DE L'ENTREPRISE, REGLEMENTATION ET PERFORMANCE

**Nicola Brandt**

**Resumé***

S'appuyant sur une étude antérieure concernant les profils d'entrée, de sortie, de croissance et de survie des entreprises, elle-même fondée sur de nouvelles données d'Eurostat portant sur neuf pays membres de l'Union européenne (Brandt, 2004), le présent rapport examine de plus près le rôle des politiques et des institutions dans l'entrée sur le marché et la survie des entreprises, ainsi que le lien entre la création de nouvelles entreprises et les performances économiques. L'étude initiale révélait que les taux d'entrée des entreprises, c'est-à-dire le nombre de nouvelles entreprises en proportion de l'ensemble des entreprises en activité sur un marché, avaient été particulièrement élevés dans les branches d'activité liées à l'information et aux communications (TIC) ces dernières années. Cela tend à confirmer l'idée avancée dans certaines études théoriques sur la croissance économique selon laquelle les nouvelles entreprises jouent un rôle important dans le développement et la mise en œuvre des nouvelles technologies. Le présent rapport examine de façon plus approfondie la relation entre les taux d'entrée des entreprises et les performances économiques. Les résultats montrent qu'à des taux d'entrée élevés des entreprises correspond en général une croissance rapide de la productivité, de la production et de l'emploi, en particulier dans les secteurs de services liés aux TIC et dans certains secteurs de services aux entreprises. Cette analyse économétrique confirme l'idée selon laquelle les jeunes entreprises ont une incidence importante sur la croissance de la productivité et donc sur les performances économiques. En revanche, dans les industries manufacturières plus matures, se caractérisant par des taux d'entrée plus faibles, les dépenses consacrées aux activités de recherche-développement (R-D) structurées semblent influer plus fortement sur la croissance de la productivité. Afin de mieux comprendre les effets des politiques et des institutions sur les taux d'entrée des entreprises, des indicateurs de réglementation condensant les différents aspects du cadre institutionnel des pays sont mis en relation avec les taux d'entrée et les taux de défaillance des entreprises, ces derniers correspondant à la probabilité qu'une entreprise sorte du marché au bout d'un nombre d'années donné, à supposer qu'elle ait survécu jusque-là. Malgré l'emploi de méthodologies très prudentes, on observe une corrélation statistique significative entre certains indicateurs et les taux d'entrée des entreprises, laissant penser notamment qu'une réglementation excessivement contraignante peut avoir un effet négatif sur le taux d'entrée. Il semblerait qu'un système de licences et d'autorisations particulièrement complexe décourage la création de nouvelles entreprises. Accorder un trop long délai aux créanciers pour faire valoir leurs droits sur l'actif de l'entreprise défaillante aurait apparemment des conséquences comparables.

* L'auteur tient à remercier Dirk Pilat et Andy Wyckoff pour leurs commentaires et suggestions utiles. C'est à lui seul qu'il faut attribuer les erreurs qui pourraient subsister, de même que les avis et opinions exprimés dans le rapport, lesquels ne reflètent pas nécessairement le point de vue de l'OCDE ou de ses pays membres.

**TABLE OF CONTENTS**

**Introduction**

1. The creation of new businesses and the decline or market exit of less productive firms are often regarded key to business dynamism and economic growth in OECD economies. Young firms are thought to help shift resources to new markets, to be especially innovative and to play an important role as job creators. With these ideas in mind, policymakers have shown a vivid interest in the role of firm creation for countries' overall economic performance.

2. Prior OECD studies of business demographics (Bartelsman *et al.,* 2003; Brandt, 2004) have shown that a lot of firms enter the market every year. This involves an almost equally high number of firm exits as entrants drive incumbent firms out of the market. In many cases, the newcomers do not survive for long themselves. These general patterns with high rates of entry and exit occurring at the same time can be found even in narrowly defined sectors of the economy. The cross-country variation of entry and exit rates, the number of new or exiting enterprises in relation to all active firms, is rather moderate. In contrast, the cross-industry variation for entry and exit rates is exceptionally high in young ICT related services sectors, but a lot lower in more mature industries. In narrowly defined ICT related sectors, the cross-country variation of entry and exit rates is higher than it is on average, which might imply that policies and institutions are especially important as determinants of firm entry and exit in the youngest and most dynamic industries (Brandt, 2004). To explore this idea in more detail, this paper takes a closer look at the empirical evidence concerning the link between regulation, entrepreneurship and economic performance.

3. To get an insight into the role of policies and institutions for entrepreneurship, the relationship between OECD indicators on regulation with firm entry and survival data from Eurostat is investigated for a number of European countries. The regulation indicators employed in this study and described in more detail in Nicoletti *et al.,* (1999) summarise different aspects of countries' regulatory and institutional settings in 1998. The firm entry and survival data examined more closely in Brandt (2004) cover industries in nine European countries over the period 1998-2000. While it would be desirable to cover a larger number of countries, it should be pointed out that the business demographics data from Eurostat is based on a special effort to produce comparable data on firm entry and exit, growth and survival. At the current stage, data from other countries is not sufficiently comparable to extend the study.

4. While it is important to understand the impact of policies and institutions on market entry and survival of young firms, it is not *a priori* clear whether more firm entry is desirable or less and whether or not higher rates of new firm survival should be aspired to. To gain further insights into this issue, the firm entry data from Eurostat are related to economic performance indicators calculated with the OECD STAN database. A central finding is that firm entry rates tend to be higher in industries with higher output and employment growth.

5. This result might be related to a positive impact of firm entry on productivity. Some economic growth theories ascribe to new firms an important role for innovation and technology adoption. There is evidence from studies, based on a decomposition of aggregate productivity growth into the contributions of entrants, exitors and incumbents, that the process of firm entry and exit plays a role in reallocating resources from low to higher productivity units (Scarpetta *et al.*, 1992; Foster *et al.*, 1998, Baldwin and Gu, 2003). However, what these studies are unable to capture is that firm entry and exit may also have a more indirect impact on productivity by increasing the competitive pressure in a market through their innovative activity. This would force both new and incumbent firms to innovate and raise their efficiency in order to stay in the market, thus helping to boost overall productivity and output growth. In this paper, sectoral firm entry rates are related to industries' productivity growth. This approach helps capture both the impact that firms have via their own productivity and any indirect effect on aggregate productivity that might occur, for example, as a result of the competitive pressure created through firm entry.

6. This paper is outlined as follows. The following section takes a look at the relationship between firm entry and survival with regulatory indicators. Section 3 briefly discusses some of the links between firm entry, output and employment growth. The impact of new firm creation on productivity is investigated in section 4. Section 5 concludes and discusses some policy implications.

**Firm entry and regulation**

7. Studies of firm entry and exit reveal that firm creation seems to be part of a process of search and experimentation (Bartelsman *et al.,* 2003, Brandt, 2004). A large number of firms are involved in the process of firm turnover, the sum of firm entry and exit, every year. Entry and exit are highly correlated across industries, implying that new firms replace unsuccessful ones, frequently without significantly affecting the total number of firms in a market. Moreover, a large number of enterprises fail in their early years of life. Unsure of their future success, new firms tend to enter the market at a very small size when compared to incumbents. Yet, those newcomers who survive often grow very fast.

8. These patterns are in line with models of firm learning (Jovanovic, 1982; Ericson and Pakes, 1995) which assume that young enterprises find out about their profitability only upon entering the market. They start out small to minimise costs in case they are forced soon to exit. Yet, if they turn out to be profitable and stay in the market, they have to grow fast to reach the minimum efficient scale, otherwise they risk failing. If new firms are indeed important for the implementation of new ideas and new technologies, this involves high turnover, with many firms both entering and exiting the market. These patterns are in the spirit of Schumpeterian models of creative destruction (Aghion and Howitt, 1991) according to which new technologies are developed and implemented by market entrants that replace outpaced firms (see also Box II).

9. The cross-country variation of firm entry rates in the Eurostat database has been found to be moderate when compared to the cross-industry variation (Brandt, 2004). Entry rates are generally small in most mature manufacturing industries, a notable exception being the office machinery and computers industry. Firm birth rates are higher in services and particularly in ICT-related industries, such as telecommunications and computer services. This might of course be related to the boom these industries have experienced during the late 1990s. In any case, the findings are line with product life cycle studies (Gort and Klepper, 1982, see also Box II), which find that entry rates are very high in young sectors, levelling off as the markets get more mature. While the cross-country variation in entry rates is very moderate in general, it is quite considerable in ICT-related industries. This could suggest that policies and institutions might be more important in these young and dynamic sectors than in more mature ones.

10. To gain further insights into this issue, this paper investigates the relationship between firm entry rates and indicators summarising aspects of the regulatory framework. The OECD Economics Department has developed a product market regulation indicator 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). [1] 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 the birth of new firms in an earlier OECD study (Scarpetta *et al*., 2002).

---

1. The indicators are based on the situation in or around 1998. This is well-suited for the entry data experienced in this study which covers the years 1998-2000. However, since 1998, many countries have implemented reforms in these regulations. An update of the indicators will be released by the OECD in 2004.

**Box I. Methodological difficulties**

Since the Eurostat data provide a rich industry dimension, it is tempting to exploit this when trying to assess the influence of country specific variables on firm entry or survival. The regulatory indicators could then simply be included in a regression on industry firm entry or hazard rates along with dummies accounting for industry and time specific effects and other covariates likely to influence the independent variables. Yet, 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. This is the case, because standard errors are likely to be correlated for observations within each group (in this case countries), especially when the explanatory variable is auto-correlated itself over time and/or across different units within one country (Bertrand *et al*., 2003). This is the case for the regulatory variables explored in this section as they do not vary at all within countries. Standard estimation software provides methods to adjust standard errors for an arbitrary correlation structure across groups. Yet, these methods have been shown to fare very poorly when the number of groups is small (Bertrand *et al*., 2003), as it is the case with the Eurostat data.

The only remedy at hand seems to consist in ignoring the industry and time dimension of the data. Donald and Lang (2001) propose averaging all observations within one group. A closely related approach is proposed by Bertrand *et al*. (2003), which consists in regressing first the individual-specific observations on relevant covariates and on dummies designed to capture individual-specific, time-specific and other effects. The residuals stemming from this estimation capture the variation of the dependent variable that is not “explained” by the independent variables included in the first step. The country aggregates of these residuals are used to estimate the influence of the country-level variables. This method allows the researcher to take into account the impact of variables that vary within groups in the first step, while obtaining consistent standard errors for the coefficients of the group-level explanatory variables in the second. In this study, industry firm entry rates are regressed 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 coefficients of the industry dummies - often referred to as fixed effects - express how much in terms of percentage points the average entry rate in an industry differs from that in a reference sector. Correspondingly, the country-specific ICT industry effects express how much the average entry rate across ICT industries differs for each country from that in a reference country. Because of the inclusion of these 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 number of groups is small. Its downside is that its power is low and diminishes fast with sample size. The power expresses the probability to conclude that an explanatory has no impact (accepting the null hypothesis), although it does. 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 is available precludes estimating the influence of different explanatory variables at the same time and thus assessing their relative importance and their interaction appropriately. With the available data, applying this rather conservative method and estimating the impact of regulatory variables individually is unfortunately the best that can be done.

