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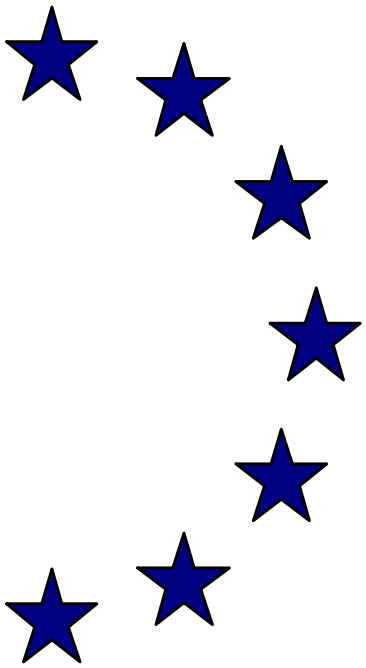

ISSN 1725-3187
http://europa.eu.int/comm/economy_finance

N° 222 February 2005

Impact of Market Entry and Exit onEU Productivity and Growth Performance

by

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This study was commissioned by the Directorate General Economic and Financial Affairs of the European Commission under the reference ECFIN/191-2003/SI. The authors are most grateful to Adriaan Dierx, Fabienne Ilzkovitz, Gaëtan Nicodème, Una Oligbo, Jacques-Bernard Sauner-Leroy, Jan Schmidt, Khalid Sekkat, Reinhilde Veugelers as well as participants at two internal meetings for helpful comments and suggestions. The findings, interpretations and conclusions expressed in this paper are entirely those of the authors and do not necessarily represent those of the European Commission. They should not be attributed to the European Commission.

ECFIN/000573/05-EN

ISBN 92-894-8861-1

KC-AI-05-222-EN-C

Executive summary

The European Union and its Member States have been engaged in product market reforms over a long period with notable reforms including the Single Market Program and the Lisbon Agenda launched in March 2000. The Lisbon Agenda is a comprehensive 10-year strategy covering product, labour and capital market reforms which aim to transform the EU into the most competitive and dynamic knowledge-based economy in the world by increasing the employment rate and the level of labour productivity as well as contributing to raise the rate of potential output growth.

In the past decade, the European Union's product market reforms have included the dismantling of barriers to trade in the Internal Market, the liberalisation of network industries (telecommunications, electricity, gas, transport and postal services), reductions in State Aid, reforms to competition policy and the deregulation of product markets. The main aim of these reforms is to increase productivity given the sharp decrease in EU productivity growth rates compared with those of the United States after 1995, which has led to EU GDP per capita being only 70% of US levels.

Product market reforms are seen as exerting both a direct and an indirect impact on productivity. The direct effect on productivity is due to the removal of barriers to penetrate new markets and to the decrease in the costs of doing business. However, the net effects of the direct effect were found to be small.

The indirect effect on productivity is transmitted through three channels. Product market reforms are expected to lead to a gain in allocative efficiency by reducing incumbent firms' market power and by increasing market contestability through an increase in the number of competitive firms on the market as well as in the threat of firm entry. The rise in the level of competition on the market will lead to a reduction in price mark-up and to a better allocation of resources as less efficient firms exit the market and are replaced by more productive new entrants. The second transmission channel is through an increase in productive efficiency by raising the incentives for managers and workers to organise their work more efficiently, trim fat and reduce slack, thereby minimising the under-utilisation of production factors. The third channel is by increasing the incentives of firms to carry out research and innovate and hence allowing them to move to the technology frontier more rapidly. While the allocative and productive efficiency gains are expected to take place rapidly and only once, the dynamic efficiency gains are expected to take place over a longer period of time, but have a larger impact on productivity.

In this study, we concentrate on the impact of product market reforms on firm entry and exit that can itself be decomposed into two effects: internal restructuring which refers to productivity growth of individual firms present in the industry and external restructuring whereby the process of market selection leads to a reallocation of resources among individual firms. The change in firm entry and exit will in turn affect macroeconomic performance.

The theoretical literature generally predicts a positive impact of firm entry and exit and of product market reforms on productivity and performance. Product market reforms will affect firm entry and exit through internal restructuring by modifying factors internal to the firm such as organisational change, the introduction of new technologies, increased competition, R&D activities or a change in the mix of labour and capital. There is also an external restructuring effect whereby the process of market selection leads to a reallocation of

resources among individual firms. This is done in two ways: first, there is a process of creative destruction by which low productivity firms exit the market and are replaced by new entrants that are themselves heterogeneous. Among them, the most efficient ones will survive, while the least efficient ones will exit the market in subsequent periods. Second, there is a change in market shares among incumbents, which will also have an impact on aggregate productivity growth. The latter will for example increase if high productivity firms gain market shares. At the same time, there are a number of important interactions between the various sources of aggregate productivity growth mentioned above. Existing firms may for instance increase productivity by enhancing their investment in order to preserve their market shares when faced with entry of new and more productive firms.

The deregulation of product markets will also have a positive effect on capital accumulation if it leads to a reduction in the mark-up or lowers the costs of adjusting the capital stock. There are however instances in which product market reforms may have negative effects on economic performance. If for example regulation imposed a ceiling on the rate of return on capital invested, firms may invest in additional capital in order to increase the base to which the constrained rate of return on capital is applied to increase the total remuneration for capital. Removing the constraint may lead to a decrease in the desired level of the capital stock and in investment. In addition, if public companies were heavy investors before deregulation, the privatisation process consisting in reducing the role of public companies in the sector may lead to a decrease in investment.

The empirical literature considers the direct effects of product market regulations on investment and productivity. Evidence was found that tight regulation on product markets has large negative effects on investment and that deregulation leads to an increase in investment in the long run. Entry liberalisation was found to increase productivity gains, with countries most behind in terms of technology adoption and reform having the largest productivity gains. In this report we consider the indirect effect of product market regulations on economic performance through the impact on firm entry and exit.

We used a two stage approach in the econometric framework, where we first estimated the relationship between firm entry and exit and our indicators of product market reforms and regulations while controlling for country and industry structural characteristics such as entry barriers. In the second step, we estimated the relationship between firm entry and exit rates and different macroeconomic outcomes.

We found that an increase in the level of deregulation leads to an increase in both the entry and exit rates. Among the individual regulation indicators, we found that a decrease in price controls and hidden import barriers, as well as an increase in regulatory quality and the ease of starting a new business have positive and significant effects on firm entry and exit. A decrease in transfers and subsidies as a share of GDP and in the mean tariff rate has a negative effect on firm entry, results that are contrary to expectations. Finally, we did not find a significant impact of a reduction in the time spent with government bureaucracy or of the restrictions on FDI on the entry and exit rates.

There is some evidence of a changing relationship between an increase in the entry rate and the impact on output growth, with a rise in the contemporaneous entry rate leading to higher output growth and an increase in the once-lagged entry rate having a negative impact on output growth. An increase in the once-lagged exit rate will have a negative effect on output growth.

A rise in the contemporaneous entry rate was found to have a positive impact on labour productivity, whereas an increase in the twice-lagged exit rate will lead to higher labour productivity growth.

A higher contemporaneous entry rate will lead to stronger employment growth, but a rise in the once lagged entry rate will have a negative effect on employment growth. No significant relationship was found between contemporaneous or lagged exit rates and employment growth.

We found that a higher contemporaneous and twice lagged entry rates will lead to higher R&D investment growth, but an increase in the once lagged entry rate will decrease R&D investment growth. The exit rate does not have a significant impact on R&D investment growth. There is some weak evidence that a higher contemporaneous entry rate will have a negative impact on R&D intensity.

We did not find a significant relationship between entry or exit and the growth of physical capital investment, but we did find some evidence of a negative impact of a rise in the contemporaneous exit rate on physical capital intensity.

The general policy implications that we can draw from these results is that it is desirable to pursue economic policies that improve firm entry and exit since the variation of the latter will generate significant and generally positive changes on macroeconomic performance with the magnitude of these changes being relatively large. One such policy is an increase in deregulation that will significantly increase both firm entry and exit leading to a more efficient allocation of resources within industries. The study by sector showed that an increase in the entry and exit rates would lead to sharp increases in labour productivity growth for the office machinery and computers as well as the radio, television and communication sectors. The result can be explained by the high-tech nature of these sectors that leads to only the most productive firms entering these industries. A rise in the exit rate also leads to a sharp increase in labour productivity growth in these industries, which can be explained by the high degree of competition that takes place in these sectors leading to the exit of the least productive firms. Another interesting exception is that an increase in the entry rate will lead to a decrease in employment growth for more traditional manufacturing sectors such as tobacco products, textiles, wearing and leather. This could be explained by the delocalisation of firms away from the European Union that is taking place in these sectors. A rise in the entry rate will also lead to a decrease in employment growth in the motor vehicles and electricity and water supply sectors.

The present study can be extended by using a more complete data set that would allow us to control for firm specific characteristics such as size, age or type of entrant as well as by using product market regulation indicators that vary across sectors. A longer period will likely lead to interesting results, given that product market reforms have an impact on firm entry and exit over a number of years. Future research could also include more countries in the sample such as the new EU members, as well as other entry deterring strategies such as filling in all product niches or masking the results of highly profitable units. Finally, it should be mentioned that there are two other channels through which product market reforms can impact macroeconomic performance, namely through their influence on firms' mark-up and by affecting firms' incentives to engage in R&D and innovation.

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1. Introduction

1.1. Objectives of the study and context

The purpose of the study is to analyse the impact of product market reforms on firm entry and exit and macro-economic performance. This would help in assessing the likely future costs and benefits of the Lisbon process on European macroeconomic performance.

Since the Single European Act in 1986/87, the EU has implemented several reforms to achieve the completion of the Single Market. These reforms dealt with key market distortions and were aimed at removing obstacles and trade barriers to market integration, the liberalisation of network industries (telecommunications, electricity, gas, transport and postal services), reductions in State aid, reforms to competition policy and the deregulation of product markets. More recently, the Lisbon European Council in March 2000 set an objective for the EU to become "the most competitive and dynamic knowledge-based economy in the world". The Lisbon strategy is a comprehensive 10-year strategy covering product, labour and capital market reforms aimed at enhancing the functioning of the labour, product and capital markets and as a result to increase employment, economic efficiency and productivity.

1.2. Rationale

A large amount of empirical research, including work by the European Commission and the OECD, shows a positive relationship between product market deregulation facilitating entry, productivity, investment and growth. The economic literature suggests that product market reforms may affect business and overall economic performance in various ways. First, the effect of different product market reforms may directly affect business performance through cost reductions (for example, decreasing administrative burdens for companies) and through the removal of barriers to penetrate new markets. Second, product market reforms may have an indirect impact on productivity and macroeconomic performance by changing the framework of competition and the incentives for innovation. The economic literature usually identifies three main channels through which product market reforms will indirectly influence macroeconomic performance. First, product market reforms are expected to boost competition among firms. This will in turn force firms to bring prices more in line with marginal costs and lead to a more efficient allocation of scarce resources (allocative efficiency). Second, firms will also seek to improve the utilisation of their production factors by organising their work more efficiently, trimming fat, and reducing slack (productive efficiency). Product market reforms also have an impact on macroeconomic performance through the possibility for firms to enter and exit markets. Barriers to entry and exit clearly influence the possibility for least efficient firms to exit and more efficient firms to enter, moving the market share from lower productivity to higher productivity firms. Third, product market reforms have an influence on the incentives of firms to carry out research, to innovate and to move to the technological frontier (dynamic efficiency).

1.3. Previous work

A recent report by the European Commission (2004) emphasises the central role played by product market reforms in the Lisbon strategy as they improve the framework conditions in which business operates, reduce the economic rents in the economy, promote business dynamism and stimulate innovation. Furthermore, empirical evidence shows that the medium to long-term gains in productivity due to product market reforms could be substantial and that these gains mainly operate through indirect effects.

Another recent report by Griffith and Harrison (2004) looked at the first channel and found that several product market reforms reduced the mark-up and that this increased competition is associated with higher levels of employment and investment; that reforms that increase competition are (perhaps counter-intuitively) associated with lower levels of labour productivity and lower levels of total factor productivity; and that there is also a non-linear U-shaped relationship between competition and the levels of R&D expenditure, the growth rate of labour productivity, and the growth rate of total factor productivity. The objective of the present study is to analyse the second channel by measuring the impact of product market reforms on macroeconomic performance, in particular through their effects on firms' entry and exit.

1.4. Outline of the study

The study is divided in six sections. Section 2 establishes a critical and exhaustive survey of the economic literature that analyses the impact of product market reforms on macroeconomic performance via entry and exit, and its possible interactions with competition. The entry and exit of firms is determined by a series of factors that are specific to firms, industries or countries and at the same time it is part of the market selection process by which resources are reallocated within industries, thereby having an impact on economic performance. Apart from purely economic variables, government also plays an important role in shaping industry and country parameters by the amount of regulation it chooses across the economy and within given sectors. In section 2, we survey the literature that deals with these three aspects. We begin by presenting the studies that explain the determinants of firm entry and exit both from a theoretical and an empirical point of view. We then proceed to survey the literature on the impact of firm entry and exit on economic performance, measured mainly by aggregate productivity growth. In addition, we look at how the amount of business and economic regulation affects economic performance.

Section 3 aims at presenting the different available data sources necessary to carry out the study. In particular, the suitability of the information and data for modelling purposes is verified. The study covers 9 EU Member States and focuses on the period 1997 to 2003 as well as the US for the sub-period 1999-2001. Whenever possible, the study differentiates the impact on performances across countries and across sectors at the NACE 2 level. Among the main product market reforms and regulations indicators available, we can mention the decrease in red tape and administrative burdens for companies, the ease of starting a new business, the level of price controls, the size of the public sector in the economy and the liberalisation of network industries.

Section 4 discusses the methodology and the modelling strategy used to assess the impact of product market reforms on firm entry-exit and macroeconomic performance.

In a first stage, the direct impact of product market reforms on entry-exit is estimated by means of appropriate estimation methods and relevant controls. In a second stage, we estimate the indirect effects of product market reforms on several macroeconomic performance indicators that include growth of output, labour productivity, employment, and investment in both physical and intangible capital.

Section 5 presents the results of the study. The objective here is to evaluate - both theoretically and empirically - the direct effects of product market reforms on firm entry-exit and the indirect ones on macroeconomic performance.

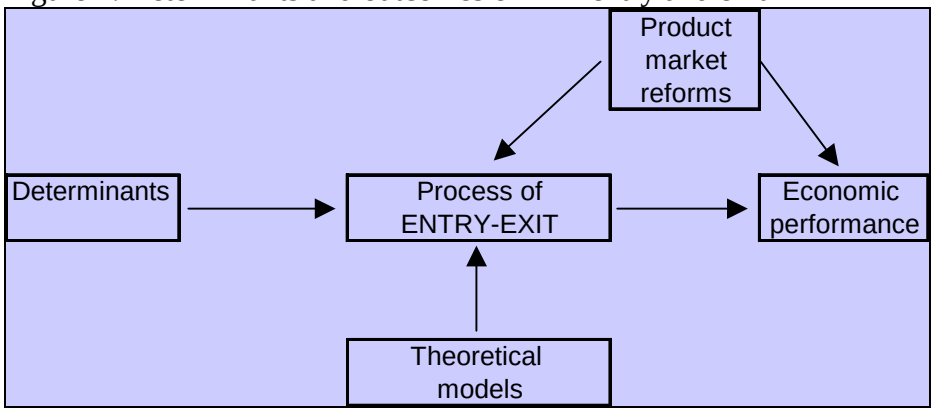
Finally, some relevant policy conclusions and issues for further investigation are discussed in the final section.

2. Entry, exit, economic performance and the degree of economic and business regulation: A review of the literature

2.1. Introduction

Firm entry and exit is part of the market selection process by which resources are reallocated within industries and encourages the introduction of new technologies, thereby having an impact on economic performance. At the same time, a series of firm, industry and country specific factors as well as entry barriers and entry deterrence strategies help determine the amount of entry and exit. In fact, the process of entry and exit influences economic performance through different channels such as factors internal to the firm, reallocation of resources among firms and changes in market shares of incumbents. Finally, public intervention through the implementation of different product market reforms can also influence the entry and exit of firms, which in turn affect economic performance. In this section, we survey the vast theoretical and empirical literature that deals with these different aspects. Figure 1 illustrates the red line followed in this exercise.

Figure 1. Determinants and outcomes of firm entry and exit



We begin in section 2.2 by presenting a series of theoretical studies that model the entry and exit process. They can be classified into models of passive and active learning, capital vintage models and product life cycle models.

In Section 2.3, we present a number of stylised facts on the types of entry into the industry, the correlation between firm entry and exit rates and of firm growth rates. We then review the main determinants of firm entry and exit. These determinants can be classified into 'basic' and entry deterrence strategic ones. A further distinction is made according to which they are specific to the firm, the industry and the country or they are determined by both firm and industry characteristics.

In Section 2.4, we look at the impact of firm entry and exit on economic performance. As we will see, a large majority of studies focus on the impact of entry and exit on aggregated productivity growth. After presenting the various decomposition methods of aggregate productivity growth used in the literature as well as the measures of the level of aggregate productivity, we summarise the findings on the contributions of entry and exit, within firm productivity growth and market share reallocation to aggregate productivity growth. After evoking a series of stylised facts on the productivities of entrants, survivors, firms that exit the industry, exporters and non-exporters and firms switching from one industry to another, we continue the review by discussing the indirect impact of entry on productivity growth through its effect on innovation.

In Section 2.5, we review the empirical studies that investigate the impact of product market reforms on both firm entry and exit and economic performance. We begin this section by briefly discussing the direct and indirect channels through which these reforms enhance the functioning of the economy.

Section 2.6 summarises and presents the main findings of this survey of the literature, which serves as a basis for the modelling of the regressions and the data necessary to carry out the analysis.

2.2. Theoretical models on entry and exit

Firm entry and exit is an important process that determines the evolution in industry productivity and structure and which has generated a substantial amount of literature aimed at better understanding this process from both a theoretical and an empirical perspective. In this section, we discuss the main theoretical models describing the entry and exit process. These models can be considered as different variants of the models of creative destruction first introduced by Schumpeter (1942). Entry and exit play an important role in this process since they facilitate innovation and the adoption of new technologies by transferring resources from less productive firms to ones that are more productive. These models can be classified into passive and active learning models, capital vintage models and product life cycle models.

a) Passive learning models

The theoretical models of passive and active learning seek to model the **entry and exit process** that takes place within an industry as a function of **firm and industry specific determinants**. In passive learning models, heterogeneous firms enter the industry without knowing what their true productivity is and they gradually learn about it over time. In the early passive learning models such as the one developed by Jovanovic (1982), industry and firm characteristics are given and are not changed. The entry and exit process is modelled as a number of heterogeneous firms that enter the market without knowing their true costs and therefore their efficiency. Once they pay a one-time cost to enter the market, they experience productivity shocks and gradually learn about their true costs in the following way. The firm uses all the information it has up to the prior period in order to choose the level of output that maximises its expected profits. Once it has taken its output decision, the productivity shock occurs and the firm observes its true costs for that period. It then decides whether to remain in the industry for one more period by comparing the value of doing so and behaving optimally to the expected present value of its fixed factor if it is employed in a different activity. In equilibrium, the profitable firms remain in the industry whereas the unprofitable ones leave. The way in which the entry and exit process is modelled implies a link between firm size and growth respectively, and firm exit and survival. Survivors have a larger size and a higher growth rate over time than those that exit the industry.

Passive learning models have since been extended to show how **changes in the structural characteristics of an industry such as entry costs, demand and the productivity shock process** affect firm turnover and distribution. Such an extension is presented by Hopenhayn (1992). Here, more specific assumptions are made on the productivity shock process in that the higher the productivity shock in the present, the more likely are productivity shocks in the future. At the same time, the firm bases its decision to exit or remain in the industry in a given period on whether the productivity shock in that period is lower than the minimum productivity level necessary for it to have positive discounted expected profits over future periods. All incumbent firms must pay a fixed cost each period. In equilibrium, there are simultaneous flows of entering and exiting firms if the entry cost is sufficiently small.

Increasing the cost of entry into the industry insulates the incumbent firms from the effects of market selection and allows them to endure low productivity for longer periods before exiting the market. It also decreases the number of firms that enter the market, thereby decreasing the firm turnover rate. An increase in the cost of entry also leads to a larger divergence between the productivity of surviving and exiting firms.

b) Active learning models

In active learning models such as the one proposed by Ericson and Pakes (1995), a firm enters the market and actively invests to increase its productivity. The **outcome of the investment is uncertain**, but if it is favourable, the firm advances to a better state in which it increases its profitability. The firms will move to less favourable states if the outcomes of its competitors, of which the firm does not know the amount of investment, are favourable or if there are advances in alternatives to the industry's products. Exit takes place if the firm's investment generates a series of unsuccessful outcomes and the firm decides that it is better off by salvaging its remaining resources and committing them to other ends.

c) Capital vintage models

Another class of models that falls under this category is the capital vintage models[1], which assume that **new technology is embodied in more recent vintage capital**. Here the entry of new firms plays an important role in the adoption of new technologies since, unlike incumbents, they do not have to incur the costs of upgrading their capital. In endogenous R&D based models of economic growth (Grossman and Helpman, 1991; Aghion and Howitt, 1992), firms invest in R&D to create new varieties of existing products or to replace existing products with higher quality ones. Those firms that are successful in their innovation process enter the market and replace old firms producing obsolete goods.

d) Life cycle models

Finally, in product life cycle models (Gort and Klepper, 1982; Klepper, 1996), firm creation and innovation depend on the **degree of maturity of the industry** with high levels of firm creation and innovation in young industries and a slowdown in firm creation and a change in the nature of innovation once the maturity of the industry increases. Starting from the observations that firm entry tends to come in waves that peak fairly early in the life of many markets and that the entry of new firms allows the introduction of innovations that would not be introduced in the absence of entry, Geroski (1995) proposes the following mechanism. At the beginning of the introduction of innovations, the industry is characterised by high entry rates as new firms propose a large number of new product designs. However, with the passage of time consumers learn about the properties of the new product designs and start focusing on particular characteristics and in the end on a particular design. Firms then stop competing in terms of product design and start competing in terms of prices and costs in supplying that particular design. Entrants may be at a severe disadvantage in the second type of competition and consequently their impact on industry structure and performance decreases. However, at various points in time, there are exogenous shifts in demand or costs, which decrease entry barriers and if the incumbent firms fail to adapt to these shifts, entry into the industry increases again and plays an important role in determining industry structure and performance.

[1] See for example Campbell (1997) or Cooper et al. (1997).

e) Summary

In this section, we reviewed a number of theoretical models of firm entry and exit. In particular, we looked at passive learning and active learning theoretical models of firm entry and exit. These models can be considered as part of a larger class of Schumpeterian models on creative destruction along with capital vintage models, R&D based models of economic growth and product life cycle models. In passive learning models, firms are unsure about their productivity when they enter the market and gradually learn about it over time. If they find out that their productivity is too low they exit the market. At the same time, changes in industry structure affect firm entry and exit, with increases in entry costs leading to a low firm turnover rate. In active learning models, firms invest in enhancing their productivity once they have entered the market. If they are successful, they remain in the market and grow, whereas if they are unsuccessful they exit the market. In capital vintage models, new technologies are embodied in new vintage capital and the entry of new firms plays an important role in adopting new technologies. In R&D based models of economic growth, firms invest in R&D in order to create new products or higher quality versions of existing products. Successful firms in innovation enter the market and replace firms producing obsolete goods. Finally, in product life cycle models the amount of firm creation and the type of innovation depend on the degree of maturity of the industry.

2.3. Determinants of firm entry and exit[2]

It follows from the review of theoretical models that firm and industry specific determinants play a major role in the entry-exit process. In this section, we survey more carefully the different determinants of entry and exit found in the theoretical and the empirical literature and which can be classified into 'basic' determinants and entry deterrence strategies. Within each of these categories the determinants can be specific to the firm or the industry; they can be influenced both by firm and industry characteristics or be specific to the country.

2.3.1. Basic determinants

Studies in the theoretical and the empirical literature have examined the relationship between firm entry and exit and a number of basic determinants. Size, age, firm growth rates or the turnover of managers in small businesses are all specific to the firm. The relationships between lagged entry and exit are determined at the industry level, whereas past profits, adjustment costs and firm survival are influenced by both developments within the firm as well as within the industry. Finally, the degree of economic development and macroeconomic shocks also have an impact on entry and exit rates and are specific to the country under investigation.

a) Firm specific determinants

Empirically, the literature has uncovered a number of stylised facts regarding the different **types of entry** into the industry, the **correlation between entry and exit rates**, the **variability of entry and exit rates** and the **variance of the firm growth rate**[3]. According to Mata (1993), firms can enter an industry through various forms. He distinguishes between **de**

[2] For a summary of the main findings of the studies presented in this section, see Table A.1 in Appendix 1.

[3] Most of these stylised facts are presented in comprehensive surveys (see Geroski, 1995 and Caves, 1998), whereas the paper by Bartelsman et al. (2003) offers a number of comparisons between European countries and the US.

novo entry, the **opening of new establishments by incumbents**, the **opening of new establishments by firms established in related industries** that may be seeking economies of scope by expanding their activities and the **opening of new establishments by firms from related industries engaged in pure diversification**.

There is a relationship between firm entry and **size** in that entrants tend to have a small size that is lower than the average firm size found in the industry[4]. Some authors[5] have uncovered evidence that firms that enter the market with a small size do so because they consider that their chance of success is small. However, if after entry, results seem promising, small sized firms have the option of investing heavily. The implication of this finding is that the structural factors characterising an industry and which were originally thought of as constituting barriers to entry for firms may in fact constitute barriers for successful entry. A relationship was also found between firm exit and size, with firms exiting the industry having a smaller size than the average size of the industry and with many small firms exiting the industry before reaching their efficient scale of production, which may reflect the intensity of the market selection process. In general, the size of incumbent firms was found to vary across countries and regions, but as a general tendency, Bartelsman et al. (2003) found that the size of firms in Europe is smaller than in the US because of industry peculiarities and differences in the sectoral composition of the economies. Firm size also has a larger variability across sectors in countries that have large domestic markets. Firm exit was found to be influenced by **age** particularly in the case of small businesses, where firm youth is one of the main factors explaining small firms' high exit rates.

The finding according to which young firms tend to exit the market after a relatively short period of activity is certainly linked to the fact that newly created firms generally enter the market with a small amount of own funds. As they are not competitive enough during the first years of their existence, they make losses that mechanically decrease the level of their own funds. After two or three years, the latter become insufficient to allow the firm to pursue its activity and that is the reason why they go bankrupt. The same result may happen to newly created firms gaining market shares if they have no access to external funding and if the level of their own funds does not allow them to finance their expansion[6]. Therefore, one important element among the determinants of exit is the initial amount of own funds and more generally the financial structure of the company. This refers to the well-known problem of the relatively low development of start-ups financing in the EU (such as risk capital funds or business angels) as compared to the US.

At the same time, exits by older firms are less sensitive to industry growth disturbances than exits by younger firms. The size and age of firms are correlated with firm growth rates that are also influenced by industry and economy growth rates, but the sense of the relationship is unclear as there are firms that contract in expanding industries and firms that expand in contracting industries[7]. At the same time, there is evidence that firms that exit the market had declining growth rates for several years prior to exit. The literature also found that **manager turnover** in small businesses had a tendency to predict sales or closures of the firm shortly afterwards.

[4] Geroski cites studies by Hause and Du Reitz (1984), Cable and Schwalbach (1991), Geroski and Schwalbach (1991), Boeri and Cramer (1992) and Mata (1993).

[5] Studies among others by Churchill (1954), Mata (1991), Wagner (1994), Audretsch (1995a), Audretsch and Mahmood (1995) and Mata (1996) found empirical evidence in this sense.

[6] In Cincera (2003), young firms appear to encounter much higher liquidity constraints as regards the financing of their physical and R&D investments as compared to older firms.

[7] Caves (1998) cites most notably the studies by Dunne et al. (1989) and Davis and Haltiwanger (1992). This finding confirms Gibrat's law that the size of units and their growth rate are statistically independent.

b) Industry specific determinants

Once firms enter an industry, the literature uncovered various links between entry and exit rates, as industries with high entry rates also have high exit rates, but in these types of industries the overall impact on employment tends to be small given the lower than average size of both entering and exiting firms. An implication of the correlation between entry and exit rates in a given industry is that gross entry and exit rates are typically higher than net entry rates. Strong correlations were also found between entry and exit rates across industries and not just within industries. According to Caves' (1998) survey, entry and exit rates tend to be positively correlated in industries with **steady states of maturity**, but varying structural entry barriers. The correlation between the two turns negative during the early and late phases of a product's life cycle. Examinations of the variability of entry and exit rates found that the variance of entry rates within industries over time is higher than the variance of entry rates between industries. The variance of entry rates within industries not only changes over time but also tends to come in waves, with different waves containing different types of entrants[8]. Other results show that the cross-sector variance of firms exiting within the first year is similar to the variance of entry rates, but the variance of exit rates lags behind that of entry rates over time. In terms of the variance of firm growth rates, the literature shows that it is large, which is consistent with the existence of adjustment costs, but it declines with the size of firms and the sunkness of capacity.

Studies also found evidence of a **lagged relationship between entry and exit rates** in US manufacturing, with exits being much more responsive to entries over a five-year period than entries to exits. The literature also found evidence of a weak relationship between firm entry and high **profits** in that entry only reacts slowly to high profits in the industry. When entry is regressed on past industry profits, the relationship between the two is found to be insignificant[9]. However, the link between entry and **adjustment costs** is stronger with the increase in adjustment costs penalising large-scale entry and rapid post-entry penetration rates. In terms of **firm survival**, studies show that the survival of entrants is low, with a large number of entrants failing within the first year[10]. The firms that do survive need 5 to 10 years to be able to compete properly with incumbents, but the failure rates of these firms decrease over time. Firms that survive in the market have a larger size than those that exit and have a more rapid growth rate which declines with age however. The average size of surviving firms increases towards the efficient scale of production.

c) Country specific determinants

Firm entry and exit are found to be affected not only by firm and industry characteristics, but also by country level characteristics, as firm turnover is influenced by the **degree of economic development**, with less developed countries having higher turnover rates since they tend to concentrate on activities characterised by smaller sunk costs. Firm turnover is also influenced by various **macroeconomic shocks**.

2.3.2. Entry deterring strategies

An important part of the literature concentrates on the use of **entry deterring strategies** by incumbents to prevent new firms from entering the industry and decreasing their profits, as

[8] See for example Saul (1962), Fearan (1969), Brock (1975), Gort and Klepper (1982), Katz and Phillips (1982), or Clark (1983).
[9] See for example Orr (1974) and Hilke (1984).
[10] High infant mortality is shown in studies by Churchill (1955), Audretsch (1991) and Baldwin (1995).

well as on the existence of **structural barriers to entry**. The classification of variables specific to the firm, the industry, influenced by both firm and industry characteristics and specific to the country can also be applied in this case. Entry deterring strategies such as **limit pricing**, **predatory pricing**, **investment in excess capacity**, **filling in all product niches, masking the results of highly profitable units** or the **financial structure** of firms are all determined at the firm level. The existence of structural barriers to entry such as **economies of scale** are given at the industry level, whereas some entry deterring strategies such as **advertising or innovation intensities** are partly determined at the firm level, but are also industry specific characteristics. Finally, there are also structural barriers to entry such as the **administrative and legal framework**, e.g. access to start-up capital, which are determined at the country level.

a) Firms specific determinants

One of the first theories developed on entry deterrence strategies was the **limit price theory** due to Bain (1956). In this theory, the monopolist is not concerned only with maximising current profits and thereby charging a price such that marginal cost equals marginal revenue, but takes into account the possibility that the extra normal profits that he obtains may tempt a new firm to enter the market, which in turn would lead to a decrease in profits. The monopolist will therefore charge the limit price, which is the highest price at which entry is deterred. The limit price theory has since been criticised because the outcome is not a subgame perfect Nash equilibrium since it assumes that the monopolist will continue producing the same output and charge the same price whether the new firm decides to enter the market or not and the new firm believes this. However, it is not in the monopolist's best interest to continue producing the same output once the new firm enters the market but rather to compete with the new firm as a duopolist.

Empirically not much evidence has been found to support the limit price theory. Orr (1974) is one of the earlier models that rely on the concept of limit pricing. In this model, entry is seen as a positive function of the difference between observed and entry limiting profit rates since the entry limiting firms will raise their profits until the expected post-entry profit rate of an entrant with the cost disadvantages imposed by entry barriers is equal to the entrant's opportunity cost of capital. Entry into an industry will continue until the industry's profit rate is driven to the point in which the expected rate of return on capital is equal to the opportunity cost of capital. The expected rate of growth of industry output is also used in order to control for the fact that limit pricing is more difficult to use in industries characterised by rapid growth where entry opportunities are larger. The long run or entry limiting profit rate is calculated as a function of a number of entry barriers, as well as industry concentration, with high concentration signalling the possibility that established firms are colluding to limit entry. The observed profit rate is measured as the average level of the past industry profit rate, and partly captures the extent to which economic rents have been captured by existing firms. Orr found that the impact of the difference between observed and entry limiting profit rates on entry is insignificant. This result holds both when the estimations are done for the entire sample or separately for high and low entry barrier industries. Bunch and Smiley (1992) used a different approach and conducted a survey among company product managers in the US that asked whether entry deterrence strategies were used in their industries and if so what the most frequent ones were. Again, limit pricing was among the least often used entry deterrence strategies in both new product markets and in existing mature product markets.

Another way for the incumbent firm to fight entry discussed in the literature is with **predatory pricing** whereby the incumbent threatens that if a new firm enters the market it

will engage in a price war and will cause the incumbent to make losses. This theory was also criticised because the pay-off for the incumbent will always be higher if he accommodates the new entrant than if he initiates a price war making the threat of predatory pricing not credible. Milgrom and Roberts (1982) however showed one exception in which the incumbent can successfully threaten the use of predatory pricing if he faces possible entry in an infinite number of separate markets. In this case, where the assumption is that new firms will enter markets sequentially, the incumbent has the choice between accommodating the new entrant on the first market and fighting entry by predatory pricing. He knows that if he accommodates the entrant on the first market he will have to do the same in all of the other markets and entry takes place in all of the markets since all of the other firms expect to be accommodated once they enter. If he fights entry by predatory pricing on the first market, he will avoid entry on all the other markets. Predatory pricing is therefore successful in deterring entry, but this no longer holds if the incumbent faces possible entry on a finite number of markets.

The advancements in game theory allowed determining that the reason why neither the limit price nor predatory pricing strategies constitute credible threats is the absence of a pre-commitment mechanism. This has led a number of economists to focus on **sunk costs** as such a mechanism since by incurring irreversible costs in the present the incumbent firm can affect competition in the future and be able to deter new entry in a successful way. Sutton (1991) made a distinction between endogenous and exogenous sunk costs with firms able to influence the former but not the latter.

One type of sunk cost analysed in the literature is investment in capital in order to build up **excess capacity**. Spence (1977) is one of the first to have developed such a model, which assumes that a potential entrant believes that the incumbent's post-entry output equals its pre-entry capacity. Knowing this, the incumbent firm increases its pre-entry capacity to higher levels than it will actually use in production, thereby creating excess capacity. Dixit (1980) finds that if firms play a post-entry game according to Nash rules, the incumbent firm will not invest in additional capacity that would not be used during pre-entry. Empirically, not much evidence was found that incumbent firms used excess capacity to deter entry. Lieberman (1987) studied US chemical products industries and found that most of the excess capacity held by firms was used to accommodate investment lumpiness and demand variability rather than deter entry. He found evidence that incumbents held excess capacity for entry deterrence purposes in only three of the thirty eight products taken into consideration. The regressions also showed that the probability of new plant investment was not influenced by the occurrence of entry during the year, but rather by more rapid market growth and higher capacity utilisation. Hilke (1984) also found that excess capacity did not have a significant impact on entry. In surveys among firms conducted by Bunch and Smiley (1992), Singh et al. (1998) and Chang and Tang (2001), the build-up of excess capacity was also cited as being one of the least used entry deterrence strategies by firms.

Other commonly used entry deterrence strategies cited by firms in the surveys conducted by Bunch and Smiley (1992), Singh et al. (1998) and Chang and Tang (2001) are **refilling all product niches** and **masking the** results of highly profitable units.

Martin (2003) develops a more general version of the Eaton and Lipsey (1980) model in which firms use their **financial structure** as an entry deterrence strategy. In this type of model, incumbent firms use specific capital as a pre-commitment mechanism since, because an incumbent's capital costs are unavoidable, entrants know that they will have to compete with the incumbent until the latter's capital wears out. The way the firm finances its capital determines whether the use of industry specific capital constitutes an important barrier to entry or not. If it chooses to finance a large proportion of its capital by debt, the use of specific capital will not constitute a high barrier to entry since part of the costs are avoidable from the point of view of shareholders given that debt embodies the option to default which

becomes all the more attractive as the amount of debt increases and debt also postpones the payment of capital investment. This model has a Markov perfect equilibrium in which incumbent firms limit the amount of capital financed by debt and replace their capital before it wears out producing the monopoly level of output. The amount of capital that can be financed by debt increases with duopoly profits and the durability of capital and decreases with capital costs and the discount rate. In equilibrium, entry does not occur since incumbents maintain their barrier to entry. Martin (2003) also tested his model empirically by using data on Canadian industries. The results show that the turnover rate has a positive impact on the debt to asset ratio since industries with low turnover rates use highly specific firm capital thereby having high barriers to entry. Incumbents in such industries will limit the amount of debt financing in order to avoid compromising the entry barrier. There is also a negative relationship between the degree of concentration in an industry and the debt to asset ratio since for firms in highly concentrated industries the consequences of being displaced are greater than in industries that are more competitive and therefore they will limit the amount of capital financed by debt.

b) Industry specific determinants

A frequently mentioned exogenous sunk cost at the industry level is the presence of **economies of scale**, which leads to the necessity of investing in the construction of plants of **minimum efficient scale**. The minimum efficient size plant is also seen as a barrier to entry in the limit price theory since in industries where economies of scale are high enough that a plant of efficient size is large relative to the size of the industry, a limit price significantly higher than the competitive level price can be set without attracting entry. Empirically, Hause and Du Reitz (1984) found that an increase in the minimum efficient size of new establishments leads to a decrease in the entry rate. At the same time, when scale economies are measured as the minimum efficient size of new plants relative to industry employment, they have an insignificant impact on the entry rate. Kessides (1990a) finds that the rate of entry varies inversely with the required scale of entry. Kessides (1990b) also uncovers evidence that minimum efficient scale constitutes a significant barrier to entry. There is also some evidence in the literature of a relationship between economies of scale and the use of entry deterring strategies by firms. Bunch and Smiley (1992) found that in research intensive, concentrated markets populated by large firms, the presence of entry barriers caused by the necessity of having a minimum efficient scale of production acts as a substitute for entry deterring strategies, but is not very significant. In existing mature product markets, entry deterrence strategies are used particularly in industries where the entry barriers caused by the necessity to have a minimum efficient scale of production are low.

Resource intensity can also be used to capture economies of scale as well as variances in demand and in the fundamental conditions of technology among different industries[11].

Advertising and R&D intensities are variables that on the one hand represent endogenous sunk costs which can be influenced at the firm level and on the other hand are characteristic at the industry level.

Advertising is seen as having an important influence on entry in empirical studies. According to Kessides (1986), advertising generates two opposite effects on entry. On the one hand, it creates a sunk cost barrier to entry, but on the other hand potential entrants perceive a greater probability of success in markets where advertising is important thereby encouraging entry. Advertising constitutes a sunk cost barrier to entry for the potential new entrant since it

[11] See for instance Baldwin and Rafiquzzaman (1995) who use the OECD's classification of manufacturing industries into natural resource-based, labour intensive, scale-economies-based, product differentiated and science-based.

is a necessary cost that cannot be recovered in the event of exit. Advertising increases product loyalty and reduces the perceived number of substitutes by enhancing differentiability. As a result, entry into an industry characterised by high levels of advertising poses a high risk of failure for the new entrant. At the same time, advertising can also be seen as reducing consumers' search costs and inertia by informing them about the attributes and prices of products. It is therefore a means of overcoming product loyalty and increases the perceived number of product substitutes. In the regressions, Kessides includes the unrecoverable portion of the original investment in advertising in the event of exit, as well as the industry's pre-entry level of advertising expenditure to sales. The results show evidence in favour of the fact that advertising has a sunk cost barrier effect on entry. At the same time, advertising is found as playing an information role and reducing consumers' search costs and inertia. There was no evidence found that advertising plays a persuasive role and increases product loyalty while reducing the perceived number of substitutes. Therefore, while advertising constitutes a sunk cost barrier to entry, potential entrants also perceive a greater probability of success in industries where advertising plays an important role. Thomas (1999) found that incumbent firms use advertising to limit the scale of entry. At the same time, incumbent firms are more likely to respond to large-scale entry, but less likely to respond aggressively to new name entry since new brands are less likely to capture a large market share. On the contrary, product extensions are more likely to lead to new product introduction by incumbents since they are likely to capture significant market shares. Orr (1974) also found that advertising intensity is a strong barrier to entry. Dividing the sample into consumer goods and producer goods industries shows that advertising intensity is a statistically significant barrier to entry in the consumer goods, but not the producer goods industries. In the survey approach used by Bunch and Smiley (1992), advertising was found to be one of the most frequently used entry deterrence strategies aimed at creating product loyalty in new product markets that are research intensive, concentrated markets populated by large firms. Advertising is also used as an entry deterrence strategy in existing mature product markets characterised by high concentration and low entry barriers caused by the necessity to have a minimum efficient scale of production.

Another endogenous sunk cost to entry presented in the literature is **R&D intensity**. Gilbert and Newberry (1982), for instance, develop a model in which they showed that firms that have benefited from monopoly profits would increase R&D spending strategically and patent the new product in order to prevent entry. If a new firm knows that this strategy is rational for the monopolist, it will not enter the industry. Furthermore, in this model, if the monopolist faces a perfect market for R&D inputs it has a credible threat of overtaking any rival firm that would run a competitive research program and the cost of pre-emption decreases towards 0. Empirically, Orr (1974) found that R&D intensity measured as R&D expenditures to sales only has a moderate importance as an entry barrier. Singh et al. (1998) however, surveyed firms working in the UK food, electrical engineering and chemicals industries and found that a large number of firms mentioned the use of R&D for preventing new entry as well as meeting existing competition, with a somewhat higher priority given to the latter than the former. Chang and Tang (2001) used a similar approach for manufacturing, services sectors in Singapore, and found that R&D and patent pre-emption are chosen as frequent entry deterrence strategies.

The impact of the entry deterrence strategies presented above varies with the different **types of entry** (Mata, 1993). De novo entry is sensitive to most entry barriers, whereas entry through pure diversification seems to be the form of entry that is least affected by the presence of entry barriers with capital requirements and incumbent's diversification being the only two effective entry deterrence strategies. Entry through expansion occurs less in industries where economies of scale are important and is induced by product differentiation.

Entry through extension is also deterred by the presence of economies of scale as well as by product differentiation.

c) Country specific determinants

Finally, there are **structural entry barriers** such as access to start up capital that are determined at the country level. Brito and Mello (1995) develop a model in which firms do not have equal access to credit because of the presence of binding liquidity constraints. They show that firms that perform well after entry are able to signal that they are viable companies and therefore receive increasingly favourable terms of credit.

2.3.3. Summary

The theoretical and empirical literature on firm entry and exit identifies different determinants that can be classified into three categories according to whether they are firm, industry or country specific. Some determinants are both firm and industry specific. Table 1 summarises the determinants of entry and exit according to these three categories.

Table 1. Determinants of entry and exit at the firm, industry and country levels

Firm specific determinants	Industry specific determinants	Country specific determinants
type of entrant	lagged entry	degree of economic development
size	lagged exit	macroeconomic shocks (business
age	minimum efficient scale of	cycle)
manager turnover for small firms	production	access to start-up capital
firm growth rate (in years before	capital intensity	
exit)	resource intensity	
limit price	degree of maturity of the industry	
predatory pricing	concentration	
excess capacity	differentiation	
filling in all product niches	segmentation	
masking results of highly profitable units		
debt/asset (financial structure)		
(past) profits		
adjustment costs		
subsequent growth rates of survivors		
advertising intensity		
R&D intensity, innovation		

There is generally a large number of small firms entering the industry and replacing a large number of obsolete firms exiting the industry, but not significantly altering the total number of firms present. At the same time, the survival rate of firms entering the industry is low and those firms that do survive need a number of years to increase their productivity levels to those of existing firms. Firms' failure rates tend to decrease with the passage of time and firms usually enjoy a long tenure in leading positions. There is also evidence that exiting firms have had low productivity for several years prior to exit. Firm entry rates vary across time within an industry and tend to come in waves with different waves containing different types of entrants. Both entrants and firms exiting the industry have below average size with many small firms exiting before reaching their efficient size of production. Firm youth is one of the main factors explaining small firms' high exit rates. Firm growth rates are correlated with the size and age of firms and are influenced by industry and economy growth rates. Manager turnover in small businesses can predict sales or closures of the firm shortly afterwards. There is also evidence of a lagged relationship between entry and exit rates.

In the final part of the section, we looked at entry barriers and entry deterrence strategies. The limit price theory is among the first theories developed concerning entry deterrence strategies. Here the producer charges the limit price, which is the highest price at which entry is deterred, instead of the traditional monopoly price. In the predatory pricing theory, incumbent firms threaten potential entrants with a price war if they enter the market. Advancements in game theory led to criticisms that both of these theories are flawed since they do not pose credible threats to entry because of the absence of a pre-commitment mechanism. New game theory models have generally focused on sunk costs such as advertising costs, excess capacity or R&D intensity as pre-commitment mechanisms and have studied their impact on firm entry empirically. The presence of economies of scale also has an influence on firm entry. The amount of capital financed by debt is also considered as an entry deterrence strategy since it influences the firm specific capital used as a barrier to entry. Finally, the entry rate can also be influenced by firms' access to credit financing.

2.4. The impact of firm entry and exit on economic performance[12]

A large part of studies on the impact of firm entry and exit on economic performance concentrate on the **relationship between firm entry and exit and productivity growth**. The direct impact of firm entry and exit on aggregate productivity growth comes through the latter's decomposition into three sources[13]. The first source known as the **'within effect'** or internal restructuring refers to productivity growth of individual firms in the industry. It comes from factors internal to the firm such as organisational change, the introduction of new technologies, increased competition, R&D activities or a change in the mix of labour and capital. The other two sources of productivity growth at the aggregate level refer to so-called **'external restructuring'** whereby the process of market selection leads to a reallocation of resources among individual firms. This in turn is done in two ways. First, there is a process of **creative destruction** by which low productivity firms exit the market and are replaced by new entrants that are themselves heterogeneous. Among them, the most efficient ones will survive, while the least efficient ones will exit the market in subsequent periods. Second, there is a **change in market shares among incumbents**, which will also have an impact on aggregate productivity growth. There are also a number of important interactions between the various sources of aggregate productivity growth.

In this section, we present the empirical results of studies concerning the contributions of each one of the three sources mentioned above to aggregate productivity growth. The literature also uncovered a number of stylised facts concerning the relationships between the productivities of entrants, survivors and firms that exit the industry. The productivities of exporting and non-exporting firms and those switching from one industry to another were also analysed. Apart from the direct impact of firm entry and exit on aggregate productivity growth, there is also an indirect effect through the impact of firm entry and exit on innovation, which in turn affects productivity. Here we present one of the most recent theoretical models of the impact of firm entry and exit on innovation, as well as the main empirical findings based on this model.

[12] For a summary of the main findings of the studies presented in this section, see Table A.2 in Appendix 1.

[13] Box 1 in Appendix 1 presents the different ways of decomposing aggregate productivity growth into these three sources as well as the ways of measuring the level of productivity with studies generally choosing both total factor productivity and labour productivity since each has a number of advantages and disadvantages. This decomposition into three sources is also closely related to the concepts of allocative, productive and dynamic efficiencies as discussed in Section 2.5.a.

a) Impact of entry-exit on aggregate productivity growth

The contributions of the three sources of growth to aggregate productivity growth vary from one study to another, depending on the **method of decomposition** used, on the **measurement of aggregate productivity**, the **time horizon** over which changes occur, the **business cycle**, as well as on the **country or industry** under investigation. The entry and exit of firms from the industry is generally found to have an important contribution to aggregate productivity growth[14].

Scarpetta et al. (2002) analysed several OECD countries and found that entry and exit contributed to between 20% to 40% of aggregate productivity growth. There were significant differences in the contributions of entry to aggregate productivity growth between Europe and the US. In the former, the entry of firms has a positive contribution to growth, but the effect is small, whereas in the latter, firm entry has a negative contribution to growth. On the contrary, the exit of low productivity firms has a positive contribution to aggregate growth across all countries. Differences were also found in terms of the importance of the contribution to aggregate productivity growth across manufacturing sectors. In high technology sectors, the entry of new firms has a larger than average contribution to total growth, whereas in mature industries the exit of firms has larger contributions to growth. The results also differ according to whether aggregate productivity is measured by TFP or labour productivity, with net entry having a strong contribution to TFP growth. Disney et al. (2003) found that the contribution of entry and exit to aggregate productivity growth, when the latter was measured by TFP, was sensitive to the business cycle and was larger in periods of economic slowdown (a higher contribution of entry and exit in periods of economic slowdown was also found by Hahn, 2000). According to Foster et al. (1998), the contribution of net entry to aggregate growth depends on the horizon over which the changes are measured. When high frequency data are used, the contribution of entry and exit to productivity growth is low, but with intermediate (a 5-year time horizon) or long run (a 10-year time horizon) data, the contribution of net entry is large. Baily et al. (1992) and Griliches and Regev (1995) found that firm entry and exit only had a small contribution to aggregate productivity growth for US manufacturing and Israeli industries respectively.

Martin and Jaumandreu (1999) uncovered evidence that entry and exit play an important role in aggregate productivity growth in Spain. When distinguishing between entry with displacement effects where new entrants with superior technologies replace firms already established in the industry, and entry and exit due to market enlargements or contractions, they find that the former dominate the latter. They also find that gross entry and exit rates have a positive and significant effect on aggregate productivity growth if they are included separately in the regression, but the effect of exit rates becomes insignificant when they are both included together in the regressions. At the same time, structural tests show that firm turnover had a stronger impact on productivity in the period before Spanish integration in the EU.

The contribution of increases in incumbent firm productivity was also found to be an important source for aggregate growth[15]. Foster et al. (1998) uncovered evidence that the contribution of the within plant effect to aggregate growth is lower if the within plant effect is weighted by fixed initial weights for plant multifactor or labour productivity than if it is weighted by the average time series share of activity. Scarpetta et al. (2002) uncovered evidence that across manufacturing industries, the within effect had larger contributions to growth in mature industries. It also has a higher contribution to growth in periods of economic expansions. The contribution of the within effect to aggregate productivity growth remains

[14] See among others Aw et al. (1997), Foster et al. (1998) or Hahn (2000).
[15] See Griliches and Regev (1995), Aw et al. (1997), and Scarpetta et al. (2002).

important, but is smaller when productivity is measured by TFP than when it is measured by labour productivity. The results on the contribution of market share reallocation to aggregate productivity growth are mixed. Griliches and Regev (1995), Aw et al. (1997) and Hahn (2000) found that the contribution is small, whereas Baily et al. (1992) and Foster et al. (1998) found that the contribution is important among US industries. According to Scarpetta et al. (2002), the contribution of market share reallocation is positive but typically small and varies widely from one country to another. It also increases in periods of economic slowdown.

b) Types of entry and exit

A number of stylised facts regarding the relationship between **productivities of entrants**, **survivors and firms that exit the market**, as well as those of **exporting and non-exporting firms** and those **switching from one industry to another** have been uncovered by the literature.

Foster et al. (1998) found large and persistent productivity differentials across establishments in the same industry. The same study along with Disney et al. (2003) uncovered evidence that the productivity of entrants is higher than the productivity of firms exiting the industry. Griliches and Regev (1995) found the same relationship, but the difference in productivity between the two only becomes large in the last period before exit. Hahn (2000) found the reverse in Korean industries, whereas according to Baily et al. (1992) both entrants and firms exiting the industry have below average productivity. Firms entering the industry with low productivity also failed more often several years after entry, according to Aw et al. (1997). Entrants have lower productivity than incumbent firms (Olley and Pakes, 1996; Aw et al., 1997; Hahn, 2000), but firms that survive in the industry experience an increase in productivity over time until it becomes approximately equal to that of incumbent firms (Aw et al., 1997; Hahn, 2000; Disney et al., 2003). The productivity of firms that exit the industry is lower than the productivity of survivors according to Griliches and Regev (1995) and Hahn (2000), but in the latter study the productivity differential between the two is not noticeable in the first year after entry. A productivity gap develops in subsequent years and persists over time. Both studies also found that firms that exit the industry in the future have significantly lower productivity in the present. Hahn (2000) also compared the productivity of firms that switch from one industry to another and found that it is comparable with the productivity of incumbent firms and higher than the productivities of firms entering and exiting the industry in question. Aw et al. (1997) also studied the Taiwanese export market and found that the productivity of firms entering the market is higher than the productivity of non-exporting firms after entry and in the years prior to entry. The productivity of firms that entered the export market and then left is higher than the productivity of firms that never entered the export market, whereas the productivity of continuous exporters is higher than that of new exporters. Baily et al. (1992) found that the productivity of old plants is only slightly lower than the productivity of new plants, whereas Griliches and Regev (1995) found that the productivity of older survivors decreases over time relative to that of firms established later. The latter study also found that the productivity of well run plants remains high for long periods, whereas the productivity of badly run plants remains low for long periods.

c) Indirect effect via innovation

Apart from their direct effect on productivity growth, firm entry and exit can also affect productivity growth indirectly, by stimulating **innovation**. Aghion et al. (2002) provide one of the most recent models on the impact of firm entry or the threat of entry on incumbent

firms' incentives to innovate which in turn affects aggregate productivity growth. Firm entry or the threat of entry produces two effects on incumbents' incentives to innovate. On the one hand, there is an **escape entry effect** according to which an increase in the threat of entry of new firms will increase the incentives to innovate in sectors that are close to the technological frontier because firms close to the frontier know that they can escape entry by new firms through innovation. On the other hand there is also a **discouragement effect** of entry according to which an increase in the threat of entry may discourage innovation in sectors that are initially far below their current technological frontier. In this case, firms know that they are too far away from the frontier to win against a new entrant and they decrease innovation since the increase in the threat of entry leads to a decrease in the expected payoff from investing in R&D. The model assumes an economy in which a final good is produced from intermediate inputs and is used in consumption, as an R&D input and as an input in the production of intermediate inputs. The firms producing the intermediate good differ in the technology used and can be situated on the technological frontier, one step or two steps behind. They can engage in innovation, which if successful, allows them to increase their productivity and keep up with the exogenous advancement in technology or if unsuccessful makes them fall behind the technology leader. The firms that are two steps behind have their technologies automatically upgraded by one step. In equilibrium, an increase in the threat of entry has a positive effect on innovation in sectors close to the technological frontier and may have a negative effect on innovation in sectors far below the frontier. An increase in the threat of entry also has a more positive effect on productivity growth in sectors close to the technological frontier and may have a negative effect on productivity growth in sectors below the frontier. Finally, a reduction in the incumbent firm's ability to fight entry because of cash constraints for example, reduces the positive impact of an increase in the entry threat on innovation and productivity growth for firms that are already close to the frontier.

In the second part of the paper, the authors test the model empirically using micro-level data for productivity growth and patenting activity for UK firms over the 1987-1993 period. US firms are considered as representing the world technological frontier. The results confirm the positive and significant effect on TFP growth in period t and a positive and significant effect of the import share variable on TFP growth showing that a stronger trade inflow leads to a similar reaction of domestic incumbents as foreign firm entry. Incumbent firms located far from the technological frontier are more likely to catch up by increasing their productivity faster than the industries closer to the frontier. In addition, the productivity of incumbent firms reacts more positively to entry in industries that are close to or above the world technological frontier. The results are similar when the patent count is used as the dependent variable and an inverted U-relationship is found between competition and innovation.

Geroski (1989) used data for 79 3-digit industries in the UK to study the effects of competition embodied in new firms and ideas on aggregate productivity growth. He used an econometric model in which the difference between output and capital can be written as the difference between labour and capital and a variable θ that describes all other changes in output. In the model variations of this variable is considered to illustrate the degree of competition in the markets. The results from the estimated regressions show that the domestic entry of firms and innovation led to an increase in productivity growth, with innovation playing the most important role, but domestic firm entry still having a contribution of around 30% to productivity growth. On the contrary, foreign firm entry has a negative impact on productivity growth. In addition, according to the results, competition leads to movements to and outward of the production frontier that would not have occurred without it.

d) Summary

The impact of firm entry and exit on aggregate productivity growth is summarised in Table 2. While most studies found a positive effect, results depend largely on the method of decomposing productivity growth, on whether productivity is measured using TFP or labour productivity, on the time horizon, the business cycle as well as on the country and industry under consideration. In the last two cases, the literature does not specifically identify the causes of these differences mainly because most of the studies are done for individual countries using national data sources that do not allow for international comparisons. However, the main causes may be found in the country and industry specific determinants of entry and exit which have been discussed in Section 2.3. Another main conclusion of this survey is that only a few studies in the literature have estimated the impact of entry and exit on other measures of economic performance than aggregate productivity growth[16].

Table 2. Impact of Firm Entry and Exit on Economic Performance

Type of effect	Type of impact
direct via contribution to aggregate productivity growth	positive effects which depend on: decomposition of aggregate productivity used time horizon over which changes are measured business cycle country and industry specific effects
indirect via impact on innovation	inverted-U relationship which depends on closeness of the sector or country to the technology frontier

Some studies found that firm entry and exit constitutes an important source of growth, whereas others found that the effect is close to zero. Studies on the indirect effect of entry and exit on aggregate productivity growth through innovation found an inverted U-relationship between competition and innovation. An increase in the threat of entry has a positive effect on innovation in sectors close to the technological frontier and may have a negative effect on innovation in sectors far below the frontier. At the same time, an increase in the threat of entry has a positive effect on productivity growth in sectors close to the technological frontier and may have a negative effect on growth in sectors below the frontier. Studies also found a positive relationship between innovation and productivity growth. Generally, studies have found that entrants have lower productivity than survivors do, but their productivity level compared to that of firms exiting the industry varies across studies. Firms exiting the market tend to have lower productivity than survivors do and a number of studies found that firms exiting an industry tend to have low productivity for a number of years before exit.