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. The estimated coefficients of the country dummies, the country fixed effects, express how much entry rates in each country differ in terms of percentage points on average across all industries from those of an arbitrary reference, which is Denmark in this paper. Since the country specific ICT industry effect 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 within ICT-related industries on the one hand and 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.

11. This paper 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. An update of the indicators will be released by the OECD in 2004.

12. Unlike the components of the indicators summarising state control and barriers to trade and investment, some of the components of the barriers to entrepreneurship indicator prove to have a statistically significant relationship with entry rates. Therefore, the presentation of results is confined to this latter indicator and it subcomponents. This paper examines the influence of the regulatory indicators on both entry and hazard rates, where the latter describe the probability that a firm has to exit the market at a given age, provided that it has survived so far. Since the Eurostat data has a very short time dimension, hazard rates can be calculated only for one- and two-year survival. Both the entry and survival data are available at a very detailed sectoral level. It is therefore tempting to exploit the industry dimension when using regulation indicators to try and explain some of the observed cross-country variation in firm entry and survival. 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, using aggregate country indicators to "explain" industry entry rates is subject to methodological difficulties, which can easily lead to the conclusion that the indicators have an impact when they really do not (Box I). When applying a more conservative two-step estimation method that essentially ignores the industry and the time dimension of the entry data (Box I), none of the estimated coefficients measuring the relation between regulation indicators and hazard rates are significant (Table 1). At the same time, it should be kept in mind that the estimation method used to obtain the results presented in Table 1 is very conservative. It involves a high probability of finding no significant impact of a country level variable even when it really does influence entry or hazard rates. However, with the available data, employing this very conservative method is the best that can be done.

Table 1. **Firm entry rate regressions on indicators summarising aspects of barriers to entrepreneurship**

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

| | Domain | Subdomains | | |
|---|---|---|---|---|
| | 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 than 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.
4. A * indicates statistical significance at the 1% -, ** at the 5% - and *** at the 10%-level.

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

13. The aggregate "barriers to entrepreneurship" indicator is not estimated to have a significant impact on entry rates (Table 1). Among its components, only the indicator summarising regulatory and administrative opacity has a negative impact on entry rates, which is significant. 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 2.

14. The estimates presented in Table 2 reveal that the regulatory and administrative opacity indicator seems to be significant mainly because of its component on countries' 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 simplification of rules and procedures. The scores are based on how easily citizens can obtain information on regulation and on whether or not governments have programs 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 its real impact is nil.

15. Although one of the components of the "barriers to competition" indicators summarises legal barriers to entry, none of them are found to have a significant 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% of all entrants in most countries (Brandt, 2004). 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 insignificant.

Table 2. **Firm entry regressions on indicators summarising aspects of barriers to entrepreneurship II**

(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 than 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.
4. A * indicates statistical significance at the 1% -, ** at the 5% - and *** at the 10%-level.

*Source* : OECD calculations based on Eurostat firm entry data and indicators from the OECD regulatory database and OECD, 2001.

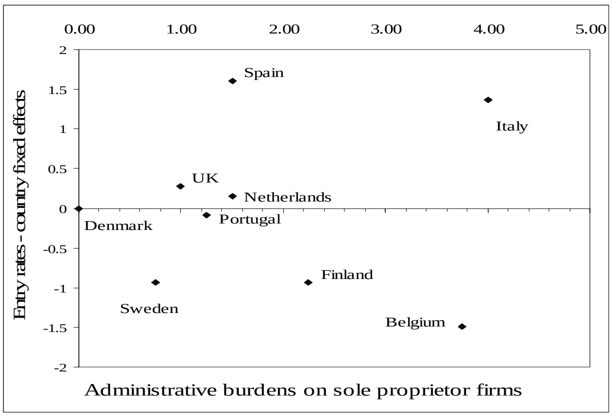
16. To shed some light on the role of exit barriers on firm entry, the impact of the number of years during which creditors have claims on a bankrupts' assets on firm entry and survival is investigated as well. As discussed above, many new firms fail trying to implement their new ideas. According to the Eurostat data in some countries up to 40% of all new firms exit the market during the first two years of life (Brandt, 2004). As new enterprises know little about their chances to stay in the market, high exit costs may prevent them from entering in the first place. In line with this argument, the results presented in

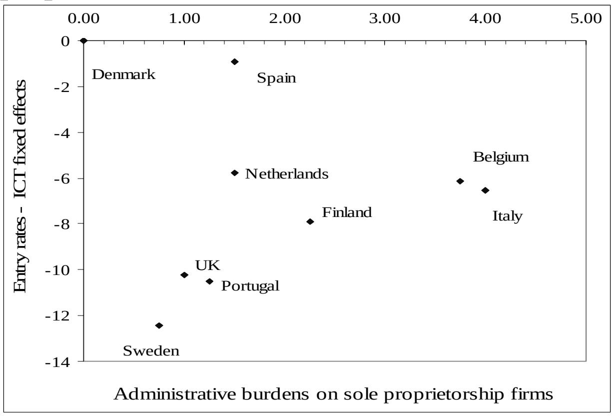
Figure 1. **Firm entry and regulatory indicators across countries**[2]

**Firm entry in non ICT-related industries** **Firm entry in ICT-related industries**

**related to..**

**…burdens for sole proprietor firms**

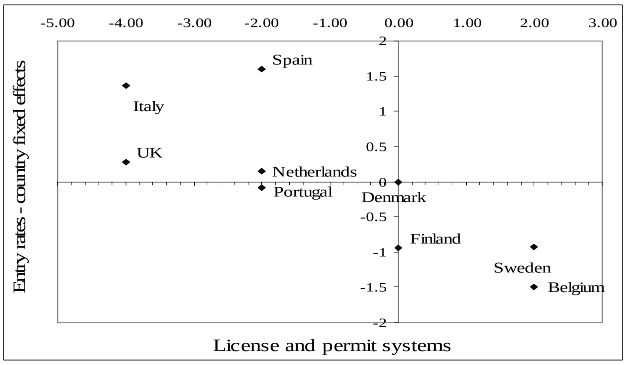


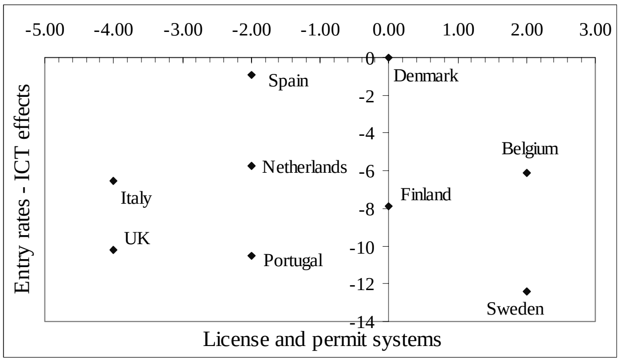




Correlation coefficient: -0.01

Correlation coefficient: -0.05

**…license and permit systems**

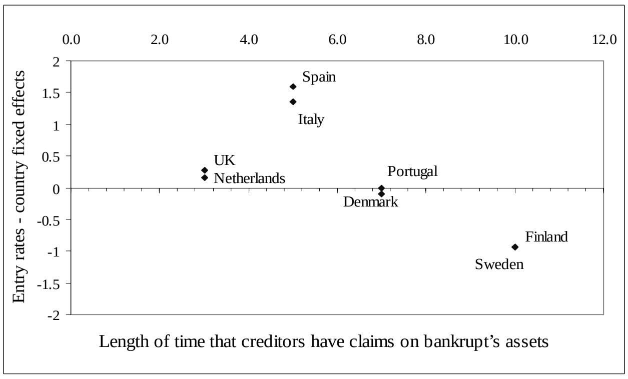


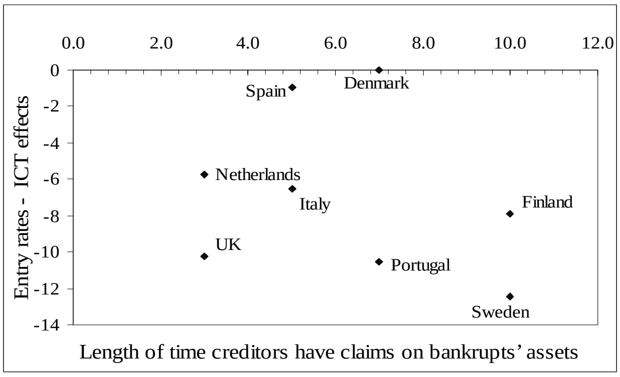




Correlation coefficient: -0.79***

Correlation coefficient: -0.03

**…number of years that creditors have claims on a bankrupts' assets**




Correlation coefficient: -0.68*

Correlation coefficient: -0.26

1. Country fixed effects and country specific ICT-industry effects from equation II and III respectively in Table 2 measure the cross-country variation of firm entry rates. Regulation indicators are from Nicoletti *et al*., 1999. The length of time creditors have claims on bankrupts' assets is from UNICE, 2000. A * indicates significance of the correlation at a 1% level, ** at the 5% and *** at the 1% level.

2. The indicators shown are drawn from Nicoletti, *et al*. (1999) and are based on the situation in or around 1998. While this is appropriate for the investigated time period, many countries have implemented reforms in these regulations since. An update of these indicators will be released by OECD in 2004.

Table 2 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 regulation have a significant impact on hazard rates.

17. 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 1 and 2 capture mainly the effect of non-ICT related industries (Box I). 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.[3]

18. The results presented in Tables 1 and 2 are confirmed when applying an alternative two-step estimation method based on Wooldridge (2003) which is explained in detail in Box I. 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 1 visualise how the cross-country differences in entry rates are related to the regulation indicators, which are normalised to zero 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 bankrupts 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% 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 1 and 2.

19. Investigating the impact of policies and institutions on firm entry and survival is by no means easy. 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 bankrupts' assets, 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 of licenses. Yet, they can hardly be used to assess the quality of different types of regulation in place. 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 this data with country variables that do not vary across industries or over time is

3. 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 1 and 2 are based on computer services at a very detailed breakdown. When abstaining from breaking down the entry data of computer services to more detail, the same qualitative results as those presented in Tables 1 and 2 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 when ICT industries are considered separately.

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. Standard remedies for this problem are not valid when the number of investigated countries is small, as in the case of the Eurostat data (see Box I). The estimation methods on which the results presented in this section are based are more appropriate, but with data on only nine countries at hand, the possibilities to conduct policy analysis are limited.

20. Nevertheless, although the methods employed in this section are very conservative, two of the indicators stand out as having a significantly negative impact on entry rates, at least in non-ICT related industries. 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 on average, although the corresponding indicator is not significantly related to the high cross-country variation within detailed ICT-related industries. Yet the overall result underlines the need for transparent regulation and procedures that are not overly expensive to avoid establishing barriers to entry.

- If creditors have claims on bankrupts' assets for an excessively long amount of time, this seems to discourage firms from entering the market. On average entry rates tend to be lower the longer creditors have claims on bankrupts assets. This result should draw attention to the importance of exit barriers. Since firms have little knowledge about their chances to survive when they enter, making it very costly for them to exit can discourage them from starting their business 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 section are very conservative with low power against the alternative, meaning that the risk of rejecting the hypothesis that an indicator has a significant impact when it really does is rather high. Moreover, 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 other, 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 has been taken into account.

21. Much work remains to be done, some of which will only be possible when comparable firm entry and survival data for more countries is available. In the first step of the estimation, it would be desirable to include more industry-specific covariates that are likely to have an influence on firm entry or survival, such as the capital intensity, as a proxy for scale economies, and a measure of profits attainable in different sectors. In the second step, which assesses the influence of country specific variables, it would be desirable to estimate the impact of different regulatory indicators simultaneously and to include variables that capture 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 on more countries. Some of these aspects may be explored in the future when more countries are added to the Eurostat data. To get an idea what the results presented in this section could imply for countries' overall economic performance, the next section explores the relationship of firm entry with employment and output growth.

**Entry rates, employment and output growth**

22. New firms are often thought to affect output and employment through their impact on productivity growth. Some economic growth models ascribe to new firms an important role for innovation

and technology adoption (see Box II). Since technological change is the main driver of economic growth according to these theories, this would also imply that firm entry should have a positive impact on output and employment expansion. This section explores whether evidence for these ideas can be found by relating the Eurostat firm entry data to output, employment and productivity data from the OECD STAN database.

**Box II. Theoretical Background**

Firm entry and exit are ascribed an important role in theories which stress the process of "creative destruction" as a mechanism that facilitates innovation and new technology adoption, helping to shift resources from less productive units to more productive ones. 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 do not only involve direct investment costs, however, 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). Because by their nature new firms do not have to reorganise their production process, some variants of these models ascribe to them an important role in the process of technology adoption (Caballero and Hammour, 1994; Campbell, 1997). Firms that enter with the state-of-the-art technology replacing incumbents which rely on outdated production processes thus play a crucial role for productivity growth in these models.

Related to these ideas are research and development (R&D) based models of economic growth (Grossman and Helpman, 1991; Aghion and Howitt, 1992), according to which new firms play a crucial role in developing innovations. Investment in R&D results in the development of a new product or a new production technology with a certain probability. Depending on the variant of the model, successful innovators enter the market to expand the existing variety of products (Grossman and Helpman, 1991) or they replace an incumbent with a higher quality variant of a product currently in place, earning monopoly profits until they are driven out of the market themselves by a new innovator (Aghion and Howitt, 1992). In both versions of the model, new firms are crucial for innovation. The creative destruction variant of Aghion and Howitt (1992) assumes that this is associated with firm entry and exit at the same time. Since innovation and technological change are the main driving forces of output growth according to these theories, this also implies that the entrepreneurial process of firm creation and destruction should have a positive impact on employment and output.

A twist to these theories about the role of new firms for innovation and technological change comes from studies of product life cycles, which are based on stylised facts concerning industrial evolution. According to these studies the amount of firm creation and the nature of innovation in an industry are related to its maturity (Gort and Klepper, 1982; Klepper, 1996). It is a frequently observed pattern that in young industries, firm creation as well as product innovation is high and market shares change rapidly, as firms enter the market often with new goods. At later stages of the product life cycle, net entry levels off, market shares stabilise and innovative efforts are increasingly devoted to improving the production process rather than to introducing new product variants. Klepper (1996) developed a model that explains these patterns with economies of scale in process innovation due to the fixed costs associated with R&D. At the beginning of the product life cycle most firms are still small and there is uncertainty about user preferences and the technological means of satisfying them. In those stages, new firms can compete with larger incumbents by entering with a new version of the product. Product innovations are incorporated into the standard good of the market, the price of which falls over time due to process innovations. Innovative incumbents expand, less productive incumbents exit and are replaced by more innovative, smaller producers. Yet, as the most successful firms expand, the advantage of size in process R&D eventually puts entrants at such a cost disadvantage that entry decreases. Eventually incumbent firms stabilise their market shares and compete more on the basis of their size and their process innovations. These ideas are a twist to those of creative destruction models of growth, as they imply that new firms have an innovative advantage only for some types of innovations.

Although studies of product life cycles do not address this question directly, it is plausible that high entry rates at the beginning of the product life cycle should coincide with high output and employment growth, as both new and incumbent firms expand when there are still a lot of unexploited technological and business opportunities. These become scarcer in mature industries, so entry as well as the expansion of incumbent firms should be expected to level off. The competitive pressure to innovate and increase productivity may be especially high in the early and most turbulent stages of the product life cycle with a lot of firm churning, although innovation continues at later stages as large incumbent firms implement process innovations.

23. The years 1998-2000, which are covered by the entry data, have been boom years marked by high output and employment growth in essentially all of the investigated countries. Thus, coverage both in

terms of countries and years is limited and there is little variation in the available aggregate firm entry and employment or output growth data. It should therefore not come as a surprise that no significant correlation can be found between aggregate employment or output growth rates for the entire economy on the one hand and aggregate firm entry rates on the other. Yet, entry rates vary a lot more across industries than across countries. This suggests that it may be more revealing to exploit the industry dimension of the data when looking for a link between firm entry and economic performance. Table 3 shows the cross-industry cross-country correlation of entry rates with output and employment growth as well as with growth in hours worked.[4] Entry rates are positively correlated with value added and employment growth, as well as with growth in hours worked. While this correlation is not very large in most cases, it is significant at all the investigated lags and for the averages over the sample period. Apparently, industries with higher firm entry also tend to experience higher output and employment growth. A positive statistical relationship between firm entry and employment growth has also been found across different metropolitan areas in the United States (Faberman, 2003).

Table 3. **Cross-industry correlation of entry rates and economic performance measures in the total economy**

(entry rates at different lags and averages over 1998-2000)

| | Output growth | | | Employment Growth | | | Growth in Hours | | |
|---|---|---|---|---|---|---|---|---|---|
| Lag | Correl. | T-Stat. | Obs. | Correl. | T-Stat. | Obs. | Correl. | T-Stat. | Obs |
| 0 | 0.28*** | 6.87 | 559 | 0.28*** | 6.77 | 560 | 0.43*** | 7.45 | 242 |
| 1 | 0.24*** | 4.71 | 356 | 0.18*** | 3.42 | 355 | 0.37*** | 4.92 | 150 |
| 2 | 0.32*** | 4.05 | 149 | 0.35*** | 4.58 | 148 | 0.44*** | 3.62 | 56 |
| Average | 0.38*** | 5.60 | 190 | 0.40*** | 6.04 | 189 | 0.57*** | 6.59 | 91 |

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

2. Growth in hours is available for Denmark, Finland, the Netherlands and Sweden only.

*Source* : OECD calculations based on Eurostat and the OECD STAN database.

24. The relationship between entry rates and performance measures is much stronger in services industries than in manufacturing. Table 4 shows that the correlations are higher and more significant when the analysis is confined to services. In contrast, when looking at manufacturing industries separately, almost all correlations are insignificant (results not shown). In the services sector, the correlation is significant at all of the investigated lags for the three performance measures, but it tends to be strongest when entry rates are lagged twice. This could be an indication that it takes some time for firm creation to unfold its impact on economic performance.

25. The finding that the cross-industry correlation of firm entry rates with economic performance measures is stronger within the services sector than within manufacturing suggests that the product life cycle theories described in Box II may have something to add to an understanding of the role of new firms for innovative activity. Manufacturing industries are generally rather mature. According to product life cycle studies, innovative activity should mainly consist of process innovation based on formal R&D spending in these sectors. As this is associated with large fixed costs and thus with economies of scale, large incumbent firms have a clear cost advantage in innovation compared to small entrants. In fact, the average firm size is higher in most manufacturing industries than in the services sector (Bartelsman *et al.*, 2003) and the most R&D intensive sectors are found in manufacturing (Table A1 in the Annex). Because manufacturing industries are almost invariably rather mature with low entry rates[5], it cannot be expected

4. Data for the manufacturing of office machinery and computing industry in Finland has not been included in the calculations, since these data points constitute outliers due to unusually large output and employment losses over the sample period, possibly due to a reclassification of some larger companies.

5. The only exception is the manufacturing of office machinery and computing industry.

that firm entry data can contribute much to explaining observed variations in innovation, output and employment growth, which vary much more in this sector than firm entry. These variables should be driven by other factors, *e.g.* by large-scale laboratory-based R&D conducted in larger incumbent firms. The picture is different for the services sector, however.

Table 4. **Cross-industry correlations of entry rates and performance measures in services**

(entry rates at different lags and averages over 1998-2000)

| | Output growth | | | Employment Growth | | | Growth in Hours | | |
|---|---|---|---|---|---|---|---|---|---|
| Lag | Correl. | T-Stat. | Obs. | Correl. | T-Stat. | Obs. | Correl. | T-Stat. | Obs |
| 0 | 0.40*** | 6.33 | 218 | 0.34*** | 4.93 | 192 | 0.40*** | 4.51 | 111 |
| 1 | 0.50*** | 6.63 | 137 | 0.29*** | 3.31 | 122 | 0.36*** | 3.10 | 68 |
| 2 | 0.57*** | 5.00 | 53 | 0.35*** | 2.59 | 49 | 0.51*** | 2.77 | 24 |
| Average | 0.57*** | 5.84 | 72 | 0.53*** | 4.70 | 58 | 0.59*** | 4.64 | 43 |

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

4. Growth in hours is available for Denmark, Finland, the Netherlands and Sweden only.

*Source* : OECD calculations based on Eurostat data.