2.5. Impact of economic and business regulation on entry and exit and on economic performance[17]

In this section, we consider a further dimension and examine the impact of regulatory reforms in product markets on firm entry and exit as well as on macro-economic performance across EU countries, in particular investment and productivity growth in manufacturing and services sectors.

We begin by reviewing the three main channels at the theoretical level through which product market reforms improve the functioning of the economy. We then look at the impact of labour market reforms on firm dynamics and productivity growth and we explore whether product market reforms led to a convergence of the business environment in OECD countries

[16] To the best of our knowledge, Brandt (2004) is the only study in that respect.
[17] For a summary of the main findings of the studies presented in this section, see Table A.3 in Appendix 1.

and whether diverging patterns of reforms can explain different evolutions in terms of productivity growth among OECD countries. We also examine the empirical effects of the deregulation of the US telecommunications market on the allocation of output, firms' capital stock and productivity as well as the probability of exit.

a) Economic theory

Besides the direct impact (cost reduction and removal of barriers to penetrate new markets), the indirect effects of product market reforms on productivity and macro-economic performance operate through their impact on market efficiency[18]. More precisely, these indirect effects are usually viewed as operating through three main channels.

- **Restoring allocative efficiency (Pareto optimal allocation of resources)**. When producers have market power, prices deviate substantially and persistently from marginal costs. As a result, the structure of consumption is distorted, total output is kept below its socially optimal level, not fully exhausting economies of scale and resources and factors of production are not used efficiently (internal allocative efficiency)[19]. Furthermore, when competition increases, less efficient firms exit the market and market shares move to more productive firms (external allocative efficiency).
- **Restoring productive efficiency**. While firms produce at the lowest cost under conditions of competition[20], they begin to operate inefficiently (through overstaffing, higher wages, lack of response to new opportunities, poor management) in situations of weak competition.
- **Fostering dynamic efficiency**. This channel is an extension of the productive efficiency one and concerns product and process innovations. In the long run, such activities speed up the move to the technology frontier, which is a major source of growth.

The indirect effects of product market reforms, as compared to the direct ones, on productivity gains are shown to be much more important (European Commission, 2004). The immediate impact of product market reform is in terms of allocative efficiency. On a given market, increased competition reduces monopoly rents, which translates into lower prices (i.e. prices closer to marginal costs). Even with unchanged nominal income, the outcome is higher demand and output in real terms. At the macroeconomic level, markets that are more competitive contribute to increased production, employment (through labour demand) and income. However, allocative efficiency gains are neither the only nor the most important outcomes of reforms. Pelkmans (1984) and Geroski and Jacquemin (1985) argue that productive and dynamic efficiency effects are far more important than allocative ones.

b) Empirical studies.

Alesina et al. (2003) study the impact of regulatory reforms in product markets on investment using a panel data approach. Their analysis concentrates on 21 OECD countries and three broad sectors: transport, communications and utilities. The underlying theoretical model assumes that a monopolistic competitive firm uses capital and labour as inputs in order

[18] See Nicodème and Sauner-Leroy (2004) for a discussion.
[19] Since total output in the sector is below the social optimal level, some factors of production are allocated in other sectors.
[20] More precisely, in the short term, when at least one production factor is fixed, a firm will produce efficiently when the factors of production are organised in such a way that the average cost of production is at the lowest point.

to produce a differentiated product. Initially, the number of firms in an industry is determined by the regulatory authority and so a deregulation of the product market leads to a larger number of firms and to a decrease in the price mark-up. The model also assumes that product market reforms affect adjustment costs, and in particular, deregulation decreases costs. This allows capturing the reduction in the shadow and actual cost of doing business associated with red tape and other administrative impediments that hamper firms' choices. The model shows that an unanticipated permanent increase in the number of firms allows operating a decrease in the price mark-up and leads to an increase in the steady state value of the capital labour ratio. It also leads to an increase in the shadow value of capital, which in turn produces an increase in the investment rate until the new steady state is reached. At the same time, a decrease in the adjustment cost parameter for a given mark-up, leads to an increase in the steady state level of the capital labour ratio. Therefore, a regulatory reform that decreases the price mark-up or the adjustment cost parameter or both leads to a higher capital stock and to a higher marginal product of labour. The decrease in the mark-up leads to higher labour demand because the mark-up acts as a tax on the use of labour for each given level of the capital labour ratio. Given that labour is available in fixed supply, this also leads to higher equilibrium wages. The number of firms is then assumed endogenous and is influenced by the government indirectly through the regulation of entry. The number of firms present on the market is derived as a function of entry costs, the adjustment cost parameter, the depreciation rate and the fixed labour supply. The effect of a change in entry costs is decomposed into the impact of entry on the number of firms and the effect of the number of firms on the capital stock. According to the model, a decrease in entry costs generates an increase in the number of firms on the market, a decrease in the mark-up and an increase in the capital stock. In the end, the deregulation of product markets will have a positive effect on capital accumulation if it leads to a reduction in the mark-up or lowers the costs of adjusting the capital stock.

Regulation affects investment through two additional channels. If it imposes a ceiling on the rate of return on capital invested, firms may invest in additional capital in order to increase the base to which the constrained rate of return on capital is applied to increase the total remuneration for capital. This leads to an alteration in the choice of factor proportions in favour of more capital use. Regulatory reforms consisting in removing the constraint on the rate of return of capital invested will then lead to a decrease in the desired level of the capital stock and in investment. The presence of public or semi-public companies will also influence the impact of regulatory reforms on investment. If public companies were heavy investors before deregulation, either because of a political mandate imposed on the managers to increase political support by setting prices below the profit maximising level or because of a manager's incentives to increase the size of the company in order to increase his monetary compensation or power or perks, then privatisation processes consisting in reducing the role of public companies in the sector may lead to a decrease in investment.

In the empirical part of the paper, the authors constructed a series of regulation indicators based on barriers to entry, public ownership, market share of new entrants and price controls. The investment capital ratio for each country, year and sector is regressed on the indicator of regulation, values of the investment capital ratio lagged once and twice, country fixed effects, sector fixed effects and common or sector specific dummies. The results show that tight regulation on product markets has large negative effects on investment and that deregulation leads to an increase in investment in the long run. Among the different deregulation measures, entry liberalisation is found to play the most important role for investment, with the reduction of entry barriers leading to a decrease in the mark-up and to greater investment. Industry level measures of privatisation are not found to affect investment significantly and contrasting forces are found to be at work for public ownership.

Griffith and Harrison (2004) studied the impact of product market reforms carried out in the European Union over the 1985-2000 period on macro-economic performance at the aggregate level across EU countries, as well as separately for the manufacturing and services sectors. The authors used the mark-up of price over marginal cost to capture the effects of changes in the regulatory regimes over time on the level of competition in product markets. The estimation is performed using a two step instrumental variable approach in order to solve certain endogeneity issues. First, the mark up is regressed on a vector of time and country/industry varying indicators of product market regulation, a measure of the output gap which captures country specific cyclical factors, country fixed effects and year dummies. In the second stage of the regression, the authors estimate the effects of the predicted levels of rents captured by the mark-up and estimated in the first stage on the demand for input factors, labour productivity and TFP. Therefore, the log of each of the factor inputs (investment for tangible capital, labour and intangible capital) are regressed separately on a function of the mark-up estimated in the first stage, the output gap, country fixed effects and year dummies. The results show a different impact on economic rents of product market reforms aimed at decreasing tariff rates, regulatory barriers to trade and public involvement in production, at removing price controls and easing market entry. There is evidence that labour and credit market reforms aimed at increasing competition and reducing the level of economic rents available in the economy led to an increase in employment and investment, especially in the services sector. At the same time, the reduction in the level of economic rents led to lower levels of labour productivity and TFP. The authors also find evidence that there is a non-linear relationship between the level of economic rents and levels of R&D and the growth rates of labour productivity and of TFP, with most countries having levels of economic rents where a decrease in rents leads to a reduction in R&D and labour productivity and TFP growth. The result that product market reforms in different countries led to different experiences leads to the question of whether it is possible to impose a common structure across different countries.

Nicoletti and Scarpetta (2003) analysed whether the product market reforms implemented in OECD countries led to a convergence of the business environment and whether the diverging patterns of reforms can explain the different evolutions in terms of productivity growth among OECD countries. They do this by constructing a series of regulation indicators that cover both economy and industry regulations and are based on the assumption that regulatory patterns reflect regulatory failure or policies adverse to competition and not cross-country differences in terms of public concern about the market failures that led to the regulations. The authors regress MFP growth for a given industry j of country i on the instantaneous effect of changes in the growth of the leader country, the pace of technological transfer, the technology gap between country i and the technology leader and an error term which captures all the other influences on MFP growth including the differences coming from different regulatory patterns across industries and countries. The error term can be decomposed into a vector of covariates including the structural features and the regulatory policies potentially affecting the level of MFP, unobserved country and industry effects, world macroeconomic shocks and a serially uncorrelated error term. The technological frontier is defined as the highest value of the MFP level relative to the geometric average in each industry in year t. The technological gap is then defined as the difference between the level of MFP and the frontier level in each industry and year. The results show significant links between product market policies and productivity performance, with entry liberalisation leading to productivity gains in all of the countries under consideration regardless of their position relative to the technology frontier. However, the countries most behind in terms of technology adoption and reform were found to benefit the most in terms of productivity gains from state retrenchment and the liberalisation of potentially competitive markets. There is also evidence that the privatisation process leads to additional productivity gains but this may

depend on whether the state maintains large stakes in the newly privatised companies and whether the process is accompanied by adequate promotion of competition in the markets where privatised companies operate. These results imply that there may still be sizeable benefits from further progress in reforming the regulatory environment and from decreasing the role of the state in business activities. Evidence was also found of a two fold effect of entry liberalisation over a ten year time horizon. Entry liberalisation in the services industries is estimated to boost annual MFP growth in the overall business sector, but an indirect effect of the removal of trade and administrative barriers to entry was also found. The latter depends on the technology gap that some countries accumulated in some manufacturing industries that were heavily regulated.

Scarpetta et al. (2002) look at the impact of policies and institutions on the product and labour markets on firm dynamics and productivity growth. They regress the entry rate on market profitability which is proxied by the smoothed growth rate of industry value added, potential entry costs proxied by a measure of industry capital intensity and by indicators of the stringency of regulations susceptible of having an impact on entrepreneurship, industry specific indicators of product market regulations, an aggregate time varying indicator of the stance of regulation, indicators for employment protection legislation and the size of firms. The results show that the differences in entry rates across countries are statistically significant, but decrease once the differences in the industry composition across countries are controlled for. They find evidence of a non-linear relationship between entry rates and firm size, as well as of a different impact of industry growth on the entry of small firms with respect to the others. Administrative regulations of entrepreneurial activity are found to have a strong negative impact on firm entry and this effect is even larger for small and medium sized firms. When introducing labour adjustment costs, the negative effect of tight regulation on the product market on the entry rate is confirmed and additional evidence is found of a negative impact of tight regulations on hiring and firing on firm entry.

The authors also look at the influence of policies and institutions in the product and labour markets on the differences in terms of productivity levels across industries and countries. TFP is regressed on country and industry specific factors and a catch-up term that is measured by the difference between the TFP level in a given industry and the highest TFP level amongst countries for that industry. The results show that the distance from the technological frontier has an important impact on productivity growth, with countries further behind the frontier experiencing higher rates of productivity growth. There is also evidence of a more rapid technological catching up process in the service industries compared with manufacturing. Tight product market regulations are found to have a direct negative effect on productivity and this negative effect is larger the further a country is from the technological frontier.

Olley and Pakes (1996) studied the evolution in the US telecommunications industry before and after the deregulation that took place in 1987. They found that the more competitive industry structure that resulted after the deregulation of 1987 generated a less efficient allocation of output conditional on the total output produced and on the existing joint distribution of fixed factors, compared to the allocation of output before deregulation. Deregulation was also found to have increased the probability of exit from the market. The latter is also negatively related to the firm's capital stock and productivity. Evidence was uncovered of firm entry and exit having contributed to the reallocation of capital and particularly the shutdown of unproductive plants led to a reallocation of capital that increased aggregate productivity. The estimations conducted above do not allow assessing the long-term effect of deregulation on the telecommunications industry since the latter will depend on the effects of R&D activity.

Finally, Brandt (2004), using a new data set from EUROSTAT covering nine EU countries on firm entry, exit growth and survival, examines both the role of policies and institutions on firm entry and survival and the link between new firm creation and economic performance. His results suggest that high rates of firm entry coincide with rapid productivity, output and employment growth, especially in the ICT related services sectors and in some business services industries, while 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. The author also reports a positive relationship between firm entry rates and policy regulations and institutions that support firm entry. In particular, the results suggest that an overly complicated license and permit system discourages the creation of new enterprises.

c) Summary

Table 3 summarises the types of product market regulations and the impact of deregulation on entry and economic performance. In a nutshell, studies found that regulatory reform leads to a higher capital stock or a higher marginal product of labour by decreasing the price mark-up and/or the adjustment cost parameter. They also lead to higher labour demand and higher equilibrium wages. A decrease in entry costs leads to an increase in the number of firms on the market, a decrease in the price mark-up and an increase in the capital stock. However, if there is a ceiling on the rate of return on capital invested, regulatory reforms removing the constraint will lead to a decrease in investment. Also, if public companies were heavy investors before deregulation, privatisation may decrease investment. Empirically, tight regulation on the product market was found to have a negative impact on firm entry, and investment, with deregulation and especially entry liberalisation increasing investment in the long run.

Table 3. Types of product market regulations and impact of deregulation on firm entry and economic performance

Product Market Regulations	Impact of Deregulation on Entry and Economic Performance
barriers to entrepreneurship	increase in investment
constraints to business operations	increase in employment
red tape, administrative burdens	unclear effect on productivity (most studies found
public ownership	positive effect, but some found negative effect)
price controls	positive impact on entry (in particular SMEs)
barriers to entry	
tariff and non-tariff trade barriers	
foreign direct investment restrictions	
market share of new entrants	

Evidence was found that labour and credit market reforms led to an increase in employment and investment, particularly in the services sector, whereas the reduction in economic rents led to lower levels of labour productivity and TFP. A non-linear relationship was found between the level of economic rents and levels of R&D and the growth rates of labour productivity and TFP. Entry liberalisation led to productivity gains, with countries that were the most behind the technological frontier benefiting the most from state retrenchment and the liberalisation of potentially competitive markets. Privatisation leads to additional productivity gains under certain conditions. Administrative regulations of entrepreneurial activity have a strong negative effect on firm entry, which is larger for small and medium sized firms. The introduction of labour adjustment costs confirms the negative impact of tight regulation on firm entry and produces evidence of a further negative effect of tight hiring and

firing regulation on firm entry. Tight product market regulations also have a negative effect on productivity and this effect is larger the further behind the country is from the technological frontier.

2.6. Conclusion

In this survey of the literature, we started by presenting a number of theoretical studies modelling the entry and exit process based on the Schumpeterian concept of creative destruction. In passive learning models, firms enter the industry without knowing their true costs about which they gradually learn over time. They then decide whether to exit or remain in the industry. In these models, increasing the cost of entry leads to low firm turnover. In active models, firms enter the industry and invest to increase their productivity. If they are successful, they remain in the market, if not they exit. Capital vintage models are based on the assumption that new technology is embodied in new vintage capital and new entrants have the advantage of not having to incur the costs of upgrading their capital. In R&D based models of economic growth, firms use R&D investment to create new products or higher quality versions. Successful innovators enter the industry and replace firms producing obsolete goods. Finally, according to product life cycle models, the amount of firm creation and the nature of innovation change with the degree of maturity of the industry.

We then presented the 'basic' determinants of firm entry and exit, which can be specific to the firm, the industry, determined by both firm and industry characteristics or be country specific. The main conclusions and implications of the theoretical models appear to be consistent with these determinants as well as with a series of stylised facts about firm entry and exit. In particular, we found a positive correlation between entry and exit rates in industries with steady states of maturity and a negative correlation in sectors in the early and late phases of the product's life cycle. The variance of entry rates within industries is higher than the variance between industries, it changes over time and tends to come in waves. The variance of firm growth rates is large, but declines with the size of firms and the sunkness of capacity.

Firms entering and exiting the industry have lower than average size and the size of European firms is smaller than that of US firms. Young, small firms are the ones that most frequently exit the industry. Firm growth rates are influenced by the size and age of firms and are also influenced by industry and economy growth rates. Manager turnover in small businesses plays an important role in firm exits. A relationship was also found between lagged entry and exit rates, whereas only a weak relationship was uncovered between entry and past industry profits. The survival of new entrants is low and those that do survive need an average of 5 to 10 years to become competitive with incumbents. Lower degrees of economic development correspond to higher turnover rates. The latter are also affected by macroeconomic shocks. Entry deterrence strategies and structural barriers to entry also affect the entry and exit process and can again be classified into firm, industry or country specific, or determined by both firm and industry characteristics. Limit pricing where incumbent firms charge the highest price at which entry is deterred, and predatory pricing in which incumbents engage in a price war with new entrants were both criticised for not constituting credible threats to entry. Empirically, little evidence was uncovered for the use of limit pricing by firms. The use of sunk costs as a pre-commitment mechanism to deter entry was also analysed by the literature. The use of excess capacity to deter entry was found to be infrequent empirically, but some evidence was uncovered that firms use specific capital as a pre-commitment mechanism. Advertising and R&D intensity were found to be used frequently as entry deterrence strategies, whereas economies of scale constitute an important structural barrier to entry that influences the use of entry deterring strategies by incumbent firms. The

impact of entry deterring strategies was found to depend on the type of entrant. Firm access to credit capital also plays a significant role in firm entry and exit.

In the third step, we looked at the impact of entry and exit on economic performance as mainly measured by aggregate productivity growth. There is a debate in the literature on how to best decompose aggregate productivity growth into the contributions of within firm productivity growth, entry and exit and market share reallocation. Studies also differ on the best way to measure aggregate productivity with both TFP and labour productivity having certain advantages and disadvantages. In the end, the contribution of entry and exit to aggregate productivity growth can be high or low depending on the decomposition of aggregate productivity used, the time horizon over which changes are measured, the business cycle and the country and industry under investigation. Studies found that in general entrants have lower productivity than survivors as do firms exiting the market. The latter also tend to have lower productivity for several years before exit, whereas the relationship between the productivities of entrants and of firms exiting the industry is unclear. Entry and exit also affect aggregate productivity indirectly by influencing firms' incentives to innovate. For sectors close to the technological frontier, an increase in the threat of entry has a positive effect on productivity growth, whereas for sectors far below the technological frontier the effect may be negative. Empirical evidence was found in favour of this last conclusion.

One of the main objectives of this study is to assess the link between product market reforms and macroeconomic performance via their direct impact on firms' entry and exit. The last section of the review of the literature explicitly addresses this question. In a nutshell, product market reforms aimed at enhancing the functioning of product markets can be viewed as public actions deregulating and facilitating entry or the threat of entry. These reforms concern the barriers to entrepreneurship, the constraints to business operations as well as red tape and administrative burdens on the one hand and price controls and entry barriers such as for instance tariff and non-tariff trade barriers on the other hand. Overall, these market reforms are shown to have a direct positive impact on firm entry (in particular SMEs) as well as an indirect positive effect on investment and employment. As regards productivity performance, no clear-cut conclusion seems to emerge as some studies report a negative impact of product market reforms on productivity growth while a majority of them found a positive effect.

3. Data and descriptive statistics

Based on the findings of the literature review, this section aims at identifying the main data sources and indicators necessary to analyse the effect of product market regulations and determinants of firm entry and exit on economic performance via the entry and exit of firms and at presenting the main features of four different data sets constructed for the purposes of this study. The first data set contains information on entry and exit by country, sector and year, the second on entry barriers, the third on product market reforms and the fourth on aggregate economic performance indicators. For each type of information, the main available data sources, their strengths and weaknesses are briefly discussed and the definition and construction of the main variables used in the empirical analysis are documented. Finally, the main descriptive statistics for each data set are also presented.

3.1. Data on firm entry and exit (business demography)

a) Data sources

In this study, we make use of a newly constructed data set[21]. The information comes from the DUN & BRADSTREET database, which contains series on the number of entering (new), exiting (out of business) and continuing (active) firms by year, sector and country. The industry and services sectors are broken down into 35 classes according to the NACE 2 digit level (Table A.4 in Appendix 2). The database is a balanced panel data set that covers nine EU member countries over the 1997-2003 period: Belgium, Germany, France, Ireland, Italy, The Netherlands, Spain, Portugal and the United Kingdom[22]. In addition, US data from the Census Bureau over the sub-period 1999-2001 have also been integrated into the analysis[23].

b) Main variables used

The entry-exit data set contains three basic variables:

T_{it} = total number of firms active in the i^{th} industry at the end of period t,
E_{it} = number of new firms that entered the i^{th} industry between period t and t+1, and
X_{it} = number of firms that exited (out of business) the i^{th} industry between period t and t+1.

From the three basic variables, four additional variables have been constructed:

$NE_{it} = E_{it} - X_{it}$ = net entry of firms in the i^{th} industry at the end of period t,
$ER_{it} = E_{it}/T_{it}$ = entry rate in the i^{th} industry at the end of period t,
$XR_{it} = X_{it}/T_{it}$ = exit rate in the i^{th} industry at the end of period t and
$NER_{it} = NE_{it}/T_{it}$ = net entry rate in the i^{th} industry at the end of period t.

[21] See Box 2 in Appendix 2 for a brief discussion on other existing databases on entry-exit.
[22] Data for 2003 are only available for the first 11 months.
[23] In 1997, the North American Industry Classification System (NAICS) has replaced the US Standard Industrial Classification (SIC). Unfortunately, data between both industrial classifications are not directly comparable so that data prior to 1998 have not been considered in the analysis. Further comparability issues arise between the NAICS and the NACE 2 classifications and the US data refer to establishments while the Dun & Bradstreet database covers the enterprise unit. See Table A.4 in Appendix 2 for a correspondence between the NACE 2 and the NAICS.

c) Strengths and weaknesses of data

Before presenting the main features of the data set, it is important to draw some attention on its main strengths and weaknesses. The main advantages of the entry-exit data set used in this study rest in the cross-country comparability of the underlying data thanks in particular to the harmonisation of the unit of measurement, the full coverage of the business registers and firms' population, and the availability of recent data that ensure that up-to-date trends can be presented.

Nevertheless, the data set has also some important weaknesses. A first drawback concerns the representativeness in terms of the number of countries covered. For instance, despite the large number of studies that have analysed the impact of entry barriers on firm turnover and aggregate economic performance for the US economy, this country is not available in the data set. A second shortcoming is that no information on the characteristics of entrants/exitors and/or mode of entry/exit is available. Among these characteristics, the size of new entrants and exiting firms, as discussed in the previous section, is important since entry is mostly the fact of small sized firms. As a consequence, while the entry rate can be significantly high, the market penetration rate (share of new entrants' output in total industry output) is generally modest and so is its influence on incumbent strategies and on the industry post-entry evolution. The probability of firm exit has also been found to be decreasing with size and post entry growth is negatively related to the initial size. Furthermore, entry and exit can take several forms. As regards entry, new firms can be established from scratch (de novo entry) or by diversification[24]. Firms can also exit an industry through a merger or an acquisition by a competitor. Finally, a distinction should also be made between domestic and foreign entry[25]. As the determinants of entry/exit have different effects on different types of entrants/exitors and modes of entry/exit, the availability of this kind of information would allow a more detailed analysis of the impact of entry and exit on macro-economic performance. A third limitation of the data set rests in the lack of information as regards the post-entry performance of firms. As emphasised in Section 2, what happens to new entrants subsequent to their entry is as least as important as the entry process itself. The survival rates of new entrants for instance is found to be low and firms that survive in the market need some time (on average five to ten years) before they can properly compete with incumbents. Here also, data on post-entry performance would allow one to better identify the role played by entry barriers and product market reforms on the market selection process and its long run dynamics.

d) Descriptive statistics

The purpose of this section is to provide some descriptive statistics based on the entry-exit data set and to highlight some stylised facts about entry and exit that emerge from these statistics. It follows from Figure 2, that aggregated entry rates for the nine EU Members are substantial. Large numbers of firms enter and exit most markets in most years. This figure also indicates that aggregated entry rates are, except in 2003, above exit rates and that the net entry rate is globally decreasing over the period investigated. The finding that there is both decreasing entry rates and increasing exit rates over the period may be explained by the

[24] Mata (1993, p. 103) classifies established entrants according to the main industry of the parent company. "An entrant plant is classified as an expansion entry if it operates in the same industry where the owner firm was already operating, as extension entry if the parent firm operates in a different five-digit but in the same three-digit industry, and as a purely diversifying entry if it operates in a different three-digit industry." In his review of the literature, the author finds that the de novo entry type clearly dominates with 60%.

[25] See for instance Baldwin and Gorecki (1987).

influence of the cyclical effects. There seems indeed to be some correlation between the business cycle (as measured by the annual GDP growth in the Euro area) and entry and exit rates. Hence, this factor should be considered as a control variable in the econometric analysis.

Figure 2. Aggregated entry, exit and net entry rates (in % - 9 EU countries[a] - 1997-2003[b])

Sources: Entry-exit data set, own calculations.
Notes: a) Belgium; Germany; France; Ireland; Italy; The Netherlands; Spain; Portugal, United Kingdom and US.
b) First 11 months for 2003, 1999-2001 for the US.

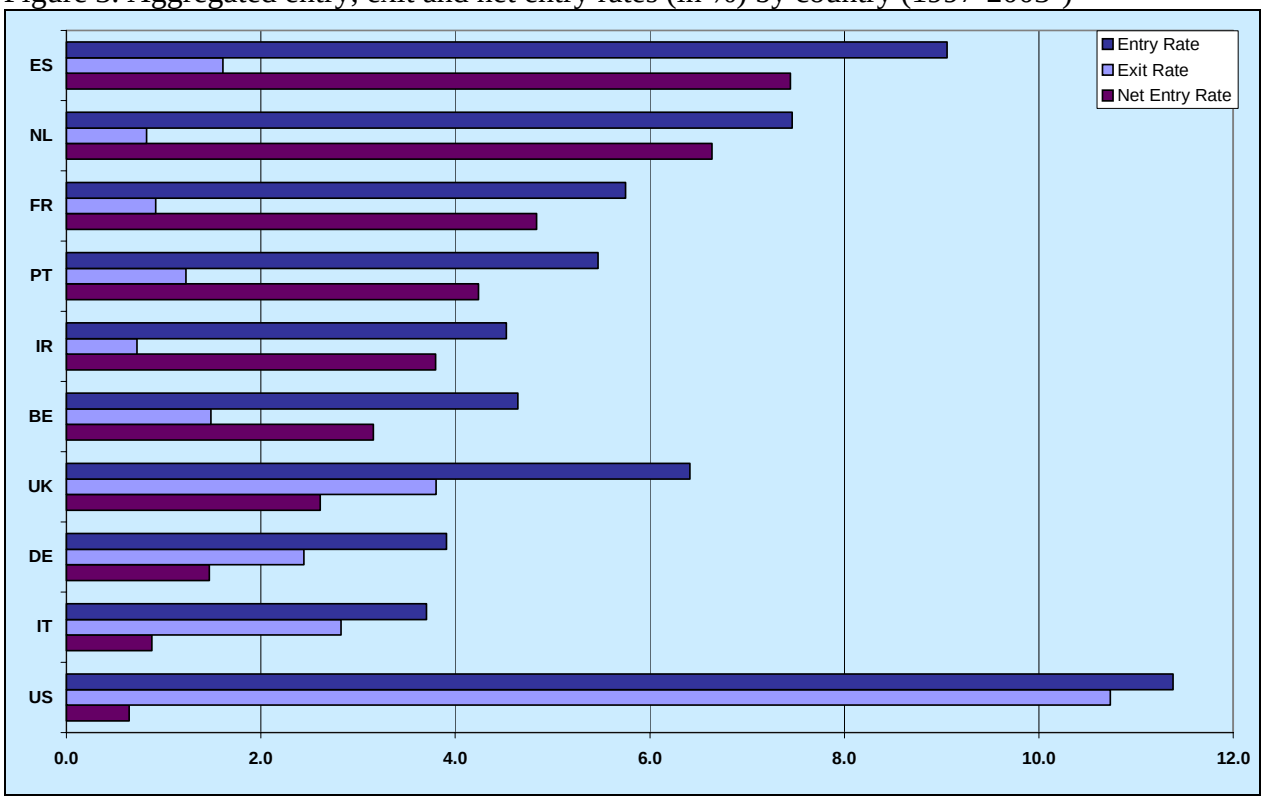
As can be seen in Figure A.1 in Appendix 2, the annual growth rate of the total number of active firms is generally positive but tends to decrease at the end of the analysed period, except for Germany and Portugal. Moreover, a similar trend is observed for most of the countries. This finding suggests the presence of common macro-economic shocks and common cyclical fluctuations across countries.

Another stylised fact that emerges from the data set is that entry, exit and net entry rates differ substantially across countries (Figure 3). Spain and The Netherlands are the two countries with the highest net entry rates for the whole period analysed. As regards Spain, the growth of value added is among the highest among the countries for which data is available (Table A.10 in Appendix 2). At the other end, Italy and the US are characterised by the lowest net entry rates. Italy is also the country that exhibits the lowest entry rate. In terms of capital intensity, this country has the highest intensity (Table A.10 in Appendix 2). Small net entry rates are however not synonym of low firm turnover activity. For the US in particular, the net entry rate represents only a small fraction of the gross entry and exit rates. A similar finding, though of less importance, emerges for the UK economy.

The importance of firm entry and exit also differs considerably across industry and services sectors (Figure 4). Post & telecommunications, real estate, renting & business

activities and electricity, gas & water supply represent the three sectors that experienced the highest net entry rates. This finding is mainly due to the size of entry, which is significantly higher as compared to the other sectors. The rapid pace of technological change in computer services that belong to the second services sector may involve a lot of creative destruction whereby innovations destroy obsolete technologies and entails the creation of a large number of firms. The size of entry can also be explained by the importance of regulatory reforms, in particular deregulation policies to open the market that have played a significant role in the two other sectors. In terms of capital intensity, however, real estate, renting & business activities and electricity, gas & water supply are the two services sectors that are the most capital intensive. As a result, economies of scale, which are considered as an important structural barrier to entry, are potentially important in these sectors and entry rates can be expected to be lower. The lowest entry rates are to be found in the wood, non metallic mineral products, instruments, fabricated metal products and machinery & equipment industries, while both entry and net entry rates tend to be small in paper and textile manufacturing sectors. These last two sectors are characterised by the lowest R&D intensities (Table A.9 in Appendix 2), whereas the wood sector is among the ones with the highest capital intensity. Finally, transport & telecommunications and office machinery & computers exhibit the highest entry rates. The importance of technological opportunity and because of innovation activities characterising these sectors as well as the importance of deregulation policies in the former sector can be seen as two major determinants explaining this finding.

Figure 3. Aggregated entry, exit and net entry rates (in %) by country (1997-2003[a])

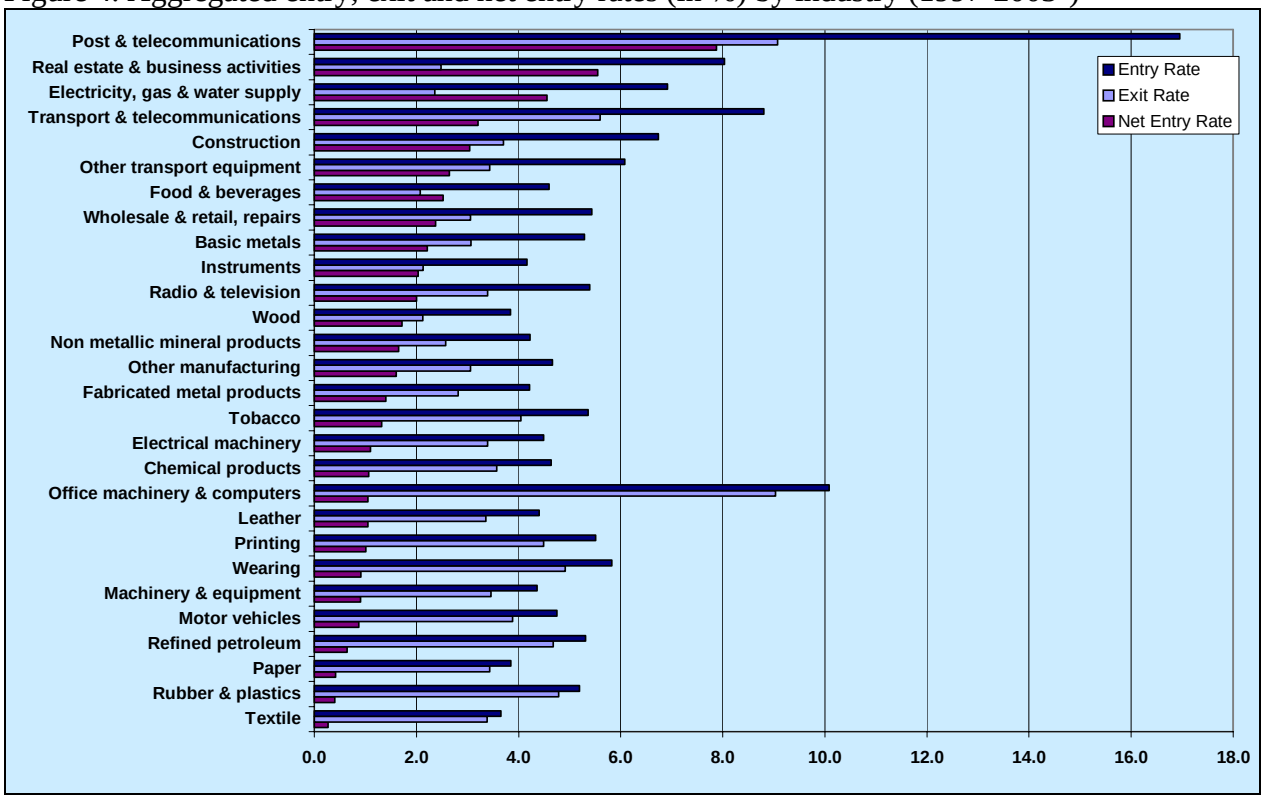


Sources: Entry-exit data set, own calculations.
Notes: a) First 11 months for 2003, 1999-2001 for the US.

The examination of standard errors shows that the heterogeneity of net entry rates varies substantially across countries and industries and somewhat less across time (Table A.5 in Appendix 2). Furthermore, this heterogeneity does not appear to be related to the importance

of the net entry rate[26]. Hence, countries or sectors with low net entry rates can be associated with an important variability of both entry and exit rates and conversely for high net entry rates. A similar pattern can be observed for the entry and exit rates variables. Yet, the standard deviations of entry rates are globally relatively more important as compared to exit rates. Several determinants can explain this heterogeneity across countries, time and industries. At the country level, more dynamic industry sectors in terms of firm entry may simply account for a larger part of the economy. At the industry level, the importance of structural determinants such as entry barriers as well as the scale and scope of product market reforms can vary a lot from one country to the other.

Figure 4. Aggregated entry, exit and net entry rates (in %) by industry (1997-2003a)



Sources: Entry-exit data set, own calculations.
Notes: a) First 11 months for 2003, 1999-2001 for the US.

The empirical literature on firm dynamics also suggests that most of the total variation in entry and exit is within industry rather than between industries. This finding is also verified in the present analysis. As shown in Table A.6 in Appendix 2, the comparison of entry, exit and net entry rates' heterogeneity (or variability) across and within industries through the analysis of variance (ANOVA) indicates that most of the total variability is within rather than between industries[27]. The same finding holds when within and between countries and time periods ANOVA are performed.

[26] For instance, the tobacco industry has an average net entry rate of 0.9% and an associated standard error of 7.5, which is much higher than the corresponding figures, observed in the electricity, gas & water supply services sector (average net entry rate of 5.9% and standard error of 4.3).

[27] If there are k industries (countries, time periods), one can show that the total variation can be decomposed as:

$$\sigma^2 = \sum_k \frac{N_k}{N}\sigma_k^2 + \sum_k \frac{N_k}{N}(\mu_k - \mu)^2$$

Another well established stylised fact in the literature concerns the positive correlation between contemporaneous rates of entry and exit across industries[28]. As can be seen in Table A.7 in Appendix 2, this finding is also found in our data set, though the correlation coefficients turn out to be statistically significant only in a few industry sectors. Furthermore, these coefficients are also negative in some cases. According to Agarwal and Gort (1996), these positive correlations "make most sense for samples of industries in steady states of maturity but varying in structural entry barriers and the sunkenness of resource commitments. In early and late phases of a product's life cycle these correlations indeed reverse to negative."[29] Finally, for some sectors, the correlations between entry and exit rates are not significant. One reason explaining such a finding is that the determinants of entry may be different or may have a different timing than the ones inducing exit. Profitability is another argument, as supranormal profitability in a given sector with low entry barriers should stimulate market entry (and market exit in sectors with subnormal profit rates).

Table A.8 in Appendix 2 shows the correlation between countries for entry and exit rates. This measure appears to be in general statistically significant and positive, especially for entry. Consequently, when entry (respectively exit) is important in one country, it is also important in other countries. This finding again suggests the presence of joint determinants of entry and exit as well as common business cyclical factors that affect firm turnover in the EU Member States and the US.

e) Summary of main findings

In a nutshell, the main findings emerging from the descriptive statistics of the entry-exit data set may be summarised as follows:

- Entry and exit are common. Large numbers of firms enter and exit most markets in most years;
- Entry (and exit rates) differ substantially across countries and industries;
- The annual growth rate of the total number of firms is generally positive but tends to decrease over the period 1997-2003;
- Heterogeneity of net entry rates varies substantially across time periods, countries and industries;
- Most of the total variation in net entry rates across industries is within-industry variation rather than between-industry variation. The same finding holds for within-country and –time period and between-country and –time period variation;
- Entry (and to some extent exit) rates across countries are generally significantly and positively correlated.

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where σ^2 is the total variance, σ_k^2 the variance in industry k, N the total number of observations, N_k is the number of observations in industry k, μ the total average and μ_k the average in industry k.

[28] See Caves (1998) for a review. According to the studies surveyed by the author, exit rates are found to be even more responsive over a five-year period than are entries to exits.

[29] Quoted in Caves (1998, p. 1957). The correlations between the two-year lagged entry and the current exit rates do not change the conclusions that follow from Table A.7 in Appendix 2.

3.2. Data on structural barriers to entry

a) Data sources

The construction of the main determinants of firm entry and exit are based on the OECD's STAN and ANBERD databases. Part of the industry specific variables that will figure as basic control variables in the regressions come from the OECD's STAN database. The STAN database contains information on production, value-added, gross fixed capital formation, employment and the volume of gross and net capital stock by country, sector and year. The industry and services sectors are broken down into 39 classes according to the ISIC Rev. 3 classification code at the 2 digit level. The database covers all the countries in our sample except for Ireland, starting from 1970 through 2002. For the descriptive statistics section, we covered the 1990-2002 period. The R&D intensity variable is based on data taken from both ANBERD and STAN databases. The ANBERD database contains R&D expenditure by country, sector and year in national currencies and in PPP US dollars. The database covers 58 manufacturing and services sectors according to the ISIC Rev. 3 classification from 1987 until 2001. We have taken the series from 1990 to 2001 for the descriptive statistics section. All of the countries in our sample are covered with the exception of Portugal, but given that we do not have the production series for Ireland in the STAN database, we also dropped this country when we calculated the R&D intensity.

b) Main variables used and data weaknesses

Given the availability of data and the importance of the different determinants presented in the empirical literature, we selected the following variables: capital intensity, resource intensity and minimum efficient scale are alternative variables aimed at capturing economies of scale. The literature (Hause and Du Rietz, 1984; Kessides, 1990a; Kessides, 1990b) found evidence of a negative relationship between the existence of economies of scale and firm entry. According to Bunch and Smiley (1992), the presence of economies of scale acts as a substitute to the use by firms of entry deterring strategies. Industry concentration is an endogenous variable that can be considered as capturing the degree of structural economic barriers in an industry (Caves, 1998; Baldwin and Caves, 1998). High industry concentration can indicate high structural entry barriers, thereby having a negative effect on firm entry. At the same time, there is also empirical evidence (Baldwin, 1995) of a strong negative effect of turnover due to entry and exit on concentration. We also used a R&D intensity variable as a determinant of firm entry and exit because of the strong empirical evidence found in the literature (Singh et al., 1998; Chang and Tang, 2001) on the strategic use of R&D spending by firms to contest new entry as well as meet existing competition. We lack a series on advertising intensity, which is also identified as being a frequently used entry deterrence strategy by firms (Kessides, 1986, Thomas, 1999, Orr, 1974, Bunch and Smiley, 1992). However, the degree of differentiation within an industry is partly the result of entry deterrence strategies used by firms such as advertising intensity and R&D intensity, and therefore is used as a determinant of firm entry and exit. The growth rates of industry value-added and employment are used to capture macroeconomic shocks as well as market growth, which also influence entry and exit.

We also used a series of variables that capture market structure given the latter's influence in determining the entry and exit of firms from industries. These indicators were taken from Davies and Lyons (1996) and Martins et al. (1996) and include minimum efficient scale, industry concentration measured in 1993, a dummy variable for whether industries are

differentiated or not[30] and a dummy variable that measures market segmentation. The main drawback for the market structure variables is that they are only available at the sector level and not at the country or year levels. We therefore assumed that the variables for a given sector are the same across all countries. Given that the sectors for which these variables are measured are classified using the NACE Rev. 1 classification code, it was necessary to convert these sectors according to the ISIC Rev. 3 classification code so that they can be compatible with the entry and exit determinants variables calculated above. In some instances, this implied aggregating several NACE sectors in order to obtain the corresponding ISIC sector. In this case, we took the average of the variables by NACE sector as the value of the variables for the global ISIC sector[31]. For the dummy variables, this meant that there were cases in which one NACE sub sector was differentiated or segmented while the other sub sector was not. The global ISIC sector can therefore be classified as fully differentiated or segmented or not if all of the NACE sub sectors have dummy variables with the same value, or semi-differentiated or semi-segmented if the dummy variables have different values.

c) Variables constructed

Based on the series provided in the STAN database, we calculated the following variables:

Capital intensity = gross fixed capital formation (in value terms)/production (at current prices),
Resource intensity = production (at current prices)/value added (at current prices),
Value-added growth = yearly annual growth rate of value added (at current prices) in percentage, and
Employment growth = yearly annual growth rate of total employment (in persons) in percentage.

We calculated value-added growth and employment growth in order to control for whether a given industry is expanding or contracting, given that according to the literature, we can have a high firm entry rate into industries that are contracting or a low entry rate into expanding industries. One way of capturing economies of scale, which are considered as an important structural barrier to entry, is by calculating the resource intensity of a sector. The capital intensity variable serves a similar purpose[32].

Given the importance of R&D as a barrier to entry stated in the literature[33], we consider the R&D intensity to proxy this barrier.

R&D Intensity = R&D expenditure (in national currencies)/production (at current prices).

[30] This variable is constructed by using the level of advertising costs and R&D expenditure to measure whether an industry produces a differentiated product or not.
[31] It was necessary to calculate a simple arithmetic average since production values were only available at the global ISIC sector and therefore could not be used as weights for the NACE sub sectors.
[32] We also calculated capital intensity as the ratio between the gross and net capital stock respectively (in volume terms)/Production (at current prices), which are more accurate measures. However, because of a large number of missing observations for the net and gross capital stock we settled for the ratio of gross fixed capital formation in value terms to production as measuring capital intensity. In terms of employment growth, we took the series on total employment in persons, but we also looked at the series on total employment and employees in full time equivalent. The problem with the last two series was a large number of missing observations that would put too many limitations on our sample.
[33] The R&D intensity variable is also often used to capture technological opportunity, i.e. the potential for technological progress in general or within a particular field. As an alternative, patent indicators by industry sectors may also be considered. Whatever the indicator chosen, technological opportunity is in general difficult to distinguish from technological barriers.

d) Descriptive statistics: Summary of main findings

The main conclusions from the descriptive statistics as regards the variables discussed in this section can be summarised as follows[34]. In terms of evolution, there is little variation in R&D intensity in a given sector across countries and years. We found moderate variation in a given sector across countries and years for capital and resource intensity, as well as for value-added and employment growth.

There are sectors where the standard deviation is substantially higher for certain variables compared to other industries: real estate, renting and business activities for capital intensity, tobacco for resource intensity, office machinery and computers for R&D intensity and employment growth, refined petroleum and office machinery and computers for value added growth.

In terms of averages, the most capital-intensive sectors are real estate, renting and business activities, post and telecom, electricity, gas and water supply and land and other transport. Real estate, renting and business activities and post and telecom are also the most resource intensive together with wholesale and retail trade. The highest R&D intensity is found in office machinery and computers and radio and TV, whereas the strongest value added growth by far is registered in the refined petroleum sector. There are also two traditional sectors that have negative value added growth on average: wearing and leather.

In terms of employment growth, sectors generally register a negative average, a notable exception being real estate, renting and business activities. At the other end, wearing has the lowest employment growth average. The variation in a given sector across countries and years is a lot stronger for the gross fixed capital formation and the labour productivity per person engaged variables compared with the others.

The highest standard deviations for the Gross Fixed Capital Formation (GFCF) variable are registered in real estate, renting and business activities, wholesale and retail trade and post and telecom. For labour productivity, the highest variation by far is found in office machinery and computers and radio and TV. The highest GFCF averages are in real estate, renting and business activities, wholesale and retail trade and post and telecom, whereas the highest labour productivity is found in office machinery and computers and radio and TV. We found moderate variation in a given country across sectors and years for capital intensity, R&D intensity and employment growth. Slightly higher variation was found for resource intensity and value added growth, whereas the highest standard deviations were found for GFCF and labour productivity. The variations in terms of resource and R&D intensity are fairly similar across countries. Portugal has a substantially higher variation in capital intensity, employment growth and value added growth compared with the other countries. The standard deviations for value added growth are more heterogeneous across countries.

The US has the strongest variation for the GFCF and the labour productivity variables followed by Germany for GFCF and Ireland for labour productivity. The average is fairly similar across countries for capital intensity, resource intensity, R&D intensity and value added growth. Portugal has a substantially higher value added growth average compared with the other countries. Most countries have a negative employment growth average, the only two exceptions being Portugal and Spain. Countries are a lot more heterogeneous in terms of the

[34] Box 3 in Appendix 2 presents a more detailed discussion.

GFCF and labour productivity averages, with the highest values for GFCF being registered in the US and Germany and the highest values for labour productivity being in the US and Ireland. The standard deviation is fairly stable across time for capital and resource intensity, it is mostly stable for value added and employment growth, it increases across time for GFCF and labour productivity and it fluctuates moderately for R&D intensity. The average for capital intensity is stable across time. It increases for GFCF and labour productivity, decreases for resource and R&D intensity and fluctuates for value added and employment growth.

The correlation matrix generally shows low correlation among the variables, the exceptions being moderate and significant correlation between market structure variables (scale economies, concentration, differentiation and segmentation) and capital intensity, GFCF, a moderate correlation between resource intensity and scale economies and a moderately negative correlation between scale economies and R&D intensity. We also found significant correlation between the market structure variables and most notably between differentiation and segmentation with concentration and concentration and segmentation with scale economies. There is a moderate correlation between R&D intensity and labour productivity.

3.3. Data on economic and business reform and regulation

The third data set constructed is on product market regulations, which according to the literature (Section 2.5), have an impact on economic performance. Whereas a majority of studies in the literature measure the effect of product market regulations directly on productivity growth and investment, in this study, we measure this effect indirectly through the influence of product market regulations on firm entry and exit which in turn affects economic performance through the contribution to aggregate productivity growth and through its influence on firms' incentives to innovate, which also influences productivity growth (Section 2.4).

a) Definition of Product Market Regulations (PMRs)

There is no generally accepted definition of regulation applicable to the very different regulatory systems in the EU countries. The OECD defines regulation as "the diverse instruments by which governments set requirements on enterprises and citizens" (OECD, 1997). Regulations include laws, formal and informal orders and subordinate rules issued by all levels of government, and rules issued by non-governmental or self-regulatory bodies to which governments have delegated regulatory powers.

Regulations fall into three categories:

- Economic regulations intervene directly in market decisions such as pricing, competition, market entry or exit.
- Social regulations protect public interests such as health, safety, the environment, and social cohesion.
- Administrative regulations are paperwork and administrative formalities, so-called "red tape", through which governments collect information and intervene in individual economic decisions. Administrative regulations are important tools to support public policies in many areas such as taxation, safety and environmental protection.

b) Data sources

Developments and cross-country comparisons in the field of economic regulation, administrative burdens on businesses, as well as on the time and costs necessary to set up a new company, are difficult to establish because data on these topics are relatively scarce. Despite these difficulties, a number of empirical studies have attempted to investigate the effects of economic and business regulatory reforms on economic performance[35]. These effects are quantified thanks to several regulations and product market reforms constructed indicators based on different sources of information available.

Among these sources, which are based –at least partly– on survey data, we can mention:

- The **OECD database on regulatory reforms**[36]. It contains indicators providing detailed information on regulatory and administrative policies as well as on administrative requirements for business start-ups. As these indicators are dating from 1998, the OECD

[35] These studies have been surveyed in Section 2.5.
[36] Data retrieved from :
http://www.oecd.org/document/49/0,2340,fr_2649_37421_2367345_119656_1_1_37421,00.html

launched a project aimed at updating them. However, the new data will not be available before October 2004.

- The **composite indicators available from the Fraser Institute**[37]. Among 38 indicators based both on survey data and on data provided by different national and international sources, five refer to business regulations: price controls; administrative conditions (procedures) for starting a new business; time spent with government bureaucracy; ease of starting a new business; and irregular payments connected with, among others, import/export permits, with business licences or with exchange controls. These indicators are designed to identify the extent to which regulatory restraints and bureaucratic procedures limit competition and the operation of markets.
- The **ENSR surveys**, which are carried out by the Observatory of European SMEs[38], have for several years included questions on the appreciation by SMEs of administrative burdens.
- The World Bank measure of the time and costs necessary to start a business is computed on the basis of a questionnaire filled out by local professionals such as corporate lawyers and consultants. The OECD also provides a synthetic indicator in this field. The **World Bank database on Governance indicators** presents six aggregated indicators among which one index referred to as "Regulatory Quality"[39]. This index includes measures of the incidence of market-unfriendly policies such as price controls or inadequate bank supervision, as well as perceptions of the burdens imposed by excessive regulation in areas such as foreign trade and business development.
- Following the Lisbon European Council in March 2000, the EU has developed several **structural indicators (EUROSTAT)** to assess the level of achievement of the main strategic goals agreed upon in Lisbon. These indicators fall into four priority areas: employment, innovation, economic reform and social cohesion. As regards economic reforms, a distinction is made between indicators of market integration and of market efficiency. For product markets, the indicator list includes an indicator of trade integration, and an indicator of relative price levels to reflect both market integration and efficiency. In addition, the evolution of prices in network industries is considered as an indicator of progress in the liberalisation of these sectors. Finally, two indicators measuring possible distortions in the functioning of product markets caused by public intervention are proposed. For capital markets, the list consists of two indicators on financial market integration and efficiency.
- The **European Centre of Enterprises with Public Participation (CEEP) Statistical Review**[40] provides information on the importance of enterprises with majority public participation. These data are available for 1991, 1995 and 1998 in the non-agricultural private business sector.

c) Data weaknesses

A main drawback of these data sources is that in many cases, the indicators are available for only one year, which prevents the use of time series. As we will see in the section presenting the econometric framework, it is important to consider the time dimension. Whenever possible, data containing time variations have been used and these data have been linearly intra and extrapolated to fit the 1997-2003 period of the entry-exit data set. A second main shortcoming of data is that only a few sources provide indicators at the industry level.

[37] See Gwartney and Lawson (2004). Data retrieved from www.freetheworld.com.
[38] Data retrieved from : www.freetheworld.com.http://www.eim.nl/Observatory_Seven_and_Eight/start.htm
[39] Data retrieved from : http://www.worldbank.org/wbi/governance/govdata2002/
[40] http://www.ceep.org/

d) Data set on regulatory reforms (and FDI restrictions)

Among the main indicators on product market reforms and regulations used in the econometric analysis, a distinction can be made between indicators available at the macro economic level and those available at the meso-economic one. Table A.13 in Appendix 2 lists the main indicators on product market reforms at the aggregated economy level[41].

These indicators are classified into five categories: ease of starting a new business, trade tariffs and barriers, state involvement in the economy, and importance of administrative burdens and regulatory quality. These indicators correspond to the ones retained in Griffith and Harisson (2004) and have been updated according to the latest data available[42]. Most of these indicators come from the Fraser Institute, which reports them on a five-year interval basis and annually from 2000 onwards[43]. The latest period currently available is 2002. Thus, four time periods are available and in order to have a continuous series over the period 1997-2003, data have been linearly intrapolated for 1996-1999 and extrapolated after 2002. The indicators take values ranging from 1 to 10 according to the level of economic freedom or regulation[44].

The World Bank "Regulatory Quality" index is measured in units ranging from -2.5 to 2.5, with higher values corresponding to better governance outcomes. The index, which is reported for four years (1996, 1998, 2000 and 2002) has also been intra- extrapolated for 1997, 1999, 2001 and 2003, and rescaled to make it comparable with the other indicators. Table A.14 in Appendix 2 reports the correlation matrix of all of these indicators. It follows that the correlation coefficients are relatively high which may lead to some multicollinearity problems in the estimations.

The second set of regulations and reforms indicators considered in this analysis are industry-specific indicators. These indicators are classified into three categories: degree of friendliness to competition, product market regulation indicators and restrictions to foreign direct investment.

The indicators in the first category measure the "degree of friendliness to competition" of regulation[45]. The scale of the indicator is 0-6, from most to least friendly to competition and the period covered is 1975-1998. These indicators have been compiled by the OECD and concern seven network industries over the period 1975-1998[46]. They are obtained from a finer data set including information on barriers to entry, public ownership, vertical integration, market structure and price controls. Two versions of these indicators are available: one including, and the other excluding, public ownership and their precise sectoral composition depends on both economic and coverage considerations. To harmonise these data with the

[41] We wish to thank Rachel Griffith and Rupert Harrison for providing their data set on product market regulations.
[42] The authors investigate several other regulation and reforms indicators that come from different sources among which the OECD and the EU and identify the most effective ones in terms of the empirical analysis. Accordingly, the same indicators have been selected in this study.
[43] As emphasised in Griffith and Harrison (2004), two key advantages of the Fraser Institute indicators are their time-series dimension and the fact that they have been collected consistently over time.
[44] A value of 10 indicates the highest level of economic freedom and the lowest level of economic regulation.
[45] As these data are still preliminary and may change in the future, only aggregate indicators are available. Furthermore, as the data have not been published yet, no table has been produced.
[46] The sectors are airlines, electricity, gas, post, telecom, railways and road freight. See Nicoletti et al. (2001) for a description of these data.

entry-exit data set and the other regulation indicators, they have been rescaled from 1 to 10 and extrapolated to 2003.

The second category of indicators covers several dimensions of industry-specific regulations for the year 1998. These indicators are "detailed" or "binary". Detailed indicators are usually smoother and come either from the OECD or from the Australian Productivity Commission. Binary indicators generally come from the OECD International Regulation Database. All original indicators are in 0-2 scale - increasing in the degree of restrictions put on market mechanisms and competition. Indicators are not comparable across industries, i.e. a value of 2 in electricity indicates legal public monopoly, and a value of 2 in retail distribution indicates some entry barriers, price controls, and administrative burdens. To be comparable, the detailed indicators have been rescaled taking into account the average or structural characteristics of industries across OECD countries and aggregated in summary indicators (covering all dimensions of regulation) for each industry using average industry employment shares in the OECD area. Table A.15 in Appendix 2 presents the summary product market regulation indicators for 2-digit non-manufacturing industries. Indicators range from 0 to 10 from most to least restrictive.

The third category of indicators relates to restrictions in different sectors for four time periods (1981, 1986, 1991 and 1998)[47]. They are presented in Table A.16 in Appendix 2. The data come from the UN Trade Analysis Information System (TRAINS) and were rescaled from 0 to 10 and intra- and extrapolated over the 1997-2003 period.

3.4. Economic performance indicators

As discussed in Section 2.4, a majority of studies examining the impact of firm entry and exit on economic performance concentrate on the relationship between firm entry and exit and aggregated productivity growth, the latter being decomposed into three components, i.e. internal and external restructuring and creative destruction (see Box 2 in Appendix 1). Unfortunately, the lack of information on the entrants' and exitors' initial shares in terms of output prevents us from implementing this method. Following the literature, we estimate the impact of the entry and exit rates on aggregated productivity growth at the industry level as well as on the demand for input factors, i.e. labour and investment in physical capital[48]. We also investigate the effect of entry and exit on output performance and on innovation activities, which we proxy with R&D expenses[49].

a) Data sources

The data sources for these variables are the same as the ones for the entry and exit determinants (Sections 3.2), i.e. the OECD's STAN and ANBERD databases except for total factor productivity and labour productivity that come from the **ICOP database** from the University of Groningen.

[47] This data is described in Golub (2003).

[48] According to Alesina et al. (2003), deregulation in particular decreases the entry costs which generates an increase in the number of firms on the market and as a result an increase in the capital stock.