26. While the manufacturing sector is rather homogeneous in terms of maturity, the services sector comprises industries with many young and dynamic market segments and high entry rates, such as telecommunications, computer and some business services, and more mature industries with lower entry rates, such as wholesale and retail trade, hotels and restaurants and some parts of the financial and insurance sectors. According to product life cycle theories, the importance of new firms' innovative activity should be highest in young industries where entrants can still compete with incumbents by introducing a new product. Yet, as R&D investments and associated process innovations are subject to fixed costs, the cost advantage of the most productive incumbents eventually becomes insurmountable for entrants, so that the opportunities for entrants to compete by introducing a new product variant decline in quantitative terms, while the importance of process innovation with respect to product innovation in the industry rises. Thus, new firms may have a positive impact on output and employment growth via productivity in the younger services sectors, while their role for productivity and thus output and employment should be less important in more mature ones. At the same time, output and employment growth can be expected to be higher in younger industries, because both new firms enter and incumbents expand in an attempt to seize unexploited business and technological opportunities. In more mature sectors, these opportunities are scarcer so less firm entry should be expected and less output and employment expansion at the same time. Moreover, the competitive pressure due to firm turnover should be expected to be stronger in younger industries, simply because firm churning is higher.

27. There are a number of reasons to expect that high entry rates and high productivity, output and employment should vary jointly across industries depending on their maturity. Some of this may be a result of new firms fostering productivity growth via their innovative activity, notably in younger industries. At the same time high rates of firm entry and output and employment growth may coincide in younger industries partly because there are more unexploited business opportunities. The next section takes a closer look at whether there is some evidence that new firms influence output and employment growth also via their innovative activity. This is done by examining the relationship between industry firm entry and productivity growth.

## Firm entry, innovation and productivity

28. Firm entry rates are assumed to capture the innovative activity of entrants and the competitive pressure created by it, which may force new firms and incumbents alike to innovate and increase their

productivity in order to stay in the market. Simple correlations suggest that there is a positive relationship between birth rates and labour productivity in the services industries, which is stronger with longer lags (Table 5). When labour productivity is measured as value added per hours worked, the relationship with entry rates is only significant with entry rates lagged twice. [6] This suggests that the effect of new firms on productivity takes some time to unfold. Labour productivity and entry rates are not correlated across manufacturing sectors. As a consequence, the positive correlation between labour productivity and entry rates disappears when manufacturing industries and services are pooled.

Table 5. **Correlations of entry rates with employment and hours based labour productivity growth**

(entry rates at different lags and averages over 1998-2000)

| Correlation with labour productivity (employment) | Entry rate at lag | | T-Statistic | No. of Obs. |
|---|---|---|---|---|
| | 0 | 0.23*** | 3.19 | 192 |
| | 1 | 0.27*** | 3.03 | 122 |
| | 2 | 0.45*** | 3.48 | 49 |
| | Average | 0.42*** | 2.69 | 35 |
| Correlation with labour productivity (hours) | 0 | 0.17* | 1.85 | 111 |
| | 1 | 0.15 | 1.24 | 68 |
| | 2 | 0.46** | 2.43 | 24 |
| | Average | 0.19 | 1.23 | 43 |

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

2. Data for hours based labour productivity include Denmark, Finland, the Netherlands and Sweden only.

*Source* : OECD calculations based on Eurostat and OECD STAN database.

29. A closer look at the productivity figures suggests that this could be related to different stages of the product life cycle entailing different types of innovative activity as drivers of productivity growth. Within the services sector, the relatively young ICT-related service industries with their exceptionally high entry rates are also among the industries which have experienced the highest labour productivity growth rates in most countries. In manufacturing, the office and computing machinery, which is at an equally early stage of the product life cycle with comparatively high entry rates, has been among the high productivity growth industries[7], but so have a number of more mature industries with much lower entry rates (Table 6). For most countries the R&D-intensive chemical industry, transport equipment as well as radio, television and communication equipment and insulated wire and cable are also among the sectors with high productivity growth. This fits into the argument made above that the innovative activity of new firms and the competitive pressure created through entry play an important role as a determinant for productivity growth in younger sectors, while large-scale laboratory based R&D subject to large fixed costs tends to outweigh this effect in manufacturing where industries are generally more mature and firms have already

6. This difference in correlations with entry rates among employment based labour productivity and hours based labour productivity can partly be explained by the difference in samples, as hours are only available for Denmark, Finland the Netherlands and Sweden. Moreover, Tables 3 and 4 show that the correlations between firm entry rates with growth in hours worked are a little stronger that with growth in employment, suggesting that in industries with high entry rates hours worked grow even faster than employment.

7. An exception is Finland, but this may be due to reclassification of some companies rather or some unusual shocks to this sector, as mentioned above.

reached a bigger size, although the office and computing machinery industry, as a notable exception, displays both high R&D intensity and high entry rates.

Table 6. **Labour productivity growth across industries and countries**

(averages over 1998-2000)

| | Cross-country Average | Denmark | Finland | Belgium | Netherlands | Sweden | Spain | Portugal | Italy | UK |
|---|---|---|---|---|---|---|---|---|---|---|
| Food & beverages | **0.97** | 6.11 | 2.32 | -0.83 | 0.58 | 1.19 | 1.21 | -0.73 | 0.23 | -1.35 |
| Textiles | **2.53** | 5.05 | 0.45 | 2.38 | 5.92 | - | 0.52 | 0.27 | 3.12 | - |
| Leather | **3.79** | 12.77 | -1.69 | 1.62 | 14.30 | - | 1.21 | -0.18 | -1.47 | - |
| Wood | **2.31** | -0.79 | 4.53 | 3.41 | 1.28 | 5.16 | 1.80 | 1.51 | 3.66 | 0.22 |
| Publishing & printing | **2.15** | 0.09 | 2.54 | 1.37 | 3.80 | 4.24 | 1.77 | 3.01 | 1.92 | 0.64 |
| Chemicals | **3.58** | 7.92 | 4.23 | 1.79 | 5.48 | 6.31 | 0.71 | 0.00 | 0.99 | 4.80 |
| Rubber & plastic | **0.94** | -1.53 | 1.56 | 0.34 | 2.27 | 0.04 | 1.22 | - | 0.97 | 2.67 |
| O. non-met. mineral prod. | **1.30** | -2.60 | -1.11 | -1.02 | 6.34 | 1.05 | 1.89 | 4.00 | 2.50 | 0.64 |
| Basic & fabricated metals | **1.89** | 1.24 | 3.30 | 2.90 | 1.68 | 2.88 | 0.58 | 3.37 | -0.35 | 1.43 |
| Machin. & equipment nec | **0.14** | -2.56 | -0.15 | 6.21 | 1.83 | 2.30 | 1.35 | -10.45 | 1.88 | 0.81 |
| Offi. machin. & computers | **2.85** | 24.21 | -17.23 | - | - | 5.82 | -2.13 | - | 3.57 | - |
| Insulated wire & cable | **5.47** | -1.43 | 8.57 | - | - | 12.60 | 2.13 | - | - | - |
| Radio, telev. & comm. eq. | **18.30** | 2.06 | 33.46 | - | - | 39.26 | -1.58 | - | - | - |
| Medical & optical inst. | **3.66** | 8.21 | -2.92 | - | - | 9.91 | 2.18 | - | 0.92 | - |
| Transport eq. | **2.96** | 6.26 | 0.06 | 4.03 | 1.31 | 6.00 | 0.22 | 6.00 | 2.28 | 0.48 |
| Manufacturing n.e.c. | **2.91** | -0.10 | 3.68 | 3.17 | 1.84 | 7.41 | 2.26 | 5.08 | 3.33 | -0.49 |
| Construction | **-0.13** | 2.66 | -2.83 | 1.41 | 1.06 | 0.12 | -0.39 | -2.10 | 0.10 | -1.17 |
| Wholesale & retail trade | **0.96** | 1.69 | 2.47 | -2.58 | 2.75 | 3.29 | -0.25 | 0.12 | 0.18 | - |
| Hotels & Restaurants | **0.92** | -1.89 | 2.09 | 2.12 | -0.12 | 2.14 | -1.68 | 4.90 | -0.23 | - |
| Transp., stor. & communic. | **3.72** | 4.15 | 5.93 | 5.42 | 3.58 | 0.86 | 2.41 | 4.19 | 1.87 | 5.01 |
| Post & telecom. | **7.58** | 5.13 | 16.23 | - | 8.78 | 3.68 | 1.32 | - | 10.36 | - |
| Financial intermediation | **3.64** | 3.11 | 7.99 | -3.82 | -2.08 | 3.09 | 2.25 | 16.06 | 2.51 | - |
| Real estate | **-1.45** | -0.14 | 0.79 | - | -0.13 | 2.84 | -10.12 | - | -1.94 | - |
| Renting of machin. & eq. | **2.03** | 0.41 | -0.25 | - | 6.26 | 5.68 | -1.94 | - | - | - |
| Computer services | **2.77** | 9.48 | -2.88 | - | 1.78 | -0.51 | 3.24 | - | 5.49 | - |
| Research & development | **-0.96** | 7.53 | -1.38 | - | -1.39 | - | -8.57 | - | - | - |
| Business services | **0.20** | 1.15 | -1.27 | - | 1.43 | 0.53 | 0.63 | - | -1.26 | - |
| Average | 2.78 | 3.64 | 2.54 | 1.64 | 2.98 | 5.24 | 0.08 | 2.19 | 1.77 | 1.14 |

*Source* : OECD calculations based on Eurostat and the OECD STAN database.

30. To explore these ideas more formally, the impact of birth rates on productivity is investigated with labour productivity estimations. The exact specification is discussed in Box III. Since it is likely that the full impact of firm entry takes some time to unfold, the estimation equation is specified with lagged entry rates as an explanatory variable. Unfortunately, however, the time dimension of the birth rate data is too short to study this aspect thoroughly. Only the impact of birth rates at lags one and two can be investigated. Yet, it may well take much longer for the effect of firm entry to unfold completely. Storey and van Stel (2002) find for example that firm entry has its strongest impact on employment creation after four to seven years.

31. In the R&D-based models of economic growth discussed in Box II, it is assumed that the innovative activity of new firms is fully reflected in their investment in R&D. There are a number of reasons to assume, however, that the kind of innovative activity conducted by new firms is often not completely captured by official R&D statistics, with the exception maybe of high-tech start-ups. Entrant firms are extremely small, more than 90 per cent employing less than 4 people, the vast majority of these employing none (Brandt, 2004). Rather than devoting specialized R&D personnel, material and machines exclusively to the development and implementation of new ideas, most of these very small new firms are more likely to innovate more informally. As they are typically small, they might enter the market with a new idea trying to implement it while running the commercial aspects of their business with the same personnel and equipment. This type of innovative activity will often not be fully captured by official R&D statistics. Moreover, innovation in services, where firm entry is generally higher differs somewhat from that in manufacturing (Pilat, 2001). Service innovation is more often non-technical and involves small changes in processes and procedures, which in many cases requires less R&D than innovations in

manufacturing. Innovation surveys suggest that expenditure on R&D constitutes are larger part of total investment in innovation in services than in manufacturing in many countries. Thus, although the coverage of R&D in services has improved a lot (Young, 1996), R&D statistics are likely to capture even a smaller part of the total innovation activity in services.

**Box III. Estimation framework**

The framework for labour productivity regressions corresponds to the standard specification of growth regressions in the literature (Barro and Sala-i-Martin, 1995):

$$gp_{ij} = \alpha_0 + \alpha_1 ba_{ij}(s) + \beta X_{ij} + \lambda_i + \varepsilon_{ij} \qquad (1)$$

where $gp_{ij}$, with $p=l,t$, is a measure of productivity growth in industry i of country j, $\lambda_i$ is a sectoral dummy, $X_{ij}$ is a vector of controls and $ba(s)_{ij}$ the firm birth rate of industry i in country j at lag s. Time subscripts are dropped for the sake of simplicity. Since it is likely that the full impact of firm entry takes some time to unfold, the estimation equation is specified with entry rates at different lags.

In the labour productivity regressions, $gl_{ij}$ is measured as the annual log difference of value added per worker. The vector of control variables includes the industry R&D intensity, measured as R&D expenditure as a ratio to value added, to account for the influence of formal research and development that will often be different in nature from the innovation activity of new firms. The latter is likely to be more informal and will often not be captured by official R&D statistics. The ratio of investment in physical capital to value added, the investment rate, is included in the estimation as a proxy for capital deepening. The initial labour productivity is employed to account for potential convergence effects, whereby less productive countries might catch up with the productivity leaders by adopting their technologies. It should be noted that since the estimation equations include lagged industry productivity levels, convergence between different industries within one country is tested as well, which is much stronger than the convergence hypothesis common in the growth literature. The control variables are lagged because similar as birth rates they are likely to unfold their full impact on productivity only after some time has elapsed.

Since the intensity of investment in physical capital is not the ideal proxy for capital accumulation, $gt_{ij}$ is measured as multifactor rather than labour productivity growth in a second set of estimations to control for capital deepening. Since capital stocks are available only for Denmark, Finland, Belgium and Italy, this investigation is confined to these four countries. Total factor productivity growth is measured as a Divisia index:

$$gt_{ij} = gy_{ij} - \hat{a}l_{ij}\, gl_{ij} - \hat{a}k_{ij}\, gk_{ij} \qquad (2)$$

where $gt_{ij}$ is the multifactor productivity growth in industry i of country j, $gy_{ij}$ is value added growth, $gl_{ij}$ is growth in total employment and $gk_{ij}$ growth of the capital stock in industry i of country j. Time subscripts are dropped for convenience. The weight for the growth of labour is the average of the labour share in income over two consecutive years $\hat{a}l_{ijt}=1/2(al_{ijt}+ al_{ij(t-1)})$ and the share of capital is the average residual income share $\hat{a}k_{,ijt}=1/2(ak_{ijt}+ ak_{ij(t-1)})$, where $ak_{ijt}=1-al_{ijt}$.. It should be noted that the residual of equation (2) measures "real" productivity growth only if the assumptions of perfect competition, constant returns to scale and full utilisation of capacity hold, otherwise it will capture the effects of economies of scale, mark-ups and/or under- or over-utilisation of capital in addition to this.

In this set of estimations, the control variables include the R&D intensity and lagged multifactor productivity to control for convergence.

32. Therefore, the R&D intensity, measured as the ratio of R&D expenditure to value added, is considered to be a measure of innovative activity that is complementary to firm entry rates, mainly measuring innovative activity of a different nature. This fits into the ideas of product life cycle studies, which suggest that new firms are important for innovation above all in younger industries. Once formal laboratory-based R&D activity based on specialized personnel and laboratories begins to dominate at later stages of the product life cycle, entering firms which typically employ less than 5 people and often none will have difficulties to compete. Table A1 in the appendix shows that the most R&D intensive sectors are in fact rather mature manufacturing industries. Within the services sector the young and dynamic ICT-related industries are the most R&D-intensive ones. This suggests that official R&D statistics may

capture some of the innovative activity in new firms after all, but it is nevertheless likely that they miss much of it.

33. Table 7 shows estimation results obtained with birth rates at lag one.[8] The results of equation [1] reveal that the firm entry rate at this lag has no impact on labour productivity growth when the growth rate equation is estimated with both manufacturing and services industries. In contrast, the estimated impact of R&D-intensity on labour productivity is large and significant (equation [2]). It hardly changes when both R&D-intensity and birth rates are included in the estimation equation (equation [3]).

Table 7**. Labour productivity growth regressions**

(the independent variable is the log annual difference in value added per worker of industry I in country j , 2000)

| | [1] | [2] | [3] | [4] | [5]+ | [6]+ | [7]+ | [8]+ |
|---|---|---|---|---|---|---|---|---|
| const. | 2.17 | 1.06 | 1.00 | 9.28 | -2.87 | -3.26 | -9.25 | -3.82 |
| | (1.58) | (1.31) | (1.58) | (17.48) | (1.93) | (1.92) | (39.06) | (58.90) |
| ba(-1) | -0.04 | | 0.08 | 0.02 | 0.39** | 0.39** | 0.38** | 0.22 |
| | (0.13) | | (0.13) | (0.14) | (0.17) | (0.17) | (0.18) | (0.37) |
| rdy(-1) | | 0.40*** | 0.40*** | 0.24*** | | 0.35** | 0.35** | 0.37 |
| | | (0.09) | (0.10) | (0.10) | | (0.16) | (0.16) | (1.21) |
| lp(-1) | | | | -0.76 | | | 0.57 | 0.38 |
| | | | | (1.61) | | | (3.72) | (5.51) |
| invy(-1) | | | | 0.02 | | | | -0.15 |
| | | | | (0.03) | | | | (0.11) |
| Obs. | 279 | 262 | 237 | 206 | 61 | 67 | 61 | 36 |
| Adj. $R^2$ | 0.01 | 0.13 | 0.11 | 0.23 | 0.35 | 0.33 | 0.34 | 0.50 |
| **Diagnostics:** | | | | | | | | |
| F.-Test [p.-value] | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| LM-Het. [p-value] | 0.60 | 0.35 | 0.43 | 0.65 | 0.67 | 0.86 | 0.68 | 0.17 |
| RESET [p-value] | 0.31 | 0.55 | 0.58 | 0.00 | 0.99 | 0.26 | 0.93 | 0.07 |
| Jarq.-B. [p-value] | 0.00 | 0.00 | 0.00 | 0.61 | 0.76 | 0.51 | 0.76 | 0.94 |

1. The dependent variable is the log difference of industry value added per worker (employment) between year t and year t-1, ba(-1) is the industry firm entry rate at lag 1, lp(-1) is the log labour productivity level at lag 1, invy(-1) is the ratio of investment in physical capital to value added at lag 1 and rdy(-1) is the ratio of investment in research and development capital to value added at lag 1. All estimations include a full set of sectoral dummies.
2. Standard errors in parentheses.
3. +Equations [5]-[8] are estimated for services industries only.
4. *** denotes significance at the 1 % level, ** at the 5 % level and * at the 10 % level.
5. As diagnostics, the p-values of Ramsey's RESET (RESET) test, of a Langrange Multiplier test for heteroscedasticity (LM.-Het.), of a Jarque-Berra normality test are reported, as well as of an F-Test for the hypothesis that all slopes are zero are presented.

*Source* : OECD estimations based on Eurostat firm entry data and data from the OECD STAN and ANBERD databases.

34. The ratio of investment in physical capital to value added, the investment rate, is included in the estimation as a proxy for capital deepening. The initial labour productivity is employed to account for potential convergence effects, whereby less productive countries might catch up with the productivity leaders by adopting their technologies. Both variables are lagged because they are likely to unfold their full impact on productivity only after some time has elapsed. While lowering the impact of the R&D variable, none of these controls is significant. It should be noted that the inclusion of initial labour productivity tests the hypothesis of productivity convergence not only among different countries, but also among different industries within the same country. Therefore, the lack of a significant impact of this variable cannot be regarded as evidence against the convergence hypothesis in the growth literature.

35. Limiting the estimation to services industries, firm entry turns out to have a significant and positive impact on labour productivity in these sectors (equation [5]). This result supports the idea that informal and small scale innovation performed by new firms is an important driving force of productivity

8. The Finnish data for the manufacturing of office machinery and computer industry was eliminated because of the problems related to it discussed before.

growth in some of the younger services sectors, while the impact of large scale, formal research and development conducted by specialized R&D personnel often in laboratories dominates in manufacturing industries. R&D has a positive impact on productivity as well, but its inclusion in the estimation equation hardly changes the estimated impact of firm entry (equation [6]). Again, the coefficient of initial labour productivity is not significant. Including the intensity of investment in physical capital in the estimation equation turns all explanatory variables insignificant (equation [7]). Since this variable is not significant itself, this should not be interpreted as evidence against the hypothesis that both firm entry and formal R&D influence labour productivity growth positively in these sectors. Rather, this result could partly be related to the fact that investment data is lacking for a considerable number of services industries, reducing the number of observations almost by half when including the investment rate in the estimation.

36. While the appropriate lag structure for firm entry rates cannot be studied because of the limited time dimension of the entry data, it is revealing to take a look at the same estimation with the firm entry variables lagged twice (Table A2 in the appendix). Again the coefficient of the firm entry variable is not significant when entering the estimation equation alone. However, when the R&D-variable is included in the estimation, it becomes significant (equation [2]). This indicates that once the effect of formal R&D on productivity is accounted for, new firms turn out to influence productivity positively across the entire sample of manufacturing and services industries. This lends some support to the idea that R&D intensity and firm entry rate data capture different aspects of innovative activity. Since the effect of the former dominates in manufacturing industries, a positive impact of firm entry on productivity in the full sample of industries can only be found once R&D is accounted for. The fact that this result cannot be found when entry rates enter the estimation equation at lag one may partly be explained with the argument that innovative activity in young firms takes some time to unfold its effect on productivity. However, it should also be noted that including birth rates at lag two rather than at lag one results in the loss of a considerable number of observations, as productivity data for the year 2000 are not available for a number industries in some countries.

37. The insignificance of the intensity of investment in physical capital in most estimations suggests that this is not the ideal proxy for capital accumulation. Another way to control for the effect of capital consists in investigating multifactor rather than labour productivity growth. Since capital stocks are available only for Denmark, Finland, Belgium and Italy, this investigation is confined to these four countries. Multifactor productivity growth is measured as a Divisia index (see Box III for details).