[49] Following Aghion et al. (2002), in sectors that are close to the technological frontier, entry stimulates innovation through an escape effect but can also discourage firms engaging in such activities (discouragement effect) for those firms far away from the frontier.

b) Weaknesses of data

Given data availability constraints for TFP[50], we use the labour productivity rather than the total factor productivity. It should be noted that results will in general differ according to whether aggregate productivity is measured by TFP or labour productivity, with net entry having a strong contribution to TFP growth. Disney et al. (2003) found that the contribution of entry and exit to aggregate productivity growth, when the latter was measured by TFP, was sensitive to the business cycle and was larger in periods of economic slowdown and a higher contribution of entry and exit in periods of economic slowdown was also found by Hahn (2000). Another main drawback of these data is the lack of information for some sectors and/or countries and years. R&D expenditure, for instance, was not available for Portugal and production for Ireland, so that it was not possible to investigate these countries in the regression analysis.

c) Main variables used

Based on the series provided in the STAN, ANBERD and ICOP databases, we calculated the following variables:

Output growth = yearly annual growth rate of total employment (in persons) in percentage,
Labour productivity growth = yearly annual growth rate of labour productivity per person engaged,
Employment Growth = yearly annual growth rate of total employment (in persons) in percentage,
Investment growth = yearly annual growth rate of investment in gross fixed capital formation,
R&D growth = yearly annual growth rate of R&D expenditure,
Investment intensity = investment in gross fixed capital formation (in value terms)/production (at current prices),
R&D intensity = R&D expenditure (in national currencies)/production (at current prices).

Finally, besides the growth of labour productivity and employment, we also consider the levels of these variables as performance indicators in the regression analysis.

d) Stylised facts

As most of these variables have already been documented in the structural barriers to entry data section, we refer to Section 3.2 and Box 3 in Appendix 2 for a summary of main findings and descriptive statistics.

[50] TFP at the sectoral level is only available for 5 countries of the data set.

4. Econometric framework

This Section presents the methodology and the models implemented to assess the impact of product market reforms on entry-exit and macroeconomic performance. By means of appropriate estimation techniques and relevant controls, the effects of product market reforms on entry-exit and on macroeconomic performance are quantified. Indicators of macroeconomic performance include growth of output, labour productivity, employment as well as investment in both physical and intangible capitals.

4.1. Two-stage approach

The econometric framework implemented for analysing the impact of product market regulations on entry-exit and on different aspects of macroeconomic performance bears on a two-stage approach. In the first stage, we estimate the relationship between firm entry and exit and our indicators of product market reforms and regulations. In addition to product market reforms, we also control for country and industry structural characteristics. We assume that the product market reform indicators directly affect firms' turnover and indirectly the macroeconomic outcomes via the entry-exit process. Following economic theory, we assume that product market reforms affect economic outcomes mainly indirectly through their impact on market efficiency, which can itself be decomposed into three main channels.

First, product market reforms aimed at decreasing the costs of entry or at reducing entry barriers have a positive impact on firm entry. Second, product market reforms and the deregulation of the economy increase competition, which in turn force firms to reduce their price mark-up (internal allocative efficiency). When competition increases, less efficient firms exit the market and market shares move to more efficient firms (external allocative efficiency). In a situation of poor competition, firms do not produce at their lower costs (productive efficiency), which can lead (new) more efficient firms to enter the market. More competition can also foster dynamic efficiency in the long run by stimulating firms to invest more in innovation activities to remain competitive.

In the second stage, we estimate the relationship between firm entry and exit rates and different macroeconomic outcomes, in particular the growth of output, labour productivity, employment, investment in tangible and intangible capitals as well as R&D and physical capital intensities. In order to control for the possible endogeneity of the entry-exit variables due to unobserved factors which can simultaneously affect these variables and macroeconomic performance, entry and exit are instrumented using an appropriate set of instrument variables. This instrumental variable approach allows us to also control whether product market reforms affect macroeconomic performance only indirectly through their direct impact on entry and exit.

4.2. Impact of PMR on entry-exit equation

The rate of entry of firms (ER) in a given country, industry and time period is expected to be affected by our different indicators of product market reforms as well as other structural characteristics. More specifically and following the literature, the entry rate of firms can be written as a function of 'basic' determinants and entry deterrence strategies and barriers at the

firm, industry and country levels (see Table 1 in Section 2.3. for a summary of these variables). These determinants are contained in the vector of variables X in equation (1)[51].

The review of the literature also suggests that the level of product and labour market regulations in general has a positive effect on entry rates (see Table 3 in Section 2.6)[52]. In our model, we only use data on product market regulations available to us (see Section 3.3) which are included in the vector Z in equation (1). These variables can be classified into indicators at the macro level which are divided into five categories (ease of starting a new business, trade tariffs and barriers, state involvement in the economy and the importance of administrative burdens and regulatory quality) and indicators available at the meso level which are divided into three categories (degree of friendliness to competition, product market regulation indicators and restrictions to foreign direct investment). Given the high contemporaneous correlation present among the product market reform indicators, the estimation of these variables may be affected by multicollinearity, i.e. the model fits the data well, but the regressors are not statistically significant. One way to cope with this issue is to reduce the number of regressors and replace them by their principal component scores.

In equation (1) we also include the entry rate lagged by one year as an explanatory variable since there is evidence in the literature (Geroski, 1995) that previous entry deters current entry. We also control for unobserved year, country and industry specific effects, which have an impact on entry. According to Geroski (1995), only a modest part of entry rate variations are explained by observed determinants, with transitory variations in the unobserved factors explaining the remaining large part. Formally, we have:

$$ER_{ijt} = \rho ER_{ijt-1} + \beta X_{ijt} + \delta Z_{ijt} + \lambda_t + \mu_i + \mu_j + u_{ijt} \qquad (1)$$

where λ_t, μ_i, μ_j are year, industry, country specific effects[53],

u_{ijt} is a random error component,

i, j and t index industries, countries and years.

In equation (1), the dependent variable is the entry rate. It may also be worth considering two alternative models with the exit rate and the turnover rate, i.e. the sum of entries and exits divided by twice the total number of firms, as dependent variables. Indeed, as the literature suggests, the impact of product market reforms and entry and exit determinants is not the same on entry and exit. Furthermore, in order to be able to identify the key parameters of interest separately from other country and industry differences, we need to use product market

[51] Given the constraints of data availability, we only use the variables constructed in section 3.2, i.e. the height of entry barriers (capital intensity, resource intensity), the rate of profitability, the current and expected level of demand (value-added growth and employment growth), R&D intensity, as well as the degrees of industry concentration, product differentiation and market segmentation at the beginning of the period. All these variables, except the last three, vary over industries, countries and time periods.

[52] For instance, Scarpetta et al. (2002), inter-alias, find that strict product market regulations have a negative effect on the entry of small firms. Tight employment protection legislation, however, has a positive, but weakly significant effect on firm entry for micro firms, which employ less than 20 people, and a negative effect on small and medium sized firms. This can be because countries with tight labour policies usually exempt firms below a certain size from some aspects of the legislation. Therefore, entry occurs with these types of firms or with large companies in which firing and hiring costs only represent a small fraction of the total entry cost.

[53] These variables reflect left-out variables that are time-persistent in the sense that for each country and industry, they remain roughly the same over time and capture unobservable country and industry heterogeneity. The period-specific component translates in omitted variables, such as common macro-economic shocks, which affect all individuals in period t.

regulations indicators that vary differentially over time across countries and industries[54]. Unfortunately, such information does not always exist, due to data availability or because of similar reforms across countries or similar timing of implementation.

4.3. Impact of entry-exit on macro-economic performance equation

In the second stage, we start from a standard industry and country level production function that depends on labour, physical and intangible capital inputs and total factor productivity growth. In the regressions we assume that the physical capital can be proxied by investment in fixed capital, whereas intangible capital inputs are measured by R&D expenditures. According to the literature, the entry and exit of firms does not significantly affect total employment since both entrants and firms exiting the industry have below average size. We therefore expect a limited impact of firm entry and exit on the labour input. The effects of entry on firms' incentives to innovate and therefore on R&D expenditures depends on the position of the firm compared to the technology frontier (Aghion et al., 2003). Finally, the entry and exit of firms has an impact on both the level and the growth rate of total factor productivity (see Table 2 in Section 2.4).

Different aspects of macroeconomic performance are measured. Formally, the equilibrium output at the country or industry level is given by:

$$Y_{ijt} = f\left(L_{ijt}, C_{ijt}, K_{ijt}, TFP_{ijt}\right) \tag{2}$$

where L, C and K represent labour, physical capital and intangible capital inputs and
TFP measures total factor productivity growth.

The entry rate is assumed to affect the growth rate of output through the growth rate of input demand and the growth rate of productivity:

$$\begin{aligned}
\Delta \ln L_{ijt} &= \beta_1^L LER_{ijt} + \beta_2^L LER_{ijt-1} + \beta_3^L LER_{ijt-2} + \lambda_t + \mu_i + \mu_j + u_{ijt}^L \\
\Delta \ln I_{ijt} &= \beta_1^I LER_{ijt} + \beta_2^I LER_{ijt-1} + \beta_3^I LER_{ijt-2} + \lambda_t + \mu_i + \mu_j + u_{ijt}^I \\
\Delta \ln R_{ijt} &= \beta_1^R LER_{ijt} + \beta_2^R LER_{ijt-1} + \beta_3^R LER_{ijt-2} + \lambda_t + \mu_i + \mu_j + u_{ijt}^R \\
\Delta \ln TFP_{ijt} &= \beta_1^{TFP} LER_{ijt} + \beta_2^{TFP} LER_{ijt-1} + \beta_3^{TFP} LER_{ijt-2} + \lambda_t + \mu_i + \mu_j + u_{ijt}^{TFP}
\end{aligned} \tag{3}$$

where I = Gross Fixed Capital Formation and
R = R&D expenditures

In addition, we also estimate equations (3) with the exit rate and the turnover rate as dependent variables (and their one and two period lagged values as explanatory variables). Given data availability constraints, we use labour productivity rather than total factor productivity. As an alternative to the growth rates of labour productivity, physical investment and R&D expenditures, we also consider the impact of entry on the level of labour productivity, fixed capital intensity and R&D intensity.

[54] Time invariant indicators cannot be included since they would be exactly correlated with the country and industry specific effects. However, these fixed effects control for them.

4.4. Estimation issues

a) Estimation of aggregate variables on micro units

A first issue encountered in the regression analysis concerns some product market reforms. The Fraser Institute indicators are only available at the aggregate macro level that raises estimation issues when we estimate the entry and exit rates, which vary at the sector, country and industry level, on these indicators that only vary across countries and time, but not across sectors. Brandt (2004) cites Moulton (1990) who showed that when estimating the effects of aggregate variables on micro units, the standard errors resulting from these estimations can have a strong downward bias because they are usually correlated among the observations within a given group. This can lead us to conclude that the aggregate variables have a significant impact on the micro unit variables, when in fact this is not the case. According to Brandt (2004), one way to address this issue is by eliminating the time and industry dimensions by averaging the variables across time and sectors. Another way is to conduct a two-step estimation where in the first equation the individual specific observations are regressed on the adequate covariates and on time and industry dummies. The residuals resulting from the first equation that would then only capture country specific effects are regressed on the country level variables. The problem with this estimation method is that it has a low explanatory power, which can lead us to conclude that the impact of a variable is insignificant when in reality it is.

b) Short term versus long-term effects

In order to address this issue, we estimated a fixed effect model on the average values of variables over the time period investigated[55]. This method allows us to capture also both the short term and the long-term effects of product market regulations on firm entry and exit and of the latter variables on macroeconomic performance[56]. In order to capture the long-term effects we assumed that in the long term, the variables converge towards their steady state and we eliminated the time dimension of the variables by averaging them over the period under consideration. The short-term effects will be captured by incorporating the time dimension of the variables. We then conducted a fixed effects panel data estimation in which we considered the fixed effects at the sector level. In the first estimation, we imposed the same coefficients across all sectors, whereas in the second part of the estimation we allowed the coefficients associated with the regulation indicators to vary across sectors. In a different specification, we allowed the coefficients associated with the regulation indicators to vary across countries.

c) Multicollinearity of product market reform variables

Another estimation issue encountered when we included the different regulation indicators was the presence of multicollinearity. To address this issue, we conducted a principal components analysis in which we first included all the Fraser regulation indicators. We took the principal component from the analysis that constitutes the REG1 variable[57]. We conducted

[55] This eliminates the time dimension as well as the individual (industry) fixed effects.

[56] Averaging the variables over time also allows us to compare the results with the ones based on the intra- and extrapolated PMR indicators (full sample).

[57] The first factor represents 64% of the initial variance (see Table A.17 in Appendix 3). In practice, the number of factors to be retained is such that the cumulative percentage of the variance explained by the first factors is about 70%. We tried to include the second (and third) factors in the regression models but these variables turned out to be insignificant at the 10% level.

a second principal components analysis in which apart from all the Fraser regulation indicators we also included the restrictions on the FDI indicator taken from the UN Trade Analysis Information System. The principal component from this second analysis constitutes the REG1* variable.

d) Endogeneity between entry-exit rates and economic outcomes

Finally, in order to control for the possible endogeneity of the entry (and exit) rate variables, we also estimated an instrumental two stage least square estimator with an appropriate set of instruments for the entry and exit variables[58]. Among the instruments available, we can choose the product market regulations indicators identified in the first equation. However, since these indicators do not vary across industry sectors, they turned out to have a weak explanatory power in instrumenting the entry and exit rates that do vary across industry sectors. Therefore, we used as additional instruments the current, one period and two period lagged values of the following variables: the number of active, entering and exiting firms, the Fraser product market regulation indicators as well as the restrictions on FDI. The explanatory power of these instruments can be tested with the partial R-squared proposed by Shea (1997) performed in the first stage regression and which takes the intercorrelations among instruments into account. Furthermore, the validity of the instruments can be tested through Sargan-Hansen tests of overidentifying restrictions[59]. This test allows us also to validate the assumption that product market reforms do not directly affect macroeconomic outcomes, i.e. that they can be excluded from equation (3)[60].

[58] The presence of common shocks may for instance positively affect both the output growth and the entry rate which will in turn exhibit similar responses to these shocks. If these effects are not accounted for, the estimation of equation (3) can lead to a (upward) biased or spurious estimated coefficient of the entry rate.
[59] Sargan (1958) and Hansen (1982). The joint null hypothesis is that the instruments are valid instruments, i.e., uncorrelated with the error term, and that they are correctly excluded from equation (3).
[60] If this assumption is rejected, then the entry-exit estimates are biased.

5. Empirical findings

This section presents the main findings regarding the relationship between the market structure and deregulation variables on firm entry and exit. We then analyse the effect of current and lagged firm entry and exit on a series of macroeconomic performance variables such as output growth, labour productivity growth, employment growth, physical capital investment and R&D investment growth and capital and R&D intensity[61].

5.1. Impact of product market reforms on entry and exit

In the first part of the estimation, we are interested in the relationship between the entry and exit rates respectively and a series of variables that characterise market structure, some of which can also constitute barriers to entry, as well as on variables capturing market regulations. The latter are taken from the Fraser Institute and the UN Trade Analysis Information System (TRAINS). These indicators are scaled from 1 to 10 with 10 representing total freedom and 1 representing total restrictions.

Besides these product market reforms, we also took the log of the capital intensity, R&D intensity, market concentration and economies of scale variables. These variables are assumed to pick up the importance of barriers to entry (and to exit). We also estimated regressions in which we introduced each regulation indicator separately in order to obtain its individual impact on firm entry and exit.

a) Long-term effects

We first comment on the results when we impose the same coefficients across all sectors and eliminate the time dimension by averaging the variables across time, giving us the average long-term effects of the impact of product market regulations on firm entry and exit. (Table 4).

The F-test rejects the hypothesis of a common intercept for all sectors at the 5% confidence level for all the specifications. The Hausmann test does not reject the null hypothesis that the fixed effects model is more appropriate than the random effects model at the 5% confidence level.

In the entry rate equation, we first estimate alternative specifications in which we used the REG1 and REG1* variables. The results are very similar in that the coefficients associated with these variables are positive and statistically significant at the 5% confidence level meaning that an increase in deregulation leads to an increase in the firm entry rate. The coefficient associated with the R&D intensity variable is negative and statistically significant at the 5% confidence level indicating that a 1% increase in R&D intensity leads to a 0.11% decrease in the entry rate, providing evidence that R&D intensity acts as a low barrier to entry. The coefficient associated with the capital intensity variable in these two alternative

[61] Due to data constraints, all the estimations are performed without The Netherlands and the Post and Telecommunication sector. No data on R&D intensity are available for Portugal and Ireland and on production for Ireland. The time period is 1997-2002.

Table 4. Impact of PMR and entry barriers on entry and exit rates (over time 'averaged' sample)

Variable	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
ENTRY RATE												
LCAP	-0.20**	-1.76	-0.20**	-1.75	-0.24**	-2.07	-0.13	-0.72	-0.03	-0.14	-0.13	-0.63
LRD	-0.11*	-3.01	-0.11*	-3.00	-0.02	-0.49	0.07	1.49	-0.02	-0.72	0.05	1.41
REG1	0.14*	4.30			0.12*	3.79	0.10**	2.30	0.12*	2.84	0.09**	2.15
REG1*			0.14*	4.28								
Lconc					0.19*	2.82						
Lscal							-0.25	-0.01				
Difer									0.34*	2.77		
Segme											0.04	0.31
R^2a	0.31		0.31		0.25		0.10		0.15		0.09	
F-statistic	F(29,96) = 3.5		F(29,96) = 3.5		F(4,73)=7.23		F(4,73)=3.12		F(4,80)=4.69		F(4,74)=3.02	
Hausman-test	$\chi^2(2) = 19.7$*		$\chi^2(2) = 19.8$*		$\chi^2(2) = 9.5$*		$\chi^2(2) = 11.6$*		$\chi^2(2) = 13.1$*		$\chi^2(2) = 12.7$*	
Nob	128		128		77		77		84		78	
EXIT RATE												
LCAP	0.18	1.08	0.19	1.11	0.05	0.57	0.19	1.21	0.23	1.38	0.15	0.85
LRD	-0.13**	-2.19	-0.13**	-2.20	-0.01	-0.38	0.05	1.35	0.00	0.04	0.05***	1.67
REG1	0.20*	4.36			0.12*	3.21	0.12*	2.81	0.13*	3.10	0.11*	2.65
REG1*			0.21*	4.26								
Lconc					0.20**	2.33						
Lscal							0.00	0.05				
Difer									0.25***	1.94		
Segme											0.04	0.35
R^2a	0.20		0.20		0.18		0.13		0.16		0.12	
F-statistic	F(29, 96) = 2.4		F(29, 96) = 2.4		F(4, 73) = 5.09		F(4, 73) = 3.81		F(4, 80) = 4.88		F(4, 74) = 3.80	
Hausman-test	$\chi^2(2) = 14.2$*		$\chi^2(2) = 13.6$*		$\chi^2(2) = 3.9$*		$\chi^2(2) = 4.9$*		$\chi^2(2) = 2.9$*		$\chi^2(2) = 6.9$*	
Nob	128		128		77		77		84		78	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level ; Nob = number of observations; R^2a = adjusted R-squared.

estimations is negative, but only significant at the 10% confidence level and indicating that a 1% increase in capital intensity will lead to a 0.20% decrease in the firm entry rate. Finally, the regression models succeed in explaining 31% of the variation in the entry rate.

Given that the estimations using the REG1 and REG1* variables render similar results, in the remaining estimations where we introduce market structure variables we only concentrate on the REG1 variable. The introduction of the market structure variables leads to a significant loss in observations which drop from 128 in the first two specifications to a minimum of 77 in the alternative specifications. The coefficient associated with the REG1 variable is always positive and significant at the 5% confidence level showing that the positive impact of deregulation on firm entry is robust to alternative specifications.

When we introduce the market structure variables into the regression the coefficient associated with the R&D intensity variable becomes insignificant, whereas the coefficient associated with the capital intensity variable is negative and statistically significant at the 5% confidence level when the market concentration variable is introduced into the regression, but becomes statistically insignificant when the other market concentration variables are introduced.

The market concentration coefficient is positive and significant at the 5% confidence level meaning that highly concentrated industries at the beginning of the period will have higher entry rates than industries with lower concentration. This can be due to the fact that in strongly concentrated industries profits are high which attracts new firms. The coefficient associated with product differentiation is also positive and statistically significant at the 5% confidence level showing that entry rates are higher in industries characterised by high product differentiation at the beginning of the estimation period. On the contrary, the segmentation and scale economies variables do not have a statistically significant impact on the entry rate. One possible explanation for the insignificance of the coefficient associated with the scale economies variable is that the latter is introduced simultaneously with the capital intensity variable that can be considered as an alternative way of measuring the presence of scale economies given that they are generally important in highly capital-intensive industries. However, the correlation matrix (Table A.12 in Appendix 2) shows a very small correlation coefficient between capital intensity and the variable measuring economies of scale, of just 0.025, which is also statistically not significant.

We also checked the correlation matrix to search for an explanation as to why the impact of the R&D intensity variable becomes insignificant once variables controlling for market structure are introduced into the regressions. However, there is only a low negative correlation between R&D intensity and the scale economies variable, of 0.15, which is statistically significant at the 1% confidence level, and a small positive correlation of 0.06 between R&D intensity and product differentiation, which is significant at the 5% confidence level. The correlation between R&D intensity and the other market structure variables is low and statistically not significant. Another explanation for the fact that R&D intensity becomes insignificant can be the large drop in observations when we introduce the market structure variables mainly because there is no data on these variables for the services sectors. The fact that we obtain a significant coefficient associated with R&D intensity in the initial estimation which becomes insignificant once we introduce the market structure variables only available for manufacturing, can also be explained by the fact that R&D intensity may be a more important barrier to entry in services sectors than in manufacturing due to particular industries such as real estate, renting and business activities. The explanatory power of the regression

model when the market structure variables are introduced decreases by 9% to 25% of the variation of the entry rate compared to the first two specifications.

We follow the same method when estimating the exit rate equation, first providing alternative specifications using the REG1 and REG1* variables to control for product market regulations. The results are similar with the coefficients associated with both variables being positive and statistically significant at the 5% confidence level, indicating that an increase in deregulation leads to an increase in the firm exit rate. The result is in line with expectations since an increase in deregulation involves a decrease in the level of protection previously enjoyed by firms in the market from outside competition, forcing the least productive of these firms to exit the market sooner than when regulation on the market was tighter. The capital intensity variable does not have a significant impact on the exit rate, whereas the coefficient associated with the R&D intensity variable is negative and significant at the 5% confidence level. The magnitude of the impact however is relatively small, with a 1% increase in R&D intensity leading to a 0.13% decrease in the exit rate. The negative impact of R&D intensity on firm exit can be due to the fact that firms in highly research intensive sectors are themselves very dynamic and innovative and therefore the number of firms that are forced to shut down operations and leave the market is lower compared to sectors where research intensity is low[62]. These two alternative specifications succeed in explaining 20% of the variation in the exit rate. Given the similarity of the results obtained using these alternative specifications we only use the REG1 variable in the other regression models. As before, the introduction of the market structure variables leads to a significant loss in observations.

The coefficient associated with the REG1 variable is always positive and significant at the 5% confidence level providing robust evidence that an increase in deregulation leads to an increase in firm exit. The coefficient associated with the capital intensity variable is always insignificant, while the impact of the R&D intensity variable becomes insignificant. Among the market structure variables, market concentration has a positive impact on firm exit, which is significant at the 5% confidence level meaning that sectors with high concentration at the beginning of the period will have higher firm exit rates than the sectors with low market concentration. The coefficient associated with the product differentiation variable is also positive and significant at the 10% confidence level indicating that industries with increased product differentiation at the beginning of the period will also face higher firm exit rates than industries characterised by a low degree of product differentiation. The presence of economies of scale and market segmentation does not have a significant impact on firm exit. The explanatory power of these regression models varies between 12% and 18% of the variation in the exit rate and is lower than the one of the first two specifications, which can be explained by the lower number of observations.

When we allow the coefficient to vary across sectors (Table A.18 in Appendix 3), we observe that both the capital intensity and R&D intensity variables have a negative impact on firm entry rates which is significant at the 5% confidence level. The magnitude of the effect is higher for capital intensity compared with R&D intensity, with a 1% increase in capital intensity leading to a 0.42% decrease in the entry rate and a 1% increase in R&D intensity leading to a 0.15% decrease in the entry rate. Among the various sectors, an increase in deregulation has a positive impact on the firm entry rate that is significant at the 5% confidence level in the following sectors: tobacco products, coke and refined petroleum products, chemicals and chemical products, basic metals, electrical machinery and apparatus,

[62] In addition, R&D projects typically involve large fixed costs that can represent an important barrier to exit.

motor vehicles and trailers, other transport equipment, furniture and manufacturing n.e.c. The impact of an increase in deregulation on entry in the electricity, gas and water supply sector is also positive, but only significant at the 10% confidence level. We also found that an increase in deregulation has a negative impact on firm entry that is significant at the 5% confidence level in the food products and beverages and the office machinery and computers sectors. The effect of deregulation on firm entry in the other sectors is statistically insignificant. The model explains 26% of the variation in the firm entry rate.

When we allow the coefficient to vary across sectors in the exit rate equation, the effect of R&D intensity on firm exit remains negative and significant at the 5% confidence level, with a 1% increase in R&D intensity leading to a 0.17% decrease in firm exit. The capital intensity variable does not have a significant effect on firm exit. Among the different sectors, an increase in deregulation has a positive and significant effect at the 5% confidence level on exit rates in the following industries: food and beverages, tobacco products, textiles, wood and products of wood, coke and refined petroleum products, other non-metallic and mineral products, machinery and equipment n.e.c., medical, precision and optical instruments, construction and transport and storage. The effect of deregulation on the other sectors under consideration is insignificant. The specification explains 22% of the variation in the firm exit rate.

We also considered the interaction terms between product market regulations and country effects (see Table A.19 in Appendix 3). An increase in the level of deregulation will lead to a positive and significant rise in the firm entry and exit rates in Belgium, France and Italy. For Germany and Spain, the results are counter-intuitive in that an increase in the level of deregulation leads to a statistically significant decrease in the entry and exit rates in Germany, whereas for Spain an increase in deregulation leads to a significant decrease in the exit rate, apart from the increase in the entry rate. These last results should be taken with caution since they are not confirmed by the estimates based on the full sample (i.e. the model without interacted country effects). In the latter sample, an increase in the level of deregulation does not have a significant effect on the entry and exit rates for Germany, whereas more deregulation has a significantly positive effect on the exit rate for Spain. The results showing that deregulation leads to lower entry and/or exit for Germany and Spain are counterintuitive at first sight but could be explained by the fact that in the short-run companies may have difficulties to adapt to the new environment, leading to low rates of entry and high rates of exit. With time, as firms adapt to the new environment, new firms start entering the market and the number of companies that exit the market decreases. Product market reforms aimed at increasing deregulation do not have a significant impact in the long term on firm entry and exit for the other countries in the sample. The regression models explain 28% of the variation in the entry rate and 27% of the variation in the exit rate.

b) Short-term effects

In Table 5, we report the results of the entry and exit rates equations estimated based on the full sample including the time dimension, therefore giving us the short-term effects. The time dimension of the sample allows introducing the entry rate lagged by one year as an independent variable both in the entry and exit rate regressions. We run two alternative regressions in which we include the REG1 variable or the restrictions to FDI variable provided by UN TRAINS.

Table 5. Impact of PMR and entry barriers on entry and exit rates (full sample)

Variable	Coefficient	t-statistic	Coefficient	t-statistic
ENTRY RATE				
ER_t-1	0.83*	16.06	0.82*	15.30
LCAP	0.04	1.22	0.03	0.86
LRD	0.01	1.42	0.01***	1.67
REG1	0.04*	3.31	0.04*	3.34
RESFDI			-0.01	-1.16
R^2a	0.66		0.66	
F-statistic	F(30,378) = 7.5		F(29,377) = 7.5	
Hausman-test	$\chi^2(4) = 0.4$		$\chi^2(4) = 7.1$	
Nob	427		427	
EXIT RATE				
ER_t-1	0.48*	7.82	0.48*	7.80
LCAP	-0.09**	-1.99	-0.08**	-1.92
LRD	0.01	0.70	0.01	0.68
REG1	0.12*	5.44	0.12*	5.43
RESFDI			0.00	0.12
R^2a	0.29		0.28	
F-statistic	F(30,378) = 3.2		F(29,377) = 3.2	
Hausman-test	$\chi^2(5) = 4.5$		$\chi^2(5) = 7.1$	
Nob	427		427	

Notes: Heteroskedastic-consistent standard errors;
* (**, ***) significant at the 1% (resp. 5%, 10%) level;
Nob = number of observations; R^2a = adjusted R-squared.

The results for the entry rate equation show that the entry rate lagged by one year has a positive effect on the current entry rate that is significant at the 5% confidence level. This seems to confirm the findings of Geroski (1995) according to which firm entry and exit tends to come in waves with periods in which there is a lot of firm entry and exit and periods where firm entry and exit decreases. According to the results, if there is a 1% increase in the firm entry rate in the previous year, it will lead to a current entry rate higher by 0.82% to 0.83%. The capital intensity and R&D intensity variables do not have a significant impact on firm entry, whereas the coefficient associated with the REG1 variable is positive and statistically significant at the 5% confidence level. This confirms the fact that an increase in deregulation will lead to an increase in the firm entry rate. On the contrary, the restrictions to FDI variable do not have a significant impact on firm entry. The models explain 66% of the variation in the firm entry rate.