38. In services industries, there is a positive relationship between firm birth rates and multifactor productivity. Table 8 shows the correlation of multifactor productivity with birth rates at different lags as well as the correlation of the average of both measures over 1998-2000 for Denmark, Finland, Belgium and Italy.

Table 8. **Correlation of multifactor productivity growth with firm birth rates in the services sector**

(birth rates at different lags and averages over 1998-2000)

| Entry rate at lag | Correlation | T-Statistic | No. of Obs. |
|---|---|---|---|
| 0 | 0.26*** | 2.53 | 87 |
| 1 | 0.16 | 1.24 | 57 |
| 2 | 0.57*** | 3.48 | 27 |
| Average | 0.41** | 2.38 | 30 |

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

2. Data includes services industries in Denmark, Finland, Belgium and the Netherlands.

*Source:* OECD calculations based on Eurostat and the OECD STAN database.

39. The correlation of multifactor productivity growth with both contemporaneous birth rates and birth rates at lag 2 are positive and highly significant, as is the correlation between productivity growth and birth rates when both measures are averaged over the sample period 1998-2000. In the manufacturing sector there is a positive and highly significant correlation between multifactor productivity growth and birth rates at lag 2, but the relationship is insignificant at shorter lags (Table 9). Again, this seems to suggest that if there is a positive effect of new firms on productivity growth it takes some time to unfold.

Table 9. **Correlation of multifactor productivity growth with birth rates in the manufacturing sector**

(birth rates at different lags and averages over 1998-2000)

| Entry rate at lag | Correlation | T-Statistic | No. of Obs. |
|---|---|---|---|
| 0 | -0.04 | -0.42 | 135 |
| 1 | 0.06 | 0.55 | 86 |
| 2 | 0.71*** | 5.95 | 37 |
| Average | 0.27* | 1.89 | 48 |

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

2. Data includes services industries in Denmark, Finland, Belgium and the Netherlands.

*Source:* OECD calculations based on Eurostat and the OECD STAN database.

40. Table 10 shows the estimation results for the sample including all manufacturing and services industries. When entering the estimation equation alone, both firm entry and research and development have a significant impact on total factor productivity growth. However, the firm entry rate is insignificant when the two variables are included together (equations [3] and [4]), which seems to suggest that it picks

Table 10. **Multifactor productivity growth regressions for manufacturing and services industries**

(the independent variable is the multifactor productivity growth of industry I in country j ,1999-2000)

| | [1] | [2] | [3] | [4] | [5]+ |
|---|---|---|---|---|---|
| const. | -1.54 | 0.16 | -1.58 | -5.95 | 0.35 |
| | (2.64) | (2.19) | (2.47) | (5.27) | (3.18) |
| ba(-1) | 0.51* | | 0.36 | 0.33 | 0.46*** |
| | (0.27) | | (0.26) | (0.27) | (0.16) |
| rdy(-1) | | 0.47** | 0.46** | 0.47** | 0.31*** |
| | | (0.22) | (0.21) | (0.21) | (0.10) |
| ltfp(-1) | | | | 0.67 | -0.39 |
| | | | | (0.72) | (0.42) |
| Obs. | 121 | 114 | 112 | 112 | 112 |
| Adj. $R^2$ | 0.24 | 0.34 | 0.35 | 0.35 | 0.37 |
| **Diagnostics:** | | | | | |
| F.-Test [p.-value] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| LM-Het. [p-value] | 0.20 | 0.24 | 0.12 | 0.12 | 0.10 |
| RESET [p-value] | 0.01 | 0.55 | 0.50 | 0.51 | 0.91 |
| Jarq.-B. [p-value] | 0.08 | 0.21 | 0.11 | 0.08 | 0.80 |
| F.-Test II [p.-value] | | | | | 0.67 |

1. The dependent variable is the annual multifactor productivity growth measured as a Divisia index, ba(-1) is the industry firm entry rate at lag , rdy(-1) is the ratio of investment in research and development capital to value added at lag 1 and ltfp(-1) is the the lagged log level of total factor productivity at lag 1. All estimations include a full set of sectoral dummies.

2. Standard errors in parentheses.

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

3. As diagnostics, the p-values of Ramsey's RESET (RESET) test, of a Langrange Multiplier test for heteroscedasticity (LM.-Het.), of a Jarque-Berra normality test are reported, as well as an F-Test for the hypothesis that all slopes are zero.

4. + Equation [5] is estimated only with significant industry dummies. F.-Test. II is the F-test for the hypothesis that the industry dummies which have been eliminated from the estimation equation are all jointly zero.

*Source* : OECD estimations based on Eurostat data and the OECD STAN and ANBERD databases.

up some of the effect of research and development on productivity growth rather than having an independent effect on productivity itself. The lagged level of total factor productivity is insignificant, suggesting that there is no convergence in the strong sense that not only countries on average, but also industries converge to a common productivity level.

41. Sectoral dummies are included in the estimation to capture the impact of any factors other than those included in the estimation equation. However, most of these estimates turn out to be insignificant. While equation [1]-[4] include a full set of industry dummies, equation [5] is estimated only with significant industry dummies. The F-statistic for the test of the hypothesis that all of the dropped industry dummies are jointly zero "F.-Test II", indicates that this is permissible. With the reduced set of sectoral dummies both the coefficient of the firm entry variable and of the R&D intensity variable are strongly significant and positive. The insignificant industry dummies seem to obscure the effect of firm entry on productivity without adding any explanatory power to the estimation.

42. As in the case of the labour productivity regressions, the estimated impact of firm entry on productivity is much higher and more significant when the equation is estimated only with services industries (Table 11, equation [1]). The coefficient of R&D-intensity is also high and significant when estimated alone (equation [2]), but it decreases and is only barely significant when both variables enter the estimation equation together (equation [3]). This also holds for the firm entry variable. Including also lagged MFP growth has the effect that the R&D variable becomes insignificant (equation [4]). Yet, once again that seems to be a result of insignificant sectoral dummies obscuring the relationship between R&D, firm entry and productivity growth. In equation [5], where insignificant dummies are not included the estimated coefficient of both R&D and firm birth is highly significant.

Table 11. **Multifactor productivity growth regressions for services industries**

(the independent variable is the multifactor productivity growth of industry I in country j ,1999-2000)

| | [1] | [2] | [3] | [4] | [5]+ | [6]++ |
|---|---|---|---|---|---|---|
| const. | -9.48 | -1.07 | -6.61* | -4.43 | 3.80 | 6.98 |
| | (4.14) | (2.11) | (3.55) | (10.14) | (5.22) | (4.71) |
| ba(-1) | 1.02*** | | 0.66* | 0.70* | 0.80*** | 0.67*** |
| | (0.38) | | (0.35) | (0.40) | (0.27) | (0.24) |
| rdy(-1) | | 0.86** | 0.60* | 0.59 | 0.34** | 0.41*** |
| | | (0.34) | (0.35) | (0.36) | (0.16) | (0.14) |
| ltfp(-1) | | | | -0.35 | -1.42** | -1.82*** |
| | | | | (1.52) | (0.68) | (0.61) |
| Obs. | 37 | 30 | 30 | 30 | 30 | 29 |
| Adj. $R^2$ | 0.19 | 0.43 | 0.49 | 0.47 | 0.51 | 0.58 |
| **Diagnostics:** | | | | | | |
| F.-Test [p.-value] | 0.06 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 |
| LM-Het. [p-value] | 0.61 | 0.53 | 0.96 | 0.94 | 0.84 | 0.68 |
| RESET [p-value] | 0.03 | 0.04 | 0.01 | 0.01 | 0.07 | 0.13 |
| Jarq.-B. [p-value] | 0.15 | 0.23 | 0.60 | 0.65 | 0.63 | 0.99 |
| F.-Test II [p.-value] | | | | | 0.87 | |

1. The dependent variable is the annual total factor productivity growth measured as a Divisia index, ba(-1) is the industry firm entry rate at lag , rdy(-1) is the ratio of investment in research and development capital to value added at lag 1 and ltfp(-1) is the the lagged level of total factor prouctivity. All estimations include a full set of sectoral dummies.

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

3. As diagnostics, the p-values of Ramsey's RESET (RESET) test, a Langrange Multiplier test for heteroscedasticity (LM.-Het.), a Jarque-Berra normality test are reported, as well as an F-Test for the hypothesis that all slopes are zero. F-Test II is the test statistic for the test that all sectoral dummies dropped from the estimation in equation [5] are jointly zero.

4. + Equation [5] is estimated only with significant industry dummies. F.-Test. II is the F-test for the hypothesis that the industry dummies which have been eliminated from the estimation equation are all jointly zero.

5. ++ excluding one outlier.

*Source* : OECD estimations based on Eurostat firm entry data and data from the OECD STAN and ANBERD databases.

43. While the coefficient of R&D is about the same size as in the full sample that includes manufacturing industries, the estimated impact of firm entry is much higher in the services sample. Once again this indicates that new firms might have a stronger impact on productivity growth in services industries than in manufacturing. The coefficient of the lagged MFP-level indicates that there is productivity convergence among services industries in the investigated countries.[9] When estimating the multifactor productivity growth equation for manufacturing industries alone, the R&D variable has a significantly positive impact, while firm entry is insignificant regardless of the specification of the estimation equation (results not shown). These results are further evidence in favour of the hypothesis that innovation activity of new firms is important for productivity growth in younger services industries, while large-scale R&D activity based on specialized personnel and equipment seems to be the dominant driving force for productivity growth in manufacturing.

44. The labour and productivity growth rates regressions reveal some interesting patterns of firm entry rates and productivity growth across industries. The results lend some support to the idea that firm entry has some positive effect on productivity especially among younger services industries. However, it should be noted that the estimated coefficients do not necessarily reflect a causal relationship. The causality may also run from productivity to firm entry (or in both directions), if highly productive and thus profitable industries attract a lot of start-ups. Although the use of lagged explanatory variables are a crude way to account for potential endogeneity problems related to industry productivity growth possibly influencing firm entry, the estimations should be considered work in progress, as more could be done in the future to refine them. Although the time dimension is short, it would be desirable to include a measure of capacity utilisation in the estimation to account for the problem that the input measures used to calculate multifactor productivity often measure capacity rather than the actual use of these inputs, and thus the residual of equation (2) in Box III will not always correspond to “real” productivity growth, but partially capture over- or under-utilisation of capacity. Consideration could be given to estimating a production function with an instrumental variable technique to take care of remaining endogeneity problems, but appropriate instruments are notoriously difficult to find. Since the results seem to lend some support to the idea that the positive relationship between firm entry and productivity is more related to informal innovation activity, while R&D statistics capture laboratory based innovation that is often subject to considerable economies of scale, it might be revealing to include a measure of industries’ average firm size in the estimations. Using data from the Community Innovation Survey (CIS) that includes more informal kinds of innovation would be a further option to get more insights into the role of young firms for innovation. For the time being, the results presented in this section should be considered as some first indications concerning the role of new firms for productivity growth.

---

9. The RESET statistic in equations [1]-[5] of Table 13 indicates that the estimation equation might be misspecified. Yet, it seems to be enough to drop an outlier to resolve this problem, which hardly changes results.

**Summary and conclusions**

45. New firms are often thought to be important as job creators and to have a positive impact on productivity and output growth. Assuming that entrants have an advantage in innovating and adopting new technologies, Schumpeterian models of creative destruction ascribe to them an important role for technological change and thus for productivity growth. 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 takes a closer look at the relationship between regulation and firm entry, as well as at the role of new firms for innovation and economic performance.

46. Indicators that capture different aspects of countries' regulatory framework are used to assess the impact on policies and institutions on firm entry and survival. Even when using very conservative methods to assess the statistical significance of observed correlations between regulatory indicators and firm entry, some of them stand out as having a very robust, significant relationship with firm entry rates. The results suggest 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 result should draw attention to the role of exit barriers. Business demographics studies invariably find that firm entry is highly experimental involving a lot of exit at the same time, as new enterprises drive a large number of incumbents out of the market and often do not survive for long themselves. To exploit the potential of those young firms that will turn out to be successful and innovative, the experimentation process associated with firm entry should be hindered as little as possible. Since entering firms know little about their chances to survive, institutions that make firm exit excessively costly, risk discouraging firms from entering the market in the first place.

47. None of the investigated indicators is found to have a significant relationship with firm survival in early life. However, that may partly be related to the conservative estimation method employed 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 more comparable data on firm dynamics is available.

48. While it is important to understand the impact on policies and institutions on firm entry, it is not *a priori* clear whether more firm entry or less is desirable. Exploring the industry dimension of the data reveals that firm entry rates are significantly correlated with output and employment growth across services sectors, while this relationship is less clear-cut in manufacturing. If new firms are thought to influence output and employment growth through their important role for innovation and technology adoption, as Schumpeterian models of growth suggest, this result appears quite puzzling at first sight. Studies of product life cycles provide some ideas that could help to understand the observed patterns of industry firm entry, output and employment growth. A stylised fact that emerges from these studies of industry evolution is that high rates of firm entry occur mainly in young industries and are often associated with product innovation. As industries mature, the amount of product innovation diminishes, while process innovation based on formal R&D activity becomes more important. Since the latter is often subject to large fixed costs, typically small entrant firms have a disadvantage for this type of innovative activity. This is how some theories of product life cycles explain why entry rates decline as industries become more mature and the most successful incumbents grow.

49. More generally, since new firms are typically very small, any type of innovation that they conduct, of the process or of the product kind, is likely to be often of a more informal and experimental kind. This will in many cases not be captured by official R&D statistics. It may be the case that the kind of innovation conducted in entrant firms is especially important for technological progress in young industries, where uncertainty about consumer preferences and technological means to satisfy them still

leaves a lot of room for experimentation. In more mature markets, where many of these issues are explored, formal, large-scale R&D subject to large fixed costs may gain relative importance and leave little room for small newcomers to conquer market shares and contribute to productivity growth. The finding that in services the relatively young ICT-related sectors marked by high entry rates have experienced exceptionally high productivity, output and employment growth, while mature R&D-intensive industries with a large average firm size are associated with comparatively high productivity growth rates in manufacturing fits into this picture.

50. Productivity growth regressions reveal that R&D intensity is positively related to both subsequent labour and total factor productivity growth throughout manufacturing and services industries. Firm entry is found to have a significantly positive impact on labour and total factor productivity growth, as well, although the impact is generally higher and more robust when the analysis is confined to services industries. These results lend some support to the idea that R&D statistics and firm entry rates capture different aspects of innovative activity, because creation and implementation of new ideas in young and typically small firms is more informal and difficult to cover with R&D surveys. The result that the positive relationship between firm entry and productivity is stronger and more robust in services is an indication that in these industries the innovative activity performed in new firms and the competitive pressure exercised through this has a particularly pervasive effect, while large-scale research and development based on specialized personnel and laboratories appear to be the dominant drivers of productivity in the generally more mature manufacturing industries.

**The role for policy**

51. The results in this paper suggest that the process of firm entry and exit plays an important role for structural change and economic performance. New firms seem to be important for shifting resources to expanding markets and for enhancing productivity growth especially in newly emerging sectors. This appears to be the result of a process of search and experimentation involving a high amount of firm churning. Not only do young firms replace outpaced incumbents, but many of them fail trying to implement their new ideas.

52. Product market regulations which constitute direct or indirect barriers to entry may impinge on a country’s ability to exploit the potential of young firms’ contribution to innovation and productivity growth in younger markets. Prior OECD research (Scarpetta *et al*., 2002) has shown that excessively stringent product and labour market regulations have had a negative impact on both firm entry and productivity in OECD countries. Therefore, legal barriers to entry should be avoided unless their benefits are certain to outweigh the cost that consists in hindering the potential of young firms to help shift resources to new and productive uses, innovate and adopt new technologies. To avoid impinging on firm entry, administrative procedures required for the establishment of new enterprises should be simple, transparent and fast and fees associated with them should not be unduly high. The importance of this recommendation is underscored by the result presented in this paper that an excessively complicated license and permit system can have a negative impact on firm entry.

53. Market exit of young firms that have turned out not to be profitable should be considered an integral part of the process of search and experimentation which leads to innovation and new technology adoption. The findings of this paper suggest that countries’ policies and institutions should not unduly hinder market entry *or* exit, since both firm creation and destruction are indispensable for the learning and experimentation process which is important for the conquest of new markets and the development of new technologies. As firms know that they might be forced to exit the market in the eventuality of failure, barriers to exit may discourage them from entering the market much in the way as entry barriers would. This is underlined by the result that the length of time during which creditors have claims on bankrupts’ assets is negatively related to firm entry. Thus, excessively stringent bankruptcy laws, which make it very

costly for firms to exit the market in case they turn out not to be profitable, should be avoided. Rather, flexible and transparent institutions facilitating both market entry of new firms and exit of failed enterprises would be in the spirit of the interpretation of entrepreneurship as a process of search and experimentation indispensable for innovation, technology adoption and economic growth.

54. Many other aspects of countries' institutional frameworks are likely to be important for the creation of new firms and for enhancing their potential to innovate successfully and thus contribute to productivity growth. This includes the development of financial institutions to provide young firms with assets and the education system to ensure that skilled labour is available. However, because for the time being comparable business dynamics data is only available for a small number of countries, possibilities to study the role of many different aspects of countries institutional frameworks empirically are limited.

**BIBLIOGRAPHY**

Aghion, P. and P. Howitt (1992), "A Model of Growth through Creative Destruction", *Econometrica* Vol. 60, No. 2, 323-351.

Ahn, S. (2001), "Firm Dynamics and Productivity Growth: A Review of Micro Evidence from OECD Countries", OECD Economics Department Working Paper no. 297.

Audretsch, D.B., L. Klomp and A.R. Thurik (1997), "Do Services Differ from Manufacturing? The Post-Entry Performance of Firms in Dutch Services", Centre for Economic Policy research (CEPR) Discussion Paper, No. 1718, November.

Audretsch, D.B., L. Klomp and A.R. thurik (1997), "Do Services Differ from Manufacturing? The Post-Entry Performance of Firms in Dutch Services", Centre for Economic Policy Research (CEPR) Discussion paper, No. 1718, November.

Baldwin, J., L. Bian, R. Dupuy and G. Gellatly (2000), *Failure Rates for New Canadian Firms: New Perspectives on Entry and Exit*, Statistics Canada, Catalogue no. 61-526-XPE, Ottawa.

Baldwin, J. and W. Gu (2003), "Plant Turnover and Productivity Growth in Canadian Manufacturing", STI Working Paper, 2002/2, OECD, Paris.

Bartelsman, E.J., S. Scarpetta and F. Schivardi (2003), "Comparative Analysis of Firm Demographics and Survival: Micro-Level Evidence for the OECD Countries", OECD Economics Department Working Paper no. 348, OECD, Paris.

Beck, T. A. Demirgüç-Kunt and V. Maksimovic (2001), "Financial and Legal Constraints to Firm Growth: Does Size Matter?", World Bank Working Paper no. 2784, The World Bank, Washington.

Bertrand, M., E. Duflo and S. Mullainathan (2003), "How Much Should We Trust Differences in Differences Estimates", *Quarterly Journal of Economics.*

Birch, D. (1979), *The Job Creation Process*, MIT Study on Neighbourhood and Regional Change. Cambridge, Massachusetts.

Birch, D. (1987), *Job Creation in America: How our Smallest Companies Put Most People to Work.* New York, Free Press.

Brandt, N. (2004), "Business Dynamics in Europe", STI Working Paper 2004/1, OECD, Paris.

Caballero R.J. and M.L. Hammour (1994), "The Cleansing Effect of Creative Destruction", *American Economic Review*, Vol. 84, No. 5, pp. 1350-68.

Caballero, R.J. and M.L. Hammour (1996), "On the Timing and Efficiency of Creative Destruction", *Quarterly Journal of Economics*, Vol. 111, pp. 805-852.

Caves, R.E. (1998), "Industrial Organization and New Findings on the Turnover and Mobility of Firms", *Journal of Economic Literature*, Vol. 36, No. 4, pp. 1947-82.

Campbell, J. (1997), "Entry, Exit, Technology and Business Cycles", *National Bureau of Economic Research Working Paper*, No. 5955.

Cooper, R., J. Haltiwanger and L. Power (1997), "Machine Replacement and the Business Cycle: Lumps and Bumps", *National Bureau Economic Research Working Paper*, No. 5260 (revised).

Cressy, R. (1996), "Are Business Start-Ups Debt-Rationed?", *The Economic Journal*, Vol. 106, 1253-1270.

Doms, M., T. Dunne and M.J. Roberts (1995), "The Role of Technology Use in the Survival and Growth of Manufacturing Plants", *International Journal of Industrial Organization*, Vol. 13, 523-542.

Donald, S. and K. Lang (2001), "Inferences with Differences in Differences and other Panel Data", *Working Paper, Boston University*.

Dupuy, G. and G. Picot (1998), "Job Creation by Company Size Class: The Magnitude, Concentration and Persistence of Job Gains and Losses in Canada", *Small Business Economics*, Vol. 10, Issue 2, March 1998.