The results for the exit rate equation again show a positive and statistically significant at the 5% confidence level relationship between the entry rate lagged by one year and the firm exit rate, with a 1% increase in the previous year's entry rate leading to a 0.48% increase in the current exit rate. This result suggests that many firms that enter the industry exit after only one year, which confirms the low entrant survival rate, found in the literature. The capital intensity variable has a negative and significant impact at the 10% confidence level on firm exit. The magnitude of the effect however is small, with a 1% increase in capital intensity leading to a decrease in firm exit by only 0.08% to 0.09%. This provides some evidence that capital intensity also constitutes a barrier to exit with possible explanations being that sectors with high capital intensity provide a de facto protection for firms operating in the market and insulate incumbent firms from competition by new entrants. A second argument is that sectors

with high capital intensity also have a high fixed cost of entry that limits entry to firms that are highly confident in their capacity to develop successfully their business once they enter the market. The number of firms that ultimately fail is therefore smaller compared to industries with low capital intensity because there is a self-selection process before firms enter the market. Finally, a third explanation is that firms in highly capital-intensive sectors also tend to use very specific capital that cannot be sold if the firm decides to exit the market. This constitutes a sunk exit cost that can discourage a number of firms from exiting the market. The R&D intensity variable does not have a significant impact on firm exit. The coefficient associated with the REG1 variable is positive and statistically significant at the 5% confidence level, which confirms that an increase in deregulation leads to a rise in the firm exit rate. The restrictions to FDI variable do not have a significant effect on firm exit. The exit rate models only explain 28% to 29% of the variation in the exit rate compared with 66 % in the entry rate models.

When we allow the coefficients to vary across sectors (see Table A.20 in Appendix 3), the entry rate lagged by one year continues to have a positive and significant at the 5% level impact on firm entry, with a 1% increase in the entry rate in the previous year leading to a 0.86% increase in the current entry rate. The capital and R&D intensity variables have an insignificant impact on the entry rate. An increase in deregulation has a positive and significant at the 5% level impact in the following sectors: pulp, paper and paper products, publishing and printing, other non-metallic and mineral products, basic metals, other transport equipment and transport and storage. Deregulation has a negative and significant impact at the 5% level on firm entry in tobacco products and a negative and significant at the 10% level on firm entry in the wholesale and retail trade and repairs sector.

When we allow the coefficients to vary in the exit rate equation, the lagged entry rate continues to have a positive and significant at the 5% level impact on firm exit, with a 1% increase in the prior year's entry rate leading to a 0.44% rise in the current exit rate. The coefficient associated with the capital intensity variable is negative and significant at the 5% confidence level, with a 1% increase in capital intensity leading to a 0.10% decrease in the exit rate. The R&D intensity variable continues to have an insignificant impact on firm exit. The effect of deregulation on firm exit differs from one sector to another, with the coefficient being positive and significant at the 5% level in the following industries: wood and products of wood, coke and refined petroleum products, rubber and plastic products, machinery and equipment n.e.c., electricity, gas and water supply and real estate, renting and business activities. In the fabricated metal products and construction sectors, the impact of deregulation on firm exit is positive and significant at the 10% confidence level. However, in the tobacco products and in transport and storage sectors, an increase in deregulation leads to a decrease in the firm exit rate, a result that is significant at the 5% confidence level in both cases. The model explains 28% of the variation in the exit rate.

Table A.21 in Appendix 3 presents the estimates regarding the interaction terms between product market regulations and country effects. An increase in the level of deregulation will lead to a decrease in the firm entry rate in Belgium and Spain, which is statistically significant. An explanation for this result may be that some sectors in the economy (notably services sectors) were initially heavily protected against foreign competition. Opening these sectors up to competition may discourage national firms from entering the market since they no longer benefit from the high level of protection that they had before. For these countries, we do find that an increase in deregulation will lead to an increase in the firm exit rate. For France we found that an increase in the level of deregulation would lead to a decrease in the

firm exit rate, however the result is only significant at the 10% confidence level. On the contrary, an increase in deregulation does not have a significant effect on firm entry. We also found that higher deregulation would have a positive and significant impact on firm entry in Italy, whereas the effect on firm exit is insignificant. For the UK, a rise in the level of deregulation will lead to a significant increase in both firm entry and exit. For the other countries, the impact of product market deregulation reforms is insignificant on both firm entry and exit in the short term. The regression model for the entry rate equation explains 68% of the variation in the entry rate, whereas the exit rate model explains only 27% of the variation in the exit rate.

We also introduced the product market regulators separately into the regressions and estimated their individual impact on firm entry and exit in the short term (full sample) (See Table A.22 in Appendix 3). The separate estimations were conducted for the following regulation indicators: transfers and subsidies as a share of GDP, mean tariff rate, hidden import barriers, price controls, time with government bureaucracy, the ease of starting a new business, regulatory quality indicator and the indicator for restrictions on FDI. We obtained counter intuitive results for the transfers and subsides as a share of GDP and mean tariff rate indicators in that a decrease in the transfers and subsidies as a share of GDP and mean tariff rate indicators leads to a significant decrease in the firm entry rate. A decrease in the transfers and subsidies as a share of GDP ratio does indeed lead to a significant increase in the firm exit rate. The results show that a decrease in the time spent with government bureaucracy or in the restrictions on FDI does not have a statistically significant impact on the firm entry and exit rates. We obtained the expected results for the other regulation indicators, namely that a decrease in hidden import barriers and price controls as well as better regulatory quality and a rise in the ease of starting a new business have a positive impact on the firm entry and exit rates that is also statistically significant.

c) Summary of findings

In conclusion, there is some evidence that capital intensity constitutes a barrier to entry and exit, as does R&D intensity, even though both of these barriers are relatively low. The entry rate lagged by one year has a positive effect on both the current entry and exit rates that can be interpreted as a confirmation of the wave theory and of the low survival rate of new entrants. The results on the market structure variables show that high levels of concentration and product differentiation at the beginning of the period lead to high firm entry and exit rates or high firm turbulence, a result that is line with Veugelers (2004) who documented considerable turbulence in market leadership in EU manufacturing industries[63].

An increase in deregulation leads on average to an increase in both firm entry and exit, a finding that is robust to alternative equation specifications and estimation methods. However, when we study specific sectors, the impact of an increase in deregulation on entry and exit varies from one industry to another. Generally, the effect of deregulation is positive and significant mainly in manufacturing sectors and only in a very limited number of services sectors. There are also a very small number of sectors where deregulation has a negative effect on firm entry and exit. Finally, there are sectors in which deregulation does not have a

[63] Firms' turnover in industries characterised by initial high diversification can be expected to be important when the competitive pressure becomes tougher (as a result of PMRs) since firms have to re-allocate their resources to their most efficient activities to ensure survival. In a same vein, the toughening of competition can be expected, through reduced prices and increased efficiency, to induce higher entry and exit activities in industry sectors characterised by high initial market concentration (Smith and Venables, 1988).

significant effect on entry, but it does have a positive and significant effect on firm exit. The latter tend to be mainly more traditional manufacturing sectors, the implications in policy terms being that while in general an increase in deregulation seems desirable since it leads to a more efficient reallocation of resources within industries through higher firm entry and exit, attention should be given to the fact that there are more traditional manufacturing sectors where deregulation does not significantly affect firm entry, but it does have a significant impact on firm exit, which could exacerbate existing problems within these sectors.

The study of specific countries also shows different effects of higher deregulation on firm entry and exit both in the short and in the long run. In the short run, an increase in deregulation will decrease firm entry in Belgium and Spain and will decrease firm exit in France. The entry of firms into the market will increase in Italy and the UK with higher deregulation, whereas firm exit will increase in Belgium, Spain and the UK. The short-term effects of a rise in deregulation are insignificant for the other countries in the sample.

In the long term, higher deregulation will lead to more firm entry and exit in Belgium, France and Italy. The firm entry rate will increase in Spain, but the firm exit rate will decrease. An increase in deregulation will lead to lower firm entry and exit in Germany, whereas the impact will be insignificant for the other countries in the sample.

Among the individual regulation indicators, we found that a decrease in price controls and hidden import barriers, as well as an increase in regulatory quality and the ease of starting a new business have positive and significant effects on firm entry and exit. A decrease in transfers and subsidies as a share of GDP and in the mean tariff rate has a negative effect on firm entry, results that are contrary to expectations. Finally, we did not find a significant impact of a reduction in the time spent with government bureaucracy or of the restrictions on FDI on the entry and exit rates.

5.2. Impact of entry and exit on economic performance

In the second part of the estimation exercise, we analysed the impact of the entry and exit rates on economic performance as measured by the growth in output, the growth in labour productivity, the growth in employment, the growth in physical capital investment, the growth in R&D investment, capital intensity and R&D intensity. Estimations were done separately for the entry and exit rates. Estimations based on the turbulence rate, i.e. entry plus exit rates on twice the number of active firms, were also investigated. However, the results turned out to be insignificant in most cases, which suggests that since entry and exit depend on different variables, mixing both might be misleading.

In the entry rate equation, we first introduced separately the current entry rate, the entry rate lagged by one year and the entry rate lagged by two years. We then introduce the three entry rates together with and without controlling for industry, country and year specific effects. We proceed in a similar manner for the exit rate equation. We introduce current and lagged entry and exit rates in order to analyse the timing of the impact of firm entry and exit on the economic performance variables. When we add interaction terms between entry, exit, industry and country dummies, this allows us to examine the sectors and countries for which the relationship between entry, exit and economic performance is contemporaneous and the ones for which the relationship is lagged.

The results based on the sample where we eliminated the time dimension by averaging the variables across time (giving us the average long terms effects of the impact of firm entry and exit on economic performance) turned out to be insignificant in most cases[64]. This finding leads one to the conclusion that entry and exit may have effects that appear with different lags and may partly cancel out in the long run.

By introducing country, industry and year specific effects, we can control for endogeneity issues since we can have a common shock that simultaneously affects firm entry, exit and economic performance. Without controlling for these issues, we can conclude that firm entry or exit has a significant impact on economic performance when in fact both variables are influenced by a common economic shock. Because of this reason, we will concentrate our analysis on the regression where we introduce the current and lagged entry (and exit) rates simultaneously and control for individual specific effects[65].

Controlling for individual specific effects is likely to slightly change the results of the regressions since part of the variations in entry and exit rates are specific to certain sectors, variables rather than to the 'actual' effect of the variable in question. Comparing the results of the two types of specifications (with and without controlling for individual specific effects) is useful since it provides a robustness test for the different explanatory variables. If the impact of a given explanatory variable continues to be significant even after controlling for individual specific effects then we can conclude with some certainty that the variation in the variable in question does have a significant effect on the dependent variable. If however the impact of an explanatory variable becomes insignificant when we control for individual specific effects, then we cannot say with certainty whether the variable in question was capturing part of the individual specific variations or whether the introduction of individual specific effects is capturing part of the variation due to firm entry or exit.

Our favourite results for the impact of firm entry on output growth are reported in column (2) of Table 6[66]. We observe a positive effect of an increase in the current firm entry rate, which is significant at the 10% confidence level, with a 1% increase in the current entry rate leading to an increase by 2.10% in output growth. The relationship between the current entry rate and output growth is robust to alternative specifications. We do not find a significant relationship between firm entry lagged by one and two years respectively and output growth. The model explains 29% of the variation in output growth. The estimations performed by 2SLS show a positive impact of current entry and a negative impact, albeit only significant at the 10% level, of the one period lagged entry rate on output growth. This negative coefficient can be explained by the low survival rate of entrants after one year following the entry in the market or by the fact that entrants do not have an important size at the beginning of their economic activity and therefore a significant impact on output growth one year later. The results for the exit rate do not change.

[64] We found a significant (at the 10% level) negative impact of entry only on the physical capital intensity and the R&D intensity variable, indicating that firms that enter a market have a lower than average intensity with respect to these capital variables.

[65] In order to control more explicitly for the potential endogeneity of the entry and exit rates, we also estimate an instrumental two-stage least square (2SLS) regression whose results are reported in Column (5*) of the Tables reporting the full results in Appendix 3. Table A.32 in Appendix 3 details the explanatory power of the chosen set of instruments. It follows that these variables explain between 94% and 98% of the instrumented variables. The Sargan-Hansen test of overidentifying restrictions clearly does not reject the null hypothesis that the instruments are not correlated with the error term and are correctly excluded from the estimated equation.

[66] Full results are reported in Table A.23 in Appendix 3.

We find that the exit rate lagged by one year has a negative impact on output growth, which is significant at the 10% confidence level, with a 1% increase in firm exit one year ago, leading to a decrease in output growth by 0.86%. The lagged relationship between firm exit and output growth is robust to alternative specifications. We do not find a significant relationship between current firm exit and output growth, nor between the twice-lagged firm exit rate and output growth. There are two possible explanations for the fact that we find a significant relationship between the once lagged exit rate and output growth, but an insignificant contemporaneous relationship between firm exit and output growth. A first explanation is that firms exit the market in different months of the year and some of the impact from firm exit will be felt mostly on next year's output growth instead of this year's growth. Another possible explanation is that firms file their accounting books during the year rather than at the beginning or at the end of the year, whereas output growth is measured from the end of one year to the end of the next year. The exit rate regression explains 16% of the variation in output growth.

In a second step, we allow the coefficient of the contemporaneous entry rate and the exit rate lagged by one year to vary across different sectors so that we can have a clearer view about the sector specific impact. From the results reported in Table A.24 in Appendix 3, we conclude on a positive effect of an increase in firm entry on output growth in the following sectors: coke and refined petroleum products, radio, TV and communication, wholesale and retail trade and repairs, transport and storage, real estate, renting and business activities. An increase in the entry rate by 1% in the coke and refined petroleum products sector increases the output growth rate by 4.44%. A rise in the entry rate by 1% in the other sectors leads to an increase in output growth of between 1.34% and 1.88%. We also find a positive impact of an increase in firm entry and output growth which is significant at the 5% confidence level in the following sectors: wood and products of wood, pulp, paper and paper products, chemicals and chemical products, other non-metallic and mineral products, office machinery and computers, other transport equipment, furniture and manufacturing n.e.c. and construction. A 1% increase in firm entry leads to an increase in output growth by 1.16% to 2.74%. Finally, there is also a positive relationship that is significant at the 10% confidence level in the following sectors: publishing and printing, medical, precision and optical instruments, motor vehicles and trailers, electricity, gas and water supply. A 1% increase in firm entry in these sectors leads to an increase in output growth of between 1.02% to 1.08%. The impact of firm entry on output growth is not significant for the other sectors under consideration. The explanatory power of the model increases to 35% of the variation in output growth.

In the exit rate equation, we find a negative impact of the once lagged exit rate on output growth that is significant at the 1% confidence level in the following industries: textiles, wearing apparel, dressing and dyeing, tanning and dressing of leather, basic metals, office machinery and computers. An increase in the exit rate during the prior year leads to a decrease in current output growth of between 0.93% to 2.83%. The relationship between the once lagged exit rate and output growth is negative and significant at the 5% confidence level in the following sectors: rubber and plastic products and fabricated metal products, with a 1% increase in the once lagged exit rate leading to a decrease in output growth of between 1.28% to 1.37%. Finally, there is also a negative impact of the lagged exit rate on output growth that is significant at the 10% confidence level in the following sectors: machinery and equipment n.e.c. and construction, with a 1% increase in the once lagged exit rate leading to a decrease in output growth of between 0.66% to 1.30%. The relationship between the once lagged exit rate and output growth in the other sectors is not significant. The model explains 13% of the variation in output growth.

Table 6. Impact of entry-exit on economic performance

Dependent variable												
	Δlny_t		Δlnlp_t		Δlnl_t		Δlni_t		Δlnr_t		capint_t		rdint_t	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
ENTRY RATE														
C	-0.01	-0.48	-0.01	-0.34	0.00	0.08	-0.10	-1.49	0.06	0.80	5.09*	6.95	0.29	1.23
ER_t	2.10***	1.86	0.60***	1.70	2.67**	2.01	0.48	0.56	3.06**	2.30	4.67	0.52	-6.25	-1.32
ER_t-1	-1.24	-1.50	-0.30	-0.96	-2.20**	-2.10	-0.18	-0.12	-2.83**	-2.24	-6.08	-0.53	1.98	0.35
ER_t-2	-0.31	-1.22	0.14	0.69	-0.29	-1.09	-0.04	-0.08	1.60***	1.95	-4.97	-0.91	-2.46	-0.92
Industry	X				X		X		X		X		X	
Country	X				X		X		X		X		X	
Year	X				X		X		X		X		X	
R^2a	0.29				0.43		0.06		0.01		0.81		0.74	
F-statistic	F(38, 443) = 4.81*				F(38, 425) = 5.52*		F(37, 383) = 2.47*		F(36, 387) = 1.03		F(37, 359) = 40.48*		F(36, 336) = 18.89*	
Nob	482				464		421		424		397		373	
EXIT RATE														
C	0.01	0.38	0.00	0.27	0.01	0.21	-0.08	-0.91	0.13**	2.36	5.51*	10.23	0.13**	2.36
XR_t	0.17	0.39	0.16	0.59	-0.45	-0.92	-0.35	-0.49	-0.98	-1.09	-13.62**	-2.33	-0.98	-1.09
XR_t-1	-0.86***	-1.87	-0.36	-1.02	-0.43	-0.81	-2.16	-1.28	1.22	0.89	-9.77	-1.20	1.22	0.89
XR_t-2	-0.40	-1.07	0.68**	2.10	-0.71	-1.43	1.95	0.79	0.68	0.47	-3.69	-0.36	0.68	0.47
Industry	X				X		X		X		X		X	
Country	X				X		X		X		X		X	
Year	X				X		X		X		X		X	
R^2a	0.16				0.13		0.08		0.00		0.81		0.74	
F-statistic	F(38, 443) = 5.27*				F(38, 425) = 8.49*		F(37, 383) = 2.40*		F(36, 387) = 1.09		F(37, 359) = 40.25*		F(36, 336) = 18.74*	
Nob	482				464		421		424		397		373	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; R^2a = adjusted R-squared; Nob = number of observations.

If we compare the impact of firm entry and exit on output growth across various sectors, we observe that there are a number of sectors in which firm entry has a significant impact on output growth, while the effect of firm exit is insignificant. There are also sectors, which tend to be mostly traditional manufacturing industries, where the effect of firm entry on output growth is insignificant, whereas the effect of firm exit is significantly negative. In terms of interactions between entry-exit rates and country effects (see Table A.25 in Appendix 3), we observe a positive impact of entry on output growth in Portugal and Spain and a negative impact of exit for Germany, Portugal and The United Kingdom.

When we study the impact of firm entry on labour productivity growth (see Column 3 of Table 6), we observe a positive contemporaneous relationship between firm entry and labour productivity growth, which is significant at the 10% confidence level[67]. The magnitude of the effect is relatively large, with a 1% increase in the current entry rate leading to a rise in labour productivity by 0.60%. The regression explains 56% of the variation in labour productivity growth. There is also a positive relationship between the exit rate lagged by two years and labour productivity growth that is significant at the 5% confidence level. This result is surprising given that normally we would expect a contemporaneous relationship between firm exit and labour productivity growth. A 1% increase in firm exit two years ago leads to an increase of 0.68% in the current labour productivity growth rate. The regression explains 55% of the variation in labour productivity growth. The estimation performed using two stage least squares does not change the results significantly, the latter being robust to alternative specifications[68].

When we let the coefficients for the current entry rate and the twice-lagged exit rate respectively vary across sectors, we observe a positive impact of an increase in the current entry rate on labour productivity growth in the following sectors: office machinery and computers and radio, TV and communication. The effect is significant at the 1% confidence level and has a strong magnitude with a 1% increase in the current firm entry rate leading to an increase in labour productivity of 3.15% for the office machinery and computers sector and of 6.90% in the radio, TV and communication sector. We also found that the current entry rate has a negative impact on labour productivity growth which is significant at the 1%, 5% or 10% confidence level in the following sectors: rubber and plastic products, other non-metallic and mineral products, machinery and equipment n.e.c., medical, precision and optical instruments, motor vehicles and trailers, wholesale and retail trade and repairs and real estate, renting and business activities. An increase in the current entry rate by 1% leads to a decrease in labour productivity growth of between 0.53% to 1.03%. Globally, the strong increase in labour productivity generated in the office machinery and computers and radio, TV and communication sectors more than offsets the decrease in labour productivity in the other sectors such that the overall effect of the current entry rate on labour productivity growth is positive on average, as shown by the initial specification. The fact that we observe a positive relationship between the current entry rate and labour productivity growth in some sectors and a negative relationship in other sectors can be explained by the fact that in general new entrants are less productive than incumbent firms and have a negative influence on labour productivity growth, whereas in more dynamic and R&D intensive sectors like office machinery and computers and radio, TV and communication, firms that enter the market may be more productive than incumbents, thereby having a strongly positive effect on labour productivity growth. Another possible explanation is that in some sectors most firm entry may

[67] Full results are reported in Table A.26 in Appendix 3.

[68] As alternative to the growth rate of labour productivity, we also considered the level of this variable. However, the estimates turned out to be insignificant at the 10% level.

take place through diversification or by foreign multinationals that are already highly productive and not by de novo entry. It would have been interesting to be able to control for firm specific characteristics such as the type of entry, the size and the duration of survival in order to investigate further this question. The regression with sector specific coefficients explains 46% of the variation in labour productivity growth. In terms of country effects, we find a positive impact of exit on labour productivity growth in France and Portugal and a positive impact of entry in Ireland and Portugal.

When we vary the twice lagged exit rate coefficients across sectors, we find a negative relationship between an increase in the twice lagged exit rate and labour productivity growth which is significant at the 1%, 5% or 10% confidence levels in the following sectors: textiles, coke and refined petroleum products, rubber and plastic products, other non-metallic and mineral products, basic metals, fabricated metal products, machinery and equipment n.e.c., radio, TV and communication, medical, precision and optical instruments, motor vehicles and trailers, furniture and manufacturing n.e.c., construction, wholesale and retail trade and repairs and real estate, renting and business activities. The negative relationship between lagged exit and labour productivity may be due to the fact that in some sectors like textiles and motor vehicles, many large multinationals which are among the most highly productive firms relocate production in Eastern Europe or Asia, therefore leaving only the least productive firms to operate in the sectors in question and decreasing labour productivity. A 1% increase in the exit rate two years ago will lead to a decrease in labour productivity growth of between 1.19% to 3.40%. We also find a positive relationship between an increase in the exit rate lagged twice and labour productivity growth in the following sectors: office machinery and computers, radio, TV and communication, electricity, gas and water supply. A 1% increase in firm exit two years ago leads to an increase in labour productivity growth by 3.34% in office, machinery and computers and by 16.49% in the radio, TV and communication sector, both effects being significant at the 1% confidence level. There is also a 1.74% increase in labour productivity growth in the electricity, gas and water supply sector that is significant at the 5% confidence level. The very strong effects on labour productivity in the radio, TV and communication and the office machinery and computers sectors more than offset the negative influence of the twice lagged exit rate on labour productivity growth in the other sectors such that the overall effect is positive as shown by the initial regression. The regression explains 32% of the variation in labour productivity growth.

The study of the impact of firm entry and exit on employment growth shows, as can be seen in Column 4 of Table 6[69], a positive relationship between an increase in the current firm entry rate and employment growth which is significant at the 5% confidence level, with a 1% increase in the current entry rate leading to an increase in employment growth by 2.67%. There is also a negative effect of the increase in the once lagged entry rate on employment growth which is also significant at the 5% level, with a 1% increase in the entry rate one year ago leading to a 2.20% decrease in employment growth. We do not find a significant relationship between the twice-lagged entry rate and employment. There are two possible explanations as to why we find a positive contemporaneous relationship, but a negative lagged relationship between firm entry and productivity growth. The first is that firm entry in the current year leads to a substantial acceleration in employment growth during this period since entrants will hire new employees. However, this effect fades out during the following year and the employment growth rate falls back to its normal rate translating into a negative impact of the once lagged entry rate on employment growth. Another explanation is the short life

[69] Full results are reported in Table A.27 in Appendix 3.

span of new entrants, with a significant number of new firms that entered the market in the current year exiting the market in the next year and thereby decreasing employment and the employment growth rate during this period. The general short life span of new entrants is also explained by the financial structure of the companies and in particular by the low amount of own funds with which they enter the market. As these firms are not competitive enough during the first years of their existence, they make losses that decrease the level of their own funds. Within two or three years, the funds become insufficient to allow the firm to pursue its activities forcing it to enter into bankruptcy. New entrants may also be unable to finance their expansion if their level of own funds is too low and if they do not have access to external funding, forcing them out of the market. This problem is more acute in the EU because of the relatively low development of start ups financing such as risk capital funds or business angels compared to the US. The regression model explains 43% of the variation in employment growth.

If we vary the coefficient of the current entry rate across sectors we find a positive relationship between firm entry and employment growth which is significant at the 1% and 5% confidence levels in the following sectors (Column 5 of Table A.24 in Appendix 3): wood and products of wood, pulp, paper and paper products, publishing and printing, coke and refined petroleum products, chemicals and chemical products, rubber and plastic products, other non-metallic and mineral products, basic metals, fabricated metal products, machinery and equipment n.e.c., office machinery and computers, electrical machinery and apparatus, radio, TV and communication, medical, precision and optical instruments, motor vehicles and trailers, other transport equipment, furniture and manufacturing n.e.c., construction, wholesale and retail trade and repairs, transport and storage and real estate, renting and business activities. The magnitude of the effect of a 1% increase in the current entry rate on employment growth varies between 0.97% and 4.10%. The impact of the current entry rate on employment growth is insignificant in the other sectors. The regression explains 59% of the variation in employment growth. Interactions between country effects and entry rates suggest a positive impact of the latter on employment growth for France, Portugal and Spain.

In a separate regression, we also allow the coefficient associated with the once lagged entry rate to vary across sectors. The results are reported in Column 6 of Table A.24 in Appendix 3. We find a negative influence of the once lagged entry rate on employment growth, significant at the 1%, 5% and 10% confidence levels in the following sectors: tobacco products, textiles, wearing apparel, dressing and dyeing, tanning and dressing of leather, motor vehicles and trailers and electricity, gas and water supply. The magnitude of the effect is relatively small with a 1% increase in the once lagged entry rate leading to a decrease in employment growth by 0.02% to 0.03%. This specification explains 38% of the variation in employment growth. We did not find a significant contemporaneous or lagged relationship between the firm exit rate and employment growth. Finally, as an alternative to the growth rate of employment, we also considered the level of this variable. However, the estimates turned out to be insignificant at the 10% level.

We also study the impact of the firm entry and exit rates respectively on the growth of physical capital investment, but we do not find a significant effect in either the entry rate or the exit rate equation (Column 5 of Table 6)[70]. The explanatory power of the regressions was also very low with an adjusted R^2 of 6% to 8%. A likely explanation for these results is that investment in physical capital tends to be highly persistent leading to a flat growth rate.

[70] Full results are reported in Table A.28 in Appendix 3.

We also analysed the impact of firm entry and exit on R&D investment growth (Column 6 of Table 6)[71]. Although we found significant contemporaneous and lagged relationships between the firm entry rate and R&D investment growth, the adjusted R^2 is extremely low at 1%, which does not allow us to reach a pertinent conclusion as to the impact of firm entry on R&D investment growth. We did not find any significant relationship between firm exit and R&D investment growth. The explanation for these results is similar to the one on physical capital investment, as R&D investment also tends to be highly persistent and to have a flat growth rate.

As an alternative performance measure, we also regressed the current and lagged entry and exit rates on R&D intensity and on capital intensity (Columns 7 and 8 of Table 6)[72]. Here also, we did not find any significant relationship in the R&D intensity equation, but we did find evidence of a negative impact of an increase in the current firm exit rate on capital intensity which can be explained by the fact that some traditional manufacturing sectors which are in decline are also highly capital intensive and therefore the exit of firms from these sectors will have a negative effect on capital intensity.

[71] Full results are reported in Table A.29 in Appendix 3.
[72] Full results are reported in Tables A.30 and A.31 in Appendix 3.

6. Summary and conclusions

Product market reforms and measures aimed at deregulating the economy and increasing competition are essential to improve the framework conditions in which business operates, reduce the economic rents in the economy, promote business dynamism and stimulate innovation. Furthermore, empirical evidence shows that the medium to long-term gains in productivity due to product market reforms could be substantial and that these gains mainly operate indirectly through efficiency gains.