Ericson, R. and A. Pakes (1995), "Markov Perfect Industry Dynamics: A Framework for Empirical Analysis", *Review of Economic Studies*, pp. 53-82, Vol. 62, No. 1.

Faberman, J. (2003), "Job Flows and Establishment Characteristics: Variations Across U.S. Metropolitan Areas", *Paper presented at the Comparative Analysis of Enterprise (micro) Data Conference (CAED)*, London, 15-16 September, 2003.

Foster, L., J. Haltiwanger and C.J. Krizan (1998), "Aggregate Productivity Growth: Lessons from Microeconomic Evidence", *National Bureau of Economic Research Working Paper No. 6083.*

Geroski, P. (1995), "What do we Know about Entry?", *International Journal of Industrial Organization*, Vol. 13, No. 4, pp. 421-440.

Gort, M. and S. Klepper (1982), "Time Paths in the Diffusion of Product Innovations", *Economic Journal*, Vol. 92, No. 367, 630-653.

Grossman, G.M. and E. Helpman (1991), *Innovation and Growth in the Global Economy*, MIT Press, Cambridge, MA.

Hult, M. (2003), *Business Dynamics in 9 Member States – Results for 1997-2000,* Statistics in Focus, Theme 4-9/2003.

Jovanovic, B. (1982), "Selection and the Evolution of Industry", *Econometrica*, Vol. 50, No. 3, May, pp. 649-70.

Klepper, S. (1996), "Entry, Exit, Growth, and Innovation over the Product Life Cycle", *American Economic Review, Volume 86, No. 3, pp 562-583*

Moulton, Brent (1990), "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units", *Review of Economics and Statistics*, Volume 72, No. 2, pp. 334-338.

Mortensen, D. and C. Pissarides (1994) "Job Creation and Destruction in the Theory of Unemployment, *Review of Economic Studies*, Vol. 61, pp. 397-416.

Nicoletti, G., S. Scarpetta and O. Boylaud (1999), "Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation", OECD Economics Department Working Paper, No. 226, OECD, Paris.

OECD (2001), "Science, Technology and Industry Outlook – Drivers of Growth, Information Technology, Innovation and Entrepreneurship", *Special Edition 2001*, OECD, Paris.

Pilat, D. (2001), "Innovation and Productivity in Services: State of the Art", in: *Innovation and Productivity in Services,* OECD, Paris.

Scarpetta, S., P. Hemmings, T. Tressel and J. Woo (2002), "The Role of Policy and Institutions for Productivity and Firm Dynamics: Evidence from Micro and Industry Data", OECD Economics Department Working Paper, No. 329, OECD, Paris.

Solow, R. (1960), "Investment and Technical Progress", in Arrow, K., S. Kabin and P. Suppes (Eds.), *Mathematical Methods in the Social Sciences*, Stanford University Press, Stanford. UNICE (2000), "Stimulating Creativity and Innovation in Europe: The UNICE Benchmarking Report", Brussels, Belgium.

van Steel, A. and D. Storey (2002), "The Relationship between Firm Births and Job Creation", Tinbergen Institute Discussion Paper 2002-052/3.

UNICE (2000), "Stimulating Creativity and Innovation in Europe: The UNICE Benchmarking Report", Brussels, Belgium.

Wagner, J. (1994), "The Post-Entry Performance of New Small Firms in German Manufacturing Industries", *Journal of Industrial Economics,* Vol. 42, No. 2, 141-154.

Wooldridge, J. (2003), "Cluster-Sample Methods in Applied Econometrics," *American Economic Review*, Vol. 93, No. 2, 133-138.

Young, A. (1996), "Measuring R&D in Services", STI Working Paper 1996/7, OECD, Paris.

## ANNEX

Table A1. **Relative R&D-intensities across sectors and countries**

(Ratios to cross-country averages, 1998-2000)

| | Cross-country average | Denmark | Finland | Belgium | Netherlands | Sweden | Spain | Italy | UK |
|---|---|---|---|---|---|---|---|---|---|
| Food & beverages | **1.46** | 1.13 | 1.80 | 1.08 | 1.45 | 1.09 | 0.37 | 0.24 | 0.84 |
| Textiles | **1.26** | .. | 1.91 | 1.61 | 0.79 | .. | 0.65 | 0.04 | .. |
| Leather | **0.90** | .. | 1.18 | 1.77 | 1.42 | .. | 0.55 | 0.08 | .. |
| Wood | **0.42** | 1.15 | 3.38 | 0.74 | 0.36 | 0.90 | 0.39 | 0.08 | .. |
| Publishing & printing | **0.86** | 0.34 | 1.57 | 1.00 | 0.43 | 2.92 | 0.60 | 0.14 | .. |
| Chemicals | **15.23** | 1.55 | 0.83 | 0.96 | 0.77 | 1.90 | 0.30 | 0.29 | 1.39 |
| Rubber & plastic | **2.77** | 1.19 | 1.98 | 1.69 | 0.70 | 1.28 | 0.48 | 0.39 | 0.29 |
| O. non-met. mineral prod. | **1.32** | 0.82 | 1.58 | 2.33 | 0.49 | 1.41 | 0.44 | 0.09 | 0.83 |
| Basic & fabricated metals | **1.51** | 0.58 | 1.94 | 1.66 | 1.04 | 1.60 | 0.50 | 0.14 | 0.55 |
| Machin. & equipment nec | **6.00** | 1.12 | 1.36 | 1.05 | 1.15 | 1.71 | 0.46 | 0.28 | 0.86 |
| Offi. machin. & computers | **18.80** | 0.80 | 1.86 | .. | 2.63 | 0.78 | 0.31 | 0.42 | 0.20 |
| Insulated wire & cable | **7.36** | 0.90 | 1.95 | .. | 0.83 | 0.96 | 0.43 | .. | 0.93 |
| Radio, telev. & comm. eq. | **27.62** | 0.68 | 0.97 | .. | 0.82 | 2.37 | 0.70 | .. | 0.47 |
| Medical & optical inst. | **10.04** | 1.40 | 1.12 | .. | .. | 1.86 | 0.43 | 0.35 | 0.84 |
| Transport eq. | **8.71** | 0.63 | 0.43 | 0.47 | 0.50 | 2.68 | 0.48 | 1.19 | 1.62 |
| Manufacturing n.e.c. | **0.91** | .. | 2.50 | 1.50 | 0.40 | .. | 0.96 | 0.16 | 0.48 |
| Construction | **0.19** | 0.32 | 2.29 | 1.83 | 1.74 | .. | 0.17 | 0.18 | 0.47 |
| Wholesale & retail trade | **0.26** | 3.36 | 0.19 | 0.66 | 1.64 | .. | 0.08 | 0.08 | .. |
| Transp., storage & communi | **0.52** | .. | 2.86 | 0.27 | .. | .. | 0.81 | 0.05 | .. |
| Post & telecom. | **2.02** | 0.93 | 2.38 | .. | 0.51 | .. | .. | 0.03 | 1.15 |
| Financial intermediation | **0.31** | .. | .. | 1.92 | 1.61 | .. | 0.14 | 0.33 | .. |
| Computer services | **4.81** | 2.58 | 1.12 | .. | 0.36 | .. | .. | 0.19 | 0.75 |
| Research & development | **13.24** | 2.01 | .. | .. | 0.15 | .. | .. | .. | 0.84 |
| Business services | **0.78** | 3.04 | 0.65 | .. | 0.81 | .. | .. | 0.20 | 0.30 |

1. The R&D intensity is measured as industry R&D expenditure in relation to value added.
2. The cross-country average is the average across all countries of R&D intensity in a given industry. The numbers in the country columns show countries' R&D intensity in relation to the cross-country average in a given industry.

*Source* : OECD ANBERD database.

Table A2. **Labour productivity growth regressions II**

(the independent variable is the log annual difference in value added per worker of industry I in country j , 2000)

| | [1] | [2] | [3] | [4] | [5]+ | [6]+ | [7]+ | [8]+ |
|---|---|---|---|---|---|---|---|---|
| const. | 0.24 | 1.21 | -0.87 | 26.32 | -4.48 | -5.94** | 172 | 123 |
| | (1.97) | (1.79) | (1.97) | (27.46) | (3.12) | (2.84) | (81.49) | (75.74) |
| ba(-2) | 0.24 | | 0.36** | 0.45** | 0.48* | 0.61** | 0.99*** | 1.05** |
| | (0.15) | | (0.16) | (0.22) | (0.25) | (0.23) | (0.27) | (0.41) |
| rdy(-1) | | 0.25** | 0.35** | 0.31** | | 1.60** | 1.72** | 3.28* |
| | | (0.15) | (0.14) | (0.14) | | (0.66) | (0.60) | (1.62) |
| lp(-2) | | | | -2.22 | | | -17.21** | -11.55 |
| | | | | (2.57) | | | (7.85) | (7.32) |
| invy(-1) | | | | -0.18 | | | | -0.78* |
| | | | | (0.11) | | | | (0.35) |
| Obs. | 109 | 109 | 109 | 95 | 28 | 28 | 28 | 17 |
| Adj. $R^2$ | 0.17 | 0.17 | 0.21 | 0.27 | 0.41 | 0.26 | 0.51 | 0.71 |
| **Diagnostics:** | | | | | | | | |
| F.-Test [p.-value] | 0.01 | 0.01 | 0.004 | 0.002 | 0.01 | 0.06 | 0.005 | 0.02 |
| LM-Het. [p-value] | 0.65 | 0.29 | 0.87 | 0.97 | 0.68 | 0.41 | 0.65 | 0.73 |
| RESET [p-value] | 0.15 | 0.89 | 0.13 | 0.02 | 0.20 | 0.01 | 0.15 | 0.82 |
| Jarq.-B. [p-value] | 0.31 | 0.06 | 0.11 | 0.16 | 0.49 | 0.96 | 0.86 | 0.60 |

1. The dependent variable is the log difference of industry value added per worker (employment) between year t and year t-1, ba(-2) is the industry firm entry rate at lag 2, lp(-2) is the log labour productivity level at lag 2, invy(-2) is the ratio of investment in physical capital to value added at lag 1 and rdy(-1) is the ratio of investment in research and development capital to value added at lag 1. All estimations include a full set of sectoral dummies.
2. Standard errors in parentheses.
3. +Equations [5]-[8] are estimated for services industries only.
4. *** denotes significance at the 1 % level, ** at the 5 % level and * at the 10 % level.
5. As diagnostics, the p-values of Ramsey's RESET (RESET) test, of a Langrange Multiplier test for heteroscedasticity (LM.-Het.), of a Jarque-Berra normality test are reported and an F-Test for the hypothesis that all slopes are zero are presented.

*Source* : OECD estimations based on Eurostat firm entry data and data from the OECD STAN and ANBERD databases.