The relative performance of the EU economy over the recent past, in particular in terms of aggregated productivity gains as compared to the US as well as the challenge of the Lisbon strategy to transform the EU into the most competitive and dynamic knowledge-based economy in the world ask for a closer examination of the instruments and policies implemented to improve the functioning of markets. This study attempts to shed some light on one determinant of productivity and growth performance, namely the impact of product market reforms implemented in the EU over the last ten years on its macroeconomic performance, in particular through their direct effects on the process of firm entry and exit. The study is composed of four parts: a review of the literature on the determinants of entry-exit and product market reforms and their impact on economic performance, a description of data and indicators necessary to carry out the analysis, an econometric framework to implement the analysis and a discussion of the empirical findings and their main policy implications.

a) Literature review

We first conducted a survey of the empirical and theoretical literature on market entry and exit, economic performance and the degree of economic and business regulation. The literature uncovers a series of empirical facts on the correlation between entry and exit rates that is positive in industries with steady states of maturity and negative in the early and late phases of the product's life cycle. The variance of entry rates within industries is higher than the variance between industries. It changes over time and tends to come in waves. The variance of firm growth rates is large, but declines with the size of firms and the sunkness of capacity. Given these empirical observations, a number of theoretical studies modelled the entry and exit process based on the Schumpeterian concept of creative destruction. In passive learning models, firms enter the industry without knowing their true costs about which they gradually learn over time. They then decide whether to exit or remain in the industry. In these models, increasing the cost of entry leads to low firm turnover. In active models, firms enter the industry and invest to increase their productivity. If they are successful, they remain in the market, if not they exit. Capital vintage models are based on the assumption that new technology is embodied in new vintage capital and new entrants have the advantage of not having to incur the costs of upgrading their capital. In R&D based models of economic growth, firms use R&D investment to create new products and processes or higher quality versions. Successful innovators enter the industry and replace firms producing obsolete goods. Finally, according to product life cycle models, the amount of firm creation and the nature of innovation change with the degree of maturity of the industry.

We then presented the 'basic' determinants of firm entry and exit, which can be specific to the firm, the industry, determined by both firm and industry characteristics or be country specific. Firm growth rates are influenced by the size and age of firms and by industry and economy-wide output growth rates. Firms entering and exiting the industry have lower than

average size and the size of European firms is smaller than that of US firms. Young and small firms are the ones that most frequently exit the industry. Manager turnover in small businesses plays an important role in firm exits. A relationship was found between lagged entry and exit rates, whereas only a weak relationship was uncovered between entry and past industry profits. The survival of new entrants is low and those that do survive need an average of 5 to 10 years to become competitive with incumbents. Lower degrees of economic development correspond to higher turnover rates. The latter are also affected by macroeconomic shocks. Entry deterrence strategies and structural barriers to entry also affect the entry and exit process and can again be classified into firm, industry or country specific, or determined by both firm and industry characteristics. Limit pricing where incumbent firms charge the highest price at which entry is deterred, and predatory pricing in which incumbents engage in a price war with new entrants were both criticised for not constituting credible threats to entry. Empirically, little evidence was uncovered for the use of limit pricing by firms. The use of sunk costs as a pre-commitment mechanism to deter entry was also analysed in the literature. The use of excess capacity to deter entry was found to be infrequent empirically, but some evidence was uncovered that firms use specific capital as a pre-commitment mechanism. Advertising and R&D intensity were found to be used frequently as entry deterrence strategies, whereas economies of scale constitute an important structural barrier to entry that influences the use of entry deterring strategies by incumbent firms. The impact of entry deterring strategies was found to depend on the type of entrant. Firm access to credit capital also plays a significant role in firm entry and exit.

In the last part of the survey, we looked at the impact of entry and exit on economic performance as measured by aggregate productivity growth[73]. There is a debate in the literature on how to best decompose aggregate productivity growth into the contribution of within firm productivity growth, entry and exit and market share reallocation. Studies also differ on the best way to measure aggregate productivity with both TFP and labour productivity having certain advantages and disadvantages. In the end, the contribution of entry and exit to aggregate productivity growth can be high or low depending on the decomposition of aggregate productivity used, the time horizon over which changes are measured, the business cycle and the country and industry under investigation. Studies found that in general entrants have lower productivity than survivors, as do firms exiting the market. The latter also tend to have lower productivity for several years before exit, whereas the relationship between the productivities of entrants and of firms exiting the industry is unclear. Entry and exit also affect aggregate productivity indirectly by influencing firms' incentives to innovate. For sectors close to the technological frontier, an increase in the threat of entry has a positive effect on productivity growth, whereas for sectors far below the technological frontier the effect may be negative. Empirical evidence was found in favour of this last conclusion.

b) Data

In Section 3, we presented the data sources necessary to carry out the study, as well as the suitability of the information and data for modeling purposes. The firm entry and exit rates are taken from the DUN & BRADSTREET database which contains series by year, sector and country for 9 EU countries over the 1997-2003 period. We also integrated data from the Census Bureau for the US for the 1999-2001 period. An examination of the entry and exit variables enable us to draw a series of conclusions which mostly confirm the findings of the

[73] Brandt (2004) also studied the impact of firm entry on output and employment growth and found a significant correlation between firm entry rates and output and employment growth respectively across services sectors, but the relationship between these variables is less clear in manufacturing industries.

empirical literature: entry and exit are common, with large numbers of firms entering and exiting most markets in most years. Both entry and exit rates substantially differ across countries and industries, with the annual growth rate of the total number of firms being generally positive, but tending to decrease over the 1997-2003 period. We also found that the heterogeneity of net entry rates varies substantially across time periods, countries and industries, while most of the total variation in net entry rates across industries is within-industry variation rather than between-industry variation. The same finding holds for within-country and time period and between-country and time period variation. Finally, entry and to some extent exit rates across countries are generally significantly and positively correlated.

We used a second database for variables describing market structure, some of which also constitute structural barriers to entry. We based the construction of the capital, resource and R&D intensity variables and the value-added and employment growth rates on the OECD's STAN and ANBERD databases which provide coverage by sector, country and year for all the countries in the sample except Ireland and Portugal over the 1990 to 2001 or 2002 period. We also used a series of variables that capture market structure which were taken from Lyons (1996) and Martins et al. (1996) and include minimum efficient scale, industry concentration, product differentiation and market segmentation. Among the indicators of economic performance we used data on labour productivity per person engaged from the Groningen Growth and Development Center's 60-Industry Database. The series covers all the countries in the sample by sector and year over the 1997-2001 period. The main conclusions from the descriptive statistics done on these variables is that there is little variation in R&D intensity in a given sector across countries and years, but moderate variation for capital and resource intensity, as well as for value-added and employment growth. On the contrary, the variation in a given sector across countries and years is much stronger for the gross fixed capital formation and the labour productivity per person engaged variables compared with the others. There are sectors where the standard deviation and average differ substantially compared with those of the other industries. We found moderate variation in a given country across sectors and years for capital intensity, R&D intensity and employment growth. Slightly higher variation was found for resource intensity and value added growth, whereas the highest standard deviations were found for gross fixed capital formation (GFCF) and labour productivity. The variations in terms of resource and R&D intensity are fairly similar across countries. The average is fairly similar across countries for capital intensity, resource intensity, R&D intensity and value added growth, whereas countries are a lot more heterogeneous in terms of the GFCF and labour productivity averages. The standard deviation is fairly stable across time for capital and resource intensity, it is mostly stable for value added and employment growth, it increases across time for GFCF and labour productivity and it fluctuates moderately for R&D intensity. The average for capital intensity is stable across time, it increases for GFCF, decreases for resource and R&D intensity and fluctuates for value added and employment growth. The correlation matrix generally shows low correlation among the variables with some exceptions.

The third database we used in the analysis concerns product market reforms indicators. Most of the indicators we used are taken from the Fraser Institute which reports them on a five year interval basis and annually from 2000 onwards. The main drawback of the Fraser indicators is that they are only available at the macroeconomic aggregate level and therefore do not have a sector dimension. We also used industry-specific indicators for seven network industries which were compiled by the OECD, a second category of indicators which cover industry specific regulations for 1998 from the OECD and the Australian Productivity Commission and a series of indicators covering restrictions in different sectors for 1981, 1986, 1991 and 1998 from the UN Trade Analysis Information System (TRAINS). All the

regulation indicators that did not provide yearly coverage were linearly intra or extrapolated so as to provide data for the 1997-2003 period and were rescaled from 1 to 10 according to the level of deregulation in the economy.

c) Econometric framework

In Section 4, we described in detail the methodology and modelling strategy to assess the impact of product market reforms on entry-exit and macroeconomic performance and this framework is related to the survey of the literature. We used a two-stage approach, where we first estimated the relationship between firm entry and exit and our indicators of product market reforms and regulations while controlling for country and industry structural characteristics such as entry barriers. In the second stage, we estimated the relationship between firm entry and exit rates and different macroeconomic outcomes such as output growth, labour productivity growth, employment growth, physical capital and R&D investment growth and capital and R&D intensities. We encountered several estimation issues during both stages.

In the first part of the regression, we estimated firm entry and exit rates which vary at the country, industry and year levels as a function of the Fraser regulation indicators which only vary at the country and time levels, but not across sectors. The standard error resulting from these estimations can have a strong downward bias because they are usually correlated among the observations within a given group. We can therefore conclude that a regulation indicator has a significant effect on firm entry and exit when in reality it does not. In order to solve this problem we eliminate the time dimension from the regression by averaging the observations across years and we use a fixed effects panel data model where the fixed effects are at the sector level. Another estimation issue in this first stage is the presence of multicollinearity among the different regulation indicators. In order to address this issue, we also conducted a principal components analysis and we used the principal component as the regulation indicator in the estimations. In the second stage of the estimation, the problem we encountered was the possibility of endogeneity of the entry and exit variables because of unobserved common shocks that simultaneously affect firm entry and exit and macroeconomic performance. We can therefore conclude that entry and exit have a significant influence on macroeconomic performance when in fact they are both responding to a common shock. In order to solve this problem, we used two approaches: in the first, we regressed the macroeconomic variables on current and lagged firm entry and exit rates while simultaneously controlling for country, industry and year specific effects, as the latter variables are likely to capture any common shocks. The second approach was to use an instrumental variables methodology in which we used several indicators of firms' entry and exit as instrumental variables.

d) Main empirical findings

The estimation results for the first equation show evidence that capital intensity constitutes a barrier to entry and exit as does R&D intensity, even though both of these barriers are relatively low. The entry rate lagged by one year has a positive effect on both the current entry and exit rates that can be interpreted as a confirmation of the wave theory and of the low survival rate of new entrants. The results on the market structure variables show that high concentration and product differentiation at the beginning of the period lead to high firm entry and exit rates or high firm turbulence. The industries where market concentration is high also

have high profits that can attract new firms, thereby leading to an increase in firm entry. In industries with strong product differentiation, there will be higher firm entry since it is easier for firms to present new products. As efficiency gains, through the toughening of the competitive regime, are likely to be the most important in initially highly concentrated and diversified market structures, firm entry and exit can also be expected to be high in these industry sectors. An increase in deregulation leads on average to an increase in both firm entry and exit, a finding that is robust to alternative specifications and estimation methods. However, when we study specific sectors, the impact of an increase in deregulation on entry and exit varies from one industry to another. Generally, the effect of deregulation is positive and significant mainly in manufacturing sectors and only in a very limited number of services sectors. There are also a very small number of sectors where deregulation has a negative effect on firm entry and exit. Finally, there are sectors in which deregulation does not have a significant effect on entry, but it does have a positive and significant effect on firm exit. These sectors tend to be more traditional manufacturing sectors and for some of them firm exit has a positive impact on productivity.

In the second part of the estimation, we found a robust positive relationship between the current firm entry rate and output growth and a robust negative relationship between the once lagged firm exit rate and output growth. In terms of labour productivity, there is a positive and significant relationship between current firm entry and labour productivity growth as well as between firm exit lagged by two years and labour productivity growth. We can therefore conclude that the impact of firm entry on output growth and labour productivity growth occurs contemporaneously, whereas the impact of firm exit on these two economic performance variables occurs with a certain lag. In both cases, the magnitudes of the impact of both firm entry and exit are quite high. The current entry rate has a positive impact on employment growth, whereas the once lagged entry rate has a negative effect. There is no significant relationship between firm exit and employment growth. We did not find a significant relationship between entry and exit respectively and physical capital investment growth, whereas the explanatory power of the R&D investment growth regressions is very weak so that we are unable to draw any meaningful conclusions as to the relationship between firm entry and exit and this economic performance variable. A possible explanation for these two results is that both physical capital and R&D investment are highly persistent and therefore generally have a flat growth rate. The picture changes slightly if we study the impact of firm entry and exit on physical capital and R&D intensity. We found a negative and significant relationship between the current firm exit rate and physical capital intensity, but no significant impact of firm entry. On the contrary, we found some evidence of a negative and significant relationship between the current firm entry rate and R&D intensity, but no significant impact of firm exit. While these results are valid on average, a closer inspection by sector shows that the significance and even the sense of the relationship between entry and exit respectively and the different macroeconomic variables differ. In particular, while there are sectors where both entry and exit have a significant impact or both have an insignificant effect on the macroeconomic performance variables, there are also sectors where the relationship between entry and macroeconomic performance is significant, but not the relationship between exit and macroeconomic performance, with the reverse true in other sectors. The latter generally tend to be more traditional manufacturing sectors. Finally, there are also sectors where the relationship between firm entry or exit and economic performance is significant but of opposite sign than the relationship found at the average level.

e) Policy implications and further work

The general policy implications that we can draw from these results is that it is desirable to pursue economic policies that influence firm entry and exit since the variation of the latter will generate significant and generally positive changes on macroeconomic performance with the magnitude of these changes being relatively large. One such economic policy is an increase in deregulation that will significantly increase both firm entry and exit leading to a more efficient reallocation of resources within industries. However, the results for some traditional manufacturing sectors suggest that in some cases, it may be necessary to accompany deregulation policies in the short run by certain compensation measures given that in sectors that are generally on the decline, deregulation policies may exacerbate already existing problems in the absence of compensatory measures.

There are certain limitations of the current study, which are generally due to data availability. Apart from the estimation problems mentioned above, we were not able to control for firm specific characteristics such as size, age or type of entrant in our regressions. Doing so would have likely yielded further interesting results. More detailed information on our product market reforms indicators would allow us to investigate further the link between the starting point in each country of these reforms and the size of the resulting effect. Our time period of 1997 to 2003 was also relatively short. It would perhaps be interesting as further research to complete our understanding of the current general results by case specific studies. Finally, it should also be noted that we only studied one channel through which product market reforms and deregulation policies can have an influence on macroeconomic performance, namely through their impact on firm entry and exit. There are however two other important channels through which these policies can impact macroeconomic performance. The first channel concerns the influence of these policies on the degree of competition and firms' mark-up and the second channel is linked with their impact on firms' incentives to engage in R&D and innovation activities.

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APPENDICES

APPENDIX 1. Summary of empirical findings and decomposition of aggregated productivity growth

Table A1. Main empirical findings on the determinants of firm entry and exit

Authors	Sample	Main Results
Relationship between entry and past profits		
Orr (1974)	71 3-digit manufacturing industries Canada; 1963-1967	- past profit rate, past industry output growth are weak incentives to entry - entry is lower and profits higher in high barrier group compared to low barrier group
Hilke (1984)	16 4-digit and 5-digit manufacturing industries US; 1950-1966	- past growth rate has positive and significant effect at 10% confidence level - past profits have insignificant impact on entry
Entry barriers/entry deterrence strategies a. Limit pricing		
Orr (1974)	71 3-digit manufacturing industries Canada; 1963-1967	- not much evidence in favour of limit pricing
Bunch and Smiley (1992)	survey 296 managers, 42 product markets US; 1985	- limit pricing among least used entry deterrence strategies in new product and existing, mature product markets
Singh, Utton and Waterson (1998)	survey 296 marketing/product/brand managers in food and drink, electrical engineering, chemicals and pharmaceuticals industries UK	- limit pricing among least used entry deterrence strategies
Chang and Tang (2001)	survey 111 marketing/product managers and business development/planning directors in manufacturing and services sectors Singapore; 1999	- limit pricing among least used entry deterrence strategies
b. Excess capacity		
Hilke (1984)	16 4-digit and 5-digit manufacturing industries US; 1950-1966	- excess capacity is an insignificant barrier to entry
Lieberman (1987)	38 chemical products industries US; 20 year period	- incumbents did not expand preemptively to deter entry - firms held excess capacity to accommodate demand variability and investment lumpiness
Bunch and Smiley (1992)	survey 296 managers, 42 product markets US; 1985	- excess capacity rarely used as an entry deterrence strategy in new product markets and in existing, mature product markets
Singh, Utton and Waterson (1998)	survey 296 marketing/product/brand managers in food and drink, electrical engineering, chemicals and pharmaceuticals industries, UK	- excess capacity rarely used as entry deterrence strategy

Table A1. Main empirical findings on the determinants of firm entry and exit (cont.)

Authors	Sample	Main Results
Chang and Tang (2001)	survey 111 marketing/product managers and business development/planning directors in manufacturing and services sectors Singapore; 1999	- excess capacity rarely used as entry deterrence strategy
c. Financial structure of firms		
Martin (2003)	188 3-digit industries Canada; 1984-1996	- debt/asset ratio positively related to turnover - debt/asset ratio negatively related to concentration
d. Economies of scale		
Hause and Du Rietz (1984)	39 manufacturing industries Sweden; 1954-1968	- increase in minimum efficient size of new establishments decreases rate of entry - increase in minimum efficient size of new plant relative to industry employment has negative impact on entry rate, but insignificant
Kessides (1990a)	4-digit manufacturing industries with net entry between 1972-1977 US	- inverse relationship between rate of entry and required scale of entry
Kessides (1990b)	339 4-digit manufacturing industries US; 1979; 1982	- economies of scale constitute a significant barrier to entry
Bunch and Smiley (1992)	survey 296 managers, 42 product markets US; 1985	- economies of scale act as substitutes for entry deterrence strategies in new product markets - in existing mature product markets firms are more likely to deter entry in industries where entry barriers caused by the necessity of having a minimum efficient size are low
e. Advertising intensity		
Orr (1974)	71 3-digit manufacturing industries Canada; 1963-1967	- advertising intensity is strong barrier to entry - advertising intensity is statistically significant entry barrier in consumer goods industry, but insignificant in producer goods industry
Kessides (1986)	266 4-digit manufacturing industries US; 1972-1977	- advertising creates sunk cost barrier to entry - potential entrants perceive greater likelihood of success in markets with important advertising - in consumer goods industries positive effect of advertising on entry dominates negative effect
Bunch and Smiley (1992)	survey 296 managers, 42 product markets US; 1985	- in new product markets, firms are more likely to adopt entry deterring strategies in research intensive, concentrated markets populated by large firms among which creation of product loyalty through advertising and patent pre-emption - in existing mature product markets, firm advertising among the most frequently used entry deterrence strategies

Table A1. Main empirical findings on the determinants of firm entry and exit (cont.)

Authors	Sample	Main Results
Singh, Utton and Waterson (1998)	survey 296 marketing/product/brand managers in food and drink, electrical engineering, chemicals and pharmaceuticals industries UK	- advertising frequently used entry deterrence strategy
Thomas (1999)	13 groups of cereals US; 1971-1989	- incumbents accommodate other incumbents on price and new product introductions but use advertising to limit the scale of entry - if entrant enters on a small enough scale, incumbents may not find it profitable to lower price or increase advertising to drive the entrant out of the market - new name products are accommodated on price and advertising and are less likely to elicit a new name product introduction by incumbents than product extensions which are more likely to capture significant market share
Chang and Tang (2001)	survey 111 marketing/product managers and business development/planning directors in manufacturing and services sectors Singapore; 1999	- advertising frequently used as a strategic barrier to entry in industries
f. R&D intensity		
Orr (1974)	71 3-digit manufacturing industries Canada; 1963-1967	- R&D intensity is a moderate barrier to entry
Singh, Utton and Waterson (1998)	survey 296 marketing/product/brand managers in food and drink, electrical engineering, chemicals and pharmaceuticals industries UK	- R&D (not patenting) is a widely used entry deterrence strategy
Chang and Tang (2001)	survey 111 marketing/product managers and business development/planning directors in manufacturing and services sectors Singapore; 1999	- R&D intensity is frequently used as a strategic barrier to entry
Different impact of entry barriers according to type of entrant		
Mata (1993)	5-digit manufacturing industries Portugal; 1982-1986	- economies of scale are an impediment for de novo, expansion and extension entry - de novo entry sensitive to most entry barriers - extension entry is deterred by product differentiation - expansion entry is induced by product differentiation - purely diversifying entry is the least affected by entry barriers

Table A2. Main empirical findings on the impact of entry-exit on economic performance

Authors	Sample	Main Results
Contribution of entry/exit, within firm growth and market share reallocation to aggregate productivity growth		
Baily, Hulten and Campbell (1992)	23 manufacturing industries (all years); 5 manufacturing industries (1972-1987) US;1963, 67, 72, 77, 82, 87	- entry/exit contribution to productivity growth not very large since they have similar relative productivity - cyclical pattern of contribution of entry/exit to productivity growth - increasing share of output going to high productivity plants is important source of productivity growth in some but not most industries
Griliches and Regev (1995)	22 2-digit industries Israel; 1979-1988	- most of the growth in labour productivity occurs within firms, whereas net entry and market share reallocation only account for a small fraction of overall growth
Olley and Pakes (1996)	telecommunications equipment industry US; 1974-1987	- entry/exit contributed to the reallocation of capital - shutdown of unproductive plants led to the reallocation of capital that facilitated the increase in aggregate productivity
Aw, Chen and Roberts (1997)	manufacturing industry Taiwan; 1981, 1986, 1991	- TFP growth of continuing firms is significant source of aggregate productivity growth - entry/exit is important source of aggregate growth - total contribution of market share reallocation is very close to 0
Foster, Haltiwanger and Krizan (1998)	manufacturing industries 1977-1987; 3-digit automotive repair shop sector 1987-1992; US	- net entry plays an important role in aggregate productivity growth - the quantitative contribution of reallocation to the aggregate change in productivity is sensitive to the decomposition methodology - in the automotive repair shop sector net entry has a large contribution to aggregate productivity growth when productivity is measured by labour productivity
Martin and Jaumandreu (1999)	75 manufacturing industries Spain; 1979-1990	- gross entry and exit rates have positive and significant impact on productivity when included separately, but effect of exit rates becomes insignificant when both are included simultaneously - structural changes in industries derived from entry and exit accounts for almost 1/3 of average productivity growth
Disney, Haskel and Heden (2000)	19 2-digit manufacturing industries UK; 1980-1992	- magnitude of the between and net entry effects depends on the decomposition used - for TFP growth the within effect contributes 5% to 18% of aggregate productivity growth, net entry accounts for over 50% of growth, with external restructuring accounting for 70% to 80% of TFP growth - for labour productivity growth the within effect accounts for 47% to 48% of aggregate productivity growth - in economic slowdowns the contribution of net entry to TFP growth is greater

Table A2. Main empirical findings on the impact of entry-exit on economic performance (cont.)

Authors	Sample	Main results
Hahn (2000)	5-digit manufacturing industries Korea; 1990-1998	- very large effect of entry/exit on aggregate productivity growth which increases in percentage terms in periods of cyclical downturns -larger role of within effect in aggregate TFP growth during periods of cyclical upturns - contribution of market share reallocation varies with the period
Scarpetta, Hemmings, Tressel and Woo (2002)	manufacturing and services industries 10 OECD countries; 1987-1997	- within firm labour productivity accounted for 50% to 85% of aggregate productivity growth - the between effect varies widely across countries and time, but is typically small - firm labour productivity growth relative to the industry average was associated with restructuring and downsizing rather than expansion - net entry accounts for 20% to 40% of total productivity growth - within effect has stronger contribution to overall productivity growth, whereas the contributions of the between effect and net entry increases during cyclical downturns - contributions of entry and exit to productivity growth varies across industries
Impact of entry on aggregate productivity growth through innovation		
Aghion, Bloom, Blundell, Griffith, and Howitt (2002)	UK firms; 1987-1993	- positive, significant effect of entry on TFP growth - productivity growth of incumbents reacts more positively to entry in industries close to or above the world technological frontier - inverted U relationship between competition and innovation
Geroski (1989)	79 3-digit manufacturing industries UK; 1970-1979	- effect of domestic entry and innovation is positive, with innovation playing the more substantial role; effect of foreign based entry is negative - innovation count variable has largest effect on productivity growth of the 3 competition variables in the short and long run - competition plays an important role in stimulating productivity

Table A3. Main empirical findings on the impact of economic and product market reforms on economic performance

Authors	Sample	Main Results
Impact of product market regulations on productivity		
Scarpetta, Hemmings, Tressel and Woo (2002)	23 2-digit manufacturing and business services sectors 19 OECD countries; 1984-1998	- product market regulations have negative direct effect on TFP growth - strict regulations have particular detrimental effect on productivity the further the country is from the technology frontier - employment protection legislation has negative and significant effect on productivity growth when it is not allowed to vary across different industrial relations regimes and when it is allowed to vary, the negative impact is stronger and significant only in countries with an intermediate degree of centralisation/coordination
Nicoletti and Scarpetta (2003)	23 2-digit manufacturing and business services industries 18 OECD countries; 1984-1998	- evidence of more rapid technological catch-up in services than manufacturing - economy wide product market regulations that curb competition and private governance have a negative effect on productivity by slowing down technological catch-up - barriers to entrepreneurship has insignificant effect on productivity - privatisation generally has positive and significant effect on productivity by increasing competitive pressure - entry liberalisation has a generalised effect on productivity in all countries regardless of position with respect to the technology frontier - entry liberalisation in services has positive effect on productivity in the whole economy - entry liberalisation in manufacturing has insignificant effect - slightly positive direct effect of restrictive regulation on MFP is found in service industries
Griffith and Harrison (2004)	manufacturing and services industries EU countries; 1985-2000	- reforms to labour and credit markets reduce the level of economic rents available and lower levels of labour productivity and TFP - evidence of non-linear relationship between levels of economic rents and levels of R&D and growth rates of labour productivity and TFP - in most countries the levels of economic rents is such that a reduction in rents leads to a reduction in R&D and growth rates
Impact of product market regulations on investment		
Alesina, Ardagna, Nicoletti and Schiantarelli (2003)	7 non-manufacturing industries 21 OECD countries; 1975-1996	- regulation has significant negative effect on investment - effect of the overall impact of regulation on the value added to capital ratio is insignificant

Box 1. Decomposition of aggregated productivity growth and measuring the level of aggregate productivity

The impact of firm entry and exit on economic performance is generally investigated by decomposing aggregate productivity growth into the contributions made by firm entry and exit, market share reallocation and productivity growth at the firm level. The literature debated on the best way of decomposing aggregate productivity growth into these three sources. Baily et al. (1992) decompose aggregate productivity growth in the contribution of within firm productivity of continuing firms weighted by the firm's initial shares in the industry, a contribution of the change in market shares of continuing firms weighted by final period productivity and the contributions of firm entry and exit respectively.

This decomposition is seen in the literature (see for example Disney et al., 2003) as posing a problem in terms of the contribution of net entry to aggregate productivity growth. If the market shares are very low and those of exiting firms are high, then net entry may have a negative contribution to aggregate growth, even if entrants have high productivity and exiting firms have low productivity.

Foster et al. (1998) propose a modified version of the Baily et al. (1992) decomposition in which aggregate productivity growth is decomposed in the contribution of within firm productivity of continuing firms weighted by the firm's initial shares in the industry, a contribution of the change in market shares of continuing firms weighted by the deviation of the initial firm productivity from the initial industry index, a covariance type term and the contributions of firm entry and exit respectively. This type of decomposition eliminates the interpretation problem of net entry contribution to aggregate growth found in Baily et al. (1992) by using the decomposition of productivity relative to the average. This method also has the advantage of isolating the within-firm and between-firm contributions to aggregate growth from covariance effects, but has the disadvantage of being vulnerable to measurement error.

Griliches and Regev (1995) when studying the Israeli industry propose an alternative way of decomposing aggregate industry productivity growth into the three sources of growth. Aggregate productivity growth is decomposed into the within effect which is measured by the weighted sum of productivity changes in continuing firms weighted by the average of the firm's shares in output in the base and end years. The between effect is measured as the change in output shares of continuing firms weighted by the deviations of the average plant level productivity from the overall industry average, where again, the average is taken between the base year and the end year. The contributions to aggregate productivity growth of firm entry and exit is measured such that firms that enter the market will have a positive contribution to aggregate growth only if they have higher productivity than the overall industry average, and plants that exit the market will have a positive contribution to aggregate productivity growth only if their productivity is lower than the industry average. In the literature, this method is seen as having the advantage of being less vulnerable to measurement error than the Baily et al. decomposition because of the use of weights representing averages. The disadvantage is that the within and between contributions to aggregate productivity growth will also capture covariance effects.

Olley and Pakes (1996), in their study of the US telecommunications industry, propose another decomposition of aggregate industry productivity. The latter can be written as the cross-sectional non-weighted mean of the productivity across all plants in the industry and the sum over all plants of an individual plant's productivity deviation from the non-weighted mean multiplied by that plant's output share deviation from the output share mean. This decomposition allows seeing whether the cross-sectional allocation of activity has become more productivity enhancing over time and whether activity is disproportionately located in high productivity plants. The advantages of this decomposition is that it does not rely on the accurate measure of exit and entry and that cross-sectional differences in productivity are less affected by measurement errors and transitory shocks, but the disadvantage is that it does not show the contribution of entry and exit to aggregate productivity growth.

Apart from the difficulties encountered empirically in measuring the contribution of each one of the three sources to aggregate growth, there are also problems with measuring the level of aggregate productivity. Total factor productivity is the best theoretical measure because it captures both the technical and the efficiency advantages of firms over measured inputs. However, in practice, it is subject to measurement errors which mainly come from the method in which the capital stock is derived. A number of studies therefore also use labour productivity to measure aggregate productivity. The advantage is that it better captures the market selection process if total factor productivity is measured badly, but it does not provide a good measure of productivity growth in periods of capital labour substitution.

APPENDIX 2. Descriptive statistics.

Box 2. Existing Databases on entry and exit

Over the recent years, more and more longitudinal micro-level databases (LMDs) that follow large numbers of firms or plants over time have been developed[74]. The Longitudinal Research Database developed by the US Bureau of the Census, which consists of a large panel data set of US plants in the manufacturing sector, is one of the first databases[75]. Several studies have used this database to analyse productivity growth. While several other countries have similar databases, there are only a few international datasets with harmonised definitions of concepts and units of measurement that allow for cross-country comparisons of entry, exit and survival of firms over time and across sectors. Among the main international LMDs available, we can mention: the New Cronos database managed by EUROSTAT (2003) which contains data on a harmonised definition of entry and birth of enterprises broken down by sectors according to the NACE rev. 1.1 (two digit level) for 10 EU Member States and from 1998 to 2000. The data should be updated every year. The database will serve as a basis for computing a new structural indicator on business demography. However, information on France and Germany are lacking. A DG ENTR database contains information on market entries and exits for all Member States from 1995 to 2000. However, owing to the fact that the definitions of entry and exit are not harmonised, data are not comparable across countries. An OECD database (Bartelsman et al., 2003) contains information on the number of exiting, entering and continuing firms by year at the ISIC rev 3 two digit industry level (40 sectors), for five firm class sizes and for ten OECD countries from the mid 80s to 1997 or 1998. The EU countries are the following: France, Germany, UK, Italy, The Netherlands, Denmark, Portugal and Finland. However, the time series available vary from one country to another: for Germany, data are available from 1978 to 1998 (largest sample) while for Italy data are available from 1987 to 1993 (smallest sample). Moreover, for the UK there is a break in the series due to a change in the enterprise definition in 1994. Consequently, data for the 1994-1997 period cannot be compared to data for the 1986-1993 period. For Italy and Denmark, no data is available after 1993 or 1994.

Box 3. Stylised facts on main determinants of firm entry and exit

According to Table A.9 in Appendix 2, the sectors that have the highest capital intensity are real estate, renting and business activities, followed by the post and telecom and electricity, gas and water supply sectors. The least capital-intensive sectors are wearing, tobacco and leather. Capital intensity varies moderately to low in a given sector across countries and years, with the highest variation being registered in the real estate, renting and business activities sector, followed by post and telecom and electricity, gas and water. The industries with the least variation in terms of capital intensity across countries and years are wholesale and retail trade, other manufacturing and textiles.

The sectors with the highest gross fixed capital formation (in value terms) average are real estate, renting and business activities, wholesale and retail trade, post and telecom and land and other transport. The lowest average is found in tobacco, leather and wearing. There is a very strong variation in terms of gross fixed capital formation in a given sector across countries and years, with the highest variation being found in real estate, renting and business activities, wholesale and retail trade, post and telecom, land and other transport and electricity, gas and water supply. The lowest variation is found in the tobacco, leather and wearing sectors.

The data on resource intensity show that the sector with the highest resource intensity average is other transport equipment, whereas the resource intensity for the other sectors is very similar. The other transport equipment sector also has the highest variation across countries and years. All the other sectors have a very low standard deviation.

Sectors are heterogeneous in terms of R&D intensity, with the highest R&D expenditures to production being in office machinery and computers, radio and TV and other transport equipment. The lowest R&D intensity is found in construction, printing, wholesale and retail trade and wearing. The amount of R&D expenditure to production is highly similar in a given sector across different countries and years, with notable exceptions in office machinery and computers, electrical machinery, radio and TV and instruments where the standard deviation is somewhat higher.

The examination of the value-added growth variable, which captures the sector specific business cycle, shows that sectors are very heterogeneous, the highest value added growth being registered in the refined petroleum sector followed by real estate, renting and business activities, post and telecommunications and motor vehicles. At the other end of the scale is the leather sector which together with wearing registered a negative average value added growth rate across countries and time, preceded by textiles, where the value added growth

[74] See Bartelsman and Doms (2000) for a review.
[75] Times series data from 1990 to 2001 are available at http://www.sba.gov/advo/stats/data.html

Box 3. Stylised facts on main determinants of firm entry and exit (cont.)

average was slightly positive. The standard deviation shows significant variation in value added growth within a given sector across countries and time period, with the highest standard deviation being registered in the refined petroleum sector followed by office machinery and computers.

The employment growth variable shows a similar picture in terms of heterogeneity across sectors, but most sectors have registered negative employment growth on average, among the most notable exceptions being real estate, renting and business activities with the highest average employment growth, and office machinery and computers. The wearing sector registered the highest negative average employment growth, confirming the decline showed by the growth in value added. Employment growth is also subject to significant within sector variation, the highest standard deviation being registered in office machinery and computers. The picture that emerges when the value added and employment growth variables are taken together is that of a decline in the more labour intensive traditional manufacturing sectors like textiles, leather and wearing and expansions in newer sectors like office machinery and computers and real estate, renting and business activities. Most of the sectors are somewhere in between registering healthy value added growth rates, but negative employment growth that could indicate moderate increases in productivity.

The sectors with the highest labour productivity per person engaged are office, machinery and computers followed by radio and TV, electricity, gas and water supply, refined petroleum and chemical products. The sectors with the lowest productivity per person engaged are wearing, leather, wood and other manufacturing. There is a very high variation across countries and years in a given sector in terms of labour productivity per person engaged. The sector with the highest variation by far is office machinery and computers, followed by radio and TV. The sectors with the lowest variation are construction and wholesale and retail trade.

The examination of entry determinant variables across countries shows that the highest capital intensity variable is in Portugal followed by Germany and Italy, whereas the countries with the lowest capital intensity are Spain, the UK and the US (Table A.10 in Appendix 2). According to the standard deviation, there is a moderate variation in terms of capital intensity in a given country and across industries and years, with the highest variation being registered in Portugal followed by Germany and the Netherlands. The countries having the highest on average gross fixed capital formation (GFCF in value terms) are the US, Germany and France, whereas those with the lowest average are Spain, Portugal and Belgium. The variation of the GFCF variable in a given country across sectors and years is very high, with the strongest values being registered in the US, Germany and France and the weakest values registered in Spain, Portugal and Belgium. The countries in the sample have similar resource intensity averages with low variation across sectors and years, the only notable exception being Portugal that has a relatively high standard deviation and a slightly higher average compared with the other countries. The lowest R&D intensity is found in Spain, followed by Italy and Belgium, whereas the highest is in the US. The variation in R&D intensity in a given country across sectors and time is relatively low.

Countries differ in terms of value added growth with Portugal having by far the highest average, followed by Spain and Italy. The standard deviation indicates moderate variation in terms of value added growth across sectors and across time in a given country, with the highest variation being registered in Portugal followed by Germany and Italy. Most countries registered negative employment growth averages with the lowest averages being in Germany and the UK and the only exceptions being Spain and Portugal that had positive averages. There is also moderate variation in terms of employment growth across sectors and time period in the same country. The evolution in terms of value added and employment growth illustrates that countries like Spain and Portugal which are relatively less advanced are experiencing the highest increases in productivity and are catching up with the others, whereas the more advanced countries are experiencing more modest increases in productivity that are not enough to compensate for the destruction in employment that they generate. The countries registering the highest averages in terms of labour productivity per person engaged are the US, Ireland and France, whereas the lowest labour productivity per person engaged can be found in Portugal, the UK and Spain. There is a very high variation in terms of labour productivity across sectors and years in a given country, with the US, Ireland, France and Germany having the highest standard deviation, whereas Portugal, Italy and the Netherlands have the lowest standard deviation.

When examining the evolution of data over time (Table A.11 in Appendix 2), we observe that the capital intensity average is largely stable, the only notable exception being an increase between 2000 and 2002. The variation of the capital intensity variable across time is moderate and fairly stable. The average of the gross fixed capital formation variable increased steadily between 1990 and 2002. The variation of the gross fixed capital formation variable across countries and sectors also increased in the 1990 to 2002 period. The average of the resource intensity variable remained stable across years, the only notable exception being an increase in 1995 followed by a return to the value that prevailed during the other years. The standard deviation of the resource intensity variable also remained stable across years, the only exception being a sharp increase in 1995 followed by a return to the normal standard deviation in the following year. The average of the R&D intensity variable

Box 3. Stylised facts on main determinants of firm entry and exit (cont.)

decreased between 1991 and 2001, after having increased between 1990 and 1991. The standard deviation of the R&D intensity variable was fairly stable over the 1990-2000 period and decreased only slightly in 2001. The evolution in the value added growth average has been very fluctuating across years with a stable standard deviation, the only notable exception being a sharp increase in variation followed by a sharp decrease over the 1995-1997 period. The average of the employment growth variable has increased over the 1992-1999 period and decreased in the 2000-2002 period. The standard deviation was largely stable over the years with only a sharp increase and then decrease in variation over the 1998-2000 period. There is a clear and sharp increase in labour productivity per person engaged between the 1997-2001 period, but this is accompanied by an equally sharp increase in the variation of productivity.

According to Figure A.2 in Appendix 2, the industries with the highest economies of scale are motor vehicles, tobacco, other transport equipment and basic metals, whereas those with the lowest economies of scale are other manufacturing, leather, fabricated metal products, instruments and non metallic mineral products. All the other industries occupy intermediate positions. Figure A.3 in Appendix 2 shows that the industries with the highest concentration in 1993 were office machinery and computers, other transport equipment, tobacco, motor vehicles, radio and television and basic metals, whereas those with the lowest concentration were fabricated metal products, wood, printing and leather, with the other industries occupying intermediate positions. The positions of these industries changes slightly when concentration was measured in 1987, as shown in Figure A.4 in Appendix 2. Figure A.5 in Appendix 2 shows that industries can be classified into fully differentiated, represented by instruments, radio and television, electrical machinery, office machinery and computers and machinery and equipment, semi-differentiated industries represented by chemical products, other transport equipment and motor vehicles, with all the other industries for which data is available being non-differentiated.

Figure A.6 in Appendix 2 shows the classification of industries by segmentation. Non-segmented industries are leather, wood, printing, machinery and equipment and instruments, semi-segmented industries are represented by food and beverages, rubber and plastics, chemical products and other transport equipment. All of the other industries for which data is available are fully segmented.

The examination of the correlation between variables (Table A.12 in Appendix 2) shows that they generally have low correlation, the only notable exceptions being a correlation of 56% between industry concentration and differentiation, 55% between resource intensity and capital intensity, 52% between industry concentration and segmentation, 49% between resource intensity and GFCF and 47% between capital intensity and GFCF. All of these correlations are significant at the 1% confidence level, but some of these results are expected because of the way in which the capital intensity and resource intensity variables were constructed. Moderate correlation of 34% is found between labour productivity and R&D intensity, 32% between scale economies and industry concentration, 31% between resource intensity and differentiation, 28% between scale economies and GFCF and 27% between scale economies and segmentation. The correlation between employment growth and capital intensity is 22%, employment growth and GFCF is 20%, as is the one between employment growth and value added growth, and between differentiation and capital intensity. There are positive correlations between GFCF and the concentration, differentiation and segmentation variables of 16%, 19% and 15% respectively. A positive correlation of 14% exists between concentration and capital intensity and there is also a negative correlation of 15% between R&D intensity and scale economies. Finally, we found positive correlations between resource intensity and the concentration and segmentation variables of 15% and 11% respectively. All of these are significant at the 1% confidence level.

Table A4. Concordance between NACE 2, ISIC Rev. 3 and NAICS 1997

Entry and exit data set Dun and Bradstreet		Entry barriers data set OECD (STAN/ANBERD/…)		entry-exit data set US Bureau of Census	
NACE2		ISIC Rev.3		NAICS 1997	
15	Food products and beverages	15	Food products and beverages	311	Food
				3121	Beverage
16	Tobacco products	16	Tobacco products	3122	Tobacco
17	Textiles	17	Textiles	313	Textile mills
				314	Textile product mills
18	Wearing apparel; dressing and dyeing	18	Wearing apparel, dressing and dying of fur	315	Apparel
19	Tanning and dressing of leather	19	Leather, leather products and footwear	316	Leather & allied product
20	Wood and of products of wood	20	Wood and products of wood and cork	321	Wood product
21	Pulp, paper and paper products	21	Pulp, paper and paper products	322	Paper
22	Publishing, printing and reproduction	22	Printing and publishing	323	Printing & related support activities
				511	Publishing industries
				512	Motion picture & sound recording industries
23	Coke, refined petroleum products	23	Coke, refined petroleum products and nuclear fuel	324	Petroleum & coal products
24	Chemicals and chemical products	24	Chemicals and chemical products	325	Chemical
				3346	Mfg & reproducing magnetic & optical media
25	Rubber and plastic products	25	Rubber and plastics products	326	Plastics & rubber products
26	Other non-metallic mineral products	26	Other non-metallic mineral products	327	Non-metallic mineral product
27	Basic metals	27	Basic metals	331	Primary metal
28	Fabricated metal products	28	Fabricated metal products	332	Fabricated metal product
29	Machinery and equipment n.e.c.	29	Machinery and equipment, n.e.c.	333	Machinery
				3352	Household appliance
				3353	Electrical equipment
				3359	Other electrical equipment & component
30	Office machinery and computers	30	Office, accounting and computing machinery	3341	Computer & peripheral equipment mfg
31	Electrical machinery and apparatus	31	Electrical machinery and apparatus, nec	3344	Semiconductor & other electronic component
				3351	Electric lighting equipment
32	Radio, television and communication	32	Radio, television and comm. equipm.	3342	Communications equipment
				3343	Audio & video equipment
33	Medical, precision and optical instrum.	33	Medical, precision and optical instruments	3345	measuring, medical, & control instruments
34	Motor vehicles, trailers	34	Motor vehicles, trailers and semi-trailers	3361	Motor vehicle
				3362	Motor vehicle body & trailer
				3363	Motor vehicle parts
35	Other transport equipment	35	Other transport equipment	3364	Aerospace product & parts
				3365	Railroad rolling stock
				3366	Ship & boat building
				3369	Other transportation equipment
36	Furniture; manufacturing n.e.c.	36	Furniture; manufacturing, n.e.c.	337	Furniture & related product
				339	Miscellaneous
40	Electricity, gas, water supply	40-41	Electricity, gas and water supply	221	Utilities
41	Collection and distribution of water				
45	Construction	45	Construction	23	Construction
50	Sale and repair of motor vehicles	50-52	Wholesale and retail trade; repairs	42	Wholesale trade
51	Wholesale trade and commission trade,			44	Retail Trade
52	Retail trade, except of motor vehicles				
		55	Hotels & restaurants	72	Accommodation & foodservices
60	Land transport; transport via pipelines	60-63	Transport and storage	48	Transportation & warehousing
63	Supporting and auxiliary transport act.			493	Warehousing & storage
64	Post and telecommunications	64	Post and telecommunications	492	Couriers & messengers
				513	Broadcasting & telecommunications
		65-67	Financial intermediation	52	Finance & insurance
70	Real estate activities	70-74	Real estate, renting and business activities	514	Information & data processing services
71	Renting of machinery and equipment			53	Real estate & rental & leasing
72	Computer and related activities			54	Professional, scientific, & technical services
74	Other business activities			55	Management of companies & enterprises

Table A5. Descriptive statistics for entry, exit and net entry rates

	entry rate					exit rate				net entry rate			
	# of obs.	Mean	s.d.	Min	Max	Mean	s.d.	Min	Max	Mean	s.d.	Min	Max
Year													
1997	252	6.5	4.2	0	39	2.0	1.4	0	8	4.6	4.6	-6	38
1998	252	6.1	3.6	0	26	1.7	1.1	0	7	4.4	3.8	-5	25
1999	280	6.3	4.2	0	33	2.7	3.0	0	19	3.7	4.7	-17	33
2000	280	5.8	4.0	0	25	3.0	2.9	0	18	2.8	4.1	-8	22
2001	280	5.4	4.8	0	46	3.3	3.5	0	20	2.2	5.1	-20	36
2002	252	4.0	2.9	0	17	2.5	2.0	0	17	1.4	3.3	-11	15
2003	252	2.1	2.1	0	11	2.8	3.1	0	30	-0.6	4.3	-30	9
Country													
BE	196	4.7	2.7	0	14	1.7	0.9	0	7	3.0	2.7	-4	13
DE	196	4.2	3.5	0	33	3.0	2.6	0	14	1.3	4.4	-12	33
ES	196	8.3	4.6	1	39	2.0	1.0	0	9	6.3	5.0	-3	38
FR	196	4.5	2.2	0	14	2.0	2.2	0	20	2.5	3.3	-20	14
IR	196	3.0	4.1	0	20	1.4	3.4	0	30	1.6	5.9	-30	20
IT	196	3.5	2.7	0	21	3.0	1.3	1	8	0.5	3.3	-7	19
NL	196	6.2	3.4	0	25	1.2	0.8	0	5	5.1	3.4	-2	25
PT	196	4.9	4.6	0	34	1.8	2.0	0	17	3.1	5.1	-17	33
UK	196	5.7	3.4	0	21	4.1	1.7	0	12	1.7	4.2	-9	20
US	84	10.0	5.4	4	46	9.7	3.0	5	19	0.3	4.7	-6	36
Industry													
Food & beverages	66	4.3	2.2	0	11	2.2	2.2	0	10	2.2	2.6	-6	8
Tobacco	66	4.3	7.1	0	46	3.3	4.3	0	17	0.9	7.5	-17	36
Textile	66	3.8	2.1	0	9	3.0	2.8	0	16	0.9	3.4	-16	6
Wearing	66	5.1	3.9	0	17	4.4	5.2	0	30	0.8	5.7	-30	16
Leather	66	4.0	2.9	0	11	3.1	2.7	0	13	1.0	3.5	-10	10
Wood	66	3.7	2.1	0	9	2.0	2.1	0	9	1.8	2.6	-7	8
Paper	66	3.8	2.0	0	8	2.7	1.6	0	8	1.2	2.7	-8	7
Printing	66	4.7	2.3	0	9	2.6	2.4	0	11	2.1	2.8	-5	8
Refined petroleum	66	4.6	3.7	0	20	2.9	2.4	0	9	1.7	4.7	-8	20
Chemical products	66	4.5	2.1	0	9	2.7	1.6	0	8	1.7	2.5	-6	7
Rubber & plastics	66	4.3	3.0	0	13	2.7	1.9	0	10	1.8	3.3	-10	9
Non metallic mineral products	66	4.1	2.2	0	9	2.1	1.7	0	7	2.0	2.5	-6	7
Basic metals	66	4.5	2.9	0	13	2.5	1.8	0	10	2.0	2.7	-10	7
Fabricated metal products	66	4.3	2.0	0	9	2.3	1.9	0	11	2.1	3.0	-11	8
Machinery & equipment	66	4.4	2.4	0	10	2.5	1.7	0	8	2.0	2.8	-5	8
Office machinery & computers	66	6.0	7.6	0	39	3.5	5.1	0	20	2.6	8.7	-20	38
Electrical machinery	66	4.8	2.5	0	13	2.7	1.9	0	9	2.1	3.0	-6	12
Radio & television	66	5.6	3.8	0	17	2.9	2.3	0	11	2.7	4.4	-7	17
Instruments	66	4.4	2.2	0	10	2.1	2.0	0	9	2.4	3.0	-9	9
Motor vehicles	66	4.2	2.2	0	10	2.6	2.1	0	10	1.6	2.9	-10	9
Other transport equipment	66	5.8	2.9	0	12	2.8	2.3	0	10	2.9	3.5	-6	10
Other manufacturing	66	4.6	2.4	0	10	2.2	2.1	0	10	2.5	2.9	-5	9
Electricity, gas & water supply	66	7.7	4.2	0	15	1.8	1.7	0	8	5.9	4.3	-3	14
Construction	66	6.6	3.4	0	14	2.4	2.6	0	12	4.3	3.9	-5	13
Wholesale & retail, repairs	66	5.1	2.4	0	11	2.0	2.0	0	10	3.1	2.8	-4	11
Transport & telecommunications	66	7.0	5.8	0	34	1.8	2.8	0	14	5.2	5.9	-4	33
Post & telecommunications	66	11.5	7.1	0	33	2.6	3.1	0	15	9.0	7.5	-9	33
Real estate & business activities	66	8.7	4.6	0	19	2.0	2.7	0	12	6.7	5.1	-7	18

Sources: Entry-exit data set, own calculations.
Notes: a) First 11 months for 2003, 1999-2001 for the US.

Table A6. Intra- and inter-industry variability: Analysis of variance

	Entry rate		Exit rate		Net entry rate	
	Inter-group	Intra-group	Inter-group	Intra-group	Inter-group	Intra-group
Country						
Variance	5834	24789	5798	7325	6066	33697
%	19.0	81.0	44.2	55.8	15.3	84.7
Industry						
Variance	5380	25243	562	12561	6444	33319
%	17.6	82.4	4.3	95.7	16.2	83.8
Year						
Variance	3942	26681	512	12611	5245	34518
%	12.9	87.1	3.9	96.1	13.2	86.8

Sources: Entry-exit data set, own calculations.
Notes: a) First 11 months for 2003, 1999-2001 for the US.

Table A7. Coefficient of correlation (ρ) between entry and exit rates

Year	ρ	Industry	ρ	Industry	ρ
1997	-0.12***				
1998	-0.08	Food & beverages	0.30**		
1999	0.18*	Tobacco	0.20	Electrical machinery	0.03
2000	0.33*	Textile	0.02	Radio & television	0.02
2001	0.26*	Wearing	0.26**	Instruments	-0.05
2002	0.19	Leather	0.22***	Motor vehicles	0.09
2003	-0.34*	Wood	0.22***	Other transport equipment	0.15
Country	ρ	Paper	-0.18	Other manufacturing	0.21***
BE	0.12	Printing	0.25**	Electricity, gas & water supply	0.11
DE	-0.01	Refined petroleum	-0.16	Construction	0.18
ES	-0.19*	Chemical products	0.10	Wholesale & retail, repairs	0.18
FR	-0.18*	Rubber & plastics	0.09	Transport & telecommunications	0.18
IR	-0.27*	Non metallic mineral products	0.15	Post & telecommunications	0.09
IT	-0.35*	Basic metals	0.39*	Real estate & business activities	0.07
NL	0.11	Fabricated metal products	-0.13		
PT	-0.03	Machinery & equipment	0.09		
UK	-0.31*	Office machinery & computers	0.12		
US	0.52*				

Sources: Entry-exit data set, own calculations.
Notes: a) First 11 months for 2003, 1999-2001 for the US.
b) * (**, ***) statistically significant at the 1 (resp. 5, 10) % level.

Table A8. Entry and exit rate correlations

Entry Rate Correlation										
	BE	DE	ES	FR	IE	IT	NL	PT	UK	US
BE	1									
DE	0.58*	1								
ES	0.45*	0.48*	1							
FR	0.27*	0.22*	0.43*	1						
IE	0.43*	0.44*	0.39*	0.27*	1					
IT	0.48*	0.62*	0.54*	0.29*	0.50*	1				
NL	0.39*	0.28*	0.16**	0.01	0.46*	0.37*	1			
PT	0.41*	0.42*	0.24*	0.08	0.26*	0.36*	0.67*	1		
UK	0.58*	0.63*	0.58*	0.23*	0.53*	0.69*	0.44*	0.39*	1	
US	0.15	0.33*	0.41*	0.39*	0.13	0.29**	-0.03	0.38*	0.13	1
Exit Rate Correlation										
	BE	DE	ES	FR	IE	IT	NL	PT	UK	US
BE	1									
DE	0.09	1								
ES	0.40*	-0.18**	1							
FR	0.15**	0.16**	-0.02	1						
IE	-0.14***	-0.29*	0.14**	-0.07	1					
IT	0.03	-0.03	0.25*	0.32*	0.51*	1				
NL	0.02	0.16**	-0.09	-0.03	-0.20*	-0.18**	1			
PT	-0.03	0.23*	-0.04	0.35*	0.13***	0.24*	0.04	1		
UK	0.22*	0.04	0.32*	0.21*	0.22*	0.44*	-0.10	0.22*	1	
US	-0.14	0.13	-0.25**	0.10	0.02	0.37*	-0.28**	0.10	0.43*	1

Sources: Entry-exit data set, own calculations.

Notes: a) First 11 months for 2003, 1999-2001 for the US.
b) * (**, ***) statistically significant at the 1% (resp. 5% and 10%) level.

Table A9. Entry barriers: Descriptive statistics by industry

Industry	Capital Intensity		GFCF		Resource Intensity		R&D Intensity		Value Added Growth		Employment Growth		LPPE	
	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
Food & beverages	4.34	1.07	4517	4428	0.03	0.01	0.31	0.13	2.78	3.30	-0.16	1.72	44061	14842
Tobacco	2.78	1.38	154	203	0.03	0.02	0.99	1.24	4.52	14.22	-4.24	6.50	44061	14842
Textile	3.50	0.97	1490	1608	0.03	0.01	0.26	0.19	0.11	4.78	-4.30	3.95	31235	12176
Wearing	2.12	1.02	305	350	0.03	0.01	0.13	0.14	-0.19	7.14	-5.58	5.57	25195	10640
Leather	2.80	1.21	165	238	0.03	0.01	0.22	0.26	-0.26	8.03	-4.47	7.65	28040	10731
Wood	5.00	2.02	699	957	0.03	0.01	0.66	0.41	3.67	6.19	-0.33	3.71	30578	10775
Paper	7.11	1.96	2062	3088	0.02	0.01	1.44	2.58	3.86	11.22	-0.98	3.00	59371	16969
Printing	5.67	1.80	2177	2624	0.03	0.01	0.08	0.11	3.87	4.54	-0.50	3.46	53359	37498
Refined petroleum	4.17	2.43	1268	1818	0.03	0.03	0.79	0.64	29.97	197.18	-2.62	6.54	145038	56685
Chemical products	6.26	1.32	5207	6843	0.02	0.01	3.93	1.82	3.55	5.63	-1.54	2.76	112841	76847
Rubber & plastics	6.50	1.71	1930	2432	0.03	0.02	0.86	0.46	3.88	4.95	0.57	3.72	42773	15198
Non metallic mineral products	7.19	2.02	1787	1749	0.03	0.01	0.52	0.32	3.33	5.64	-0.59	3.51	45953	14185
Basic metals	5.25	1.97	2069	2358	0.03	0.01	0.57	0.34	0.85	13.30	-2.27	4.15	55443	18808
Fabricated metal products	4.69	1.45	2524	2541	0.03	0.01	0.38	0.18	3.72	5.24	0.42	3.18	35490	14522
Machinery & equipment	4.08	1.02	2780	3622	0.03	0.01	1.59	0.66	3.10	5.30	-0.39	4.07	39965	14265
Office machinery & computers	4.18	2.23	757	1132	0.02	0.01	7.57	8.13	4.19	43.81	1.91	48.44	578186	432127
Electrical machinery	4.57	1.33	1546	1394	0.03	0.02	3.40	3.96	3.29	7.08	0.23	4.33	72690	93543
Radio & TV	6.89	2.88	3437	6085	0.03	0.01	7.38	3.45	4.89	11.17	-0.92	6.08	278704	343653
Instruments	4.53	2.08	1806	2838	0.04	0.02	4.97	3.34	5.92	12.27	-0.03	4.75	33395	11827
Motor vehicles	5.74	2.63	4177	4133	0.03	0.01	2.53	1.42	6.60	16.27	-0.10	5.37	53942	23625
Other transport equipment	3.72	1.79	1167	1602	0.13	0.89	6.39	3.82	4.86	14.90	-1.09	7.27	41490	15450
Other manufacturing	4.14	0.86	781	550	0.03	0.01	0.36	0.26	2.00	4.49	-1.50	3.69	30749	11170
Electricity, gas, water supply	16.83	4.96	12367	18017	0.03	0.01	0.30	0.27	3.20	5.46	-2.71	3.89	150477	47346
Construction	3.08	1.25	4849	5491	0.03	0.01	0.05	0.04	4.45	5.75	0.56	3.92	31129	9415
Wholesale, retail trade	6.85	0.77	28058	48364	0.03	0.01	0.11	0.17	4.67	2.73	0.96	1.69	31951	9659
Land & other transport	13.88	3.44	19817	18986	0.03	0.01	0.22	0.29	4.84	3.52	0.81	2.46	45467	10845
Post & telecom	20.41	6.39	22137	34004	0.03	0.01	0.70	0.51	6.71	5.77	-0.05	3.64	77263	26119
Real estate, renting & busin. act.	22.18	11.19	71536	63908	0.03	0.01	0.34	0.17	7.35	2.98	5.03	4.58	71519	26324

Sources: STAN and ANBERD (OECD), own calculations.

Table A10. Entry barriers: Descriptive statistics by country

Country	Capital Intensity		GFCF		Resource Intensity		R&D Intensity		Value Added Growth		Employment Growth		LPPE	
	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
BE	6.38	4.22	1564	3573	0.04	0.02	1.44	2.31	2.56	8.66	-1.69	5.56	88106	96396
DE	8.15	7.56	12041	35240	0.03	0.01	2.20	3.57	1.52	11.50	-3.09	5.51	88136	156977
FR	7.69	6.83	8417	21955	0.03	0.01	2.23	3.11	2.35	9.13	-1.23	3.61	99932	171194
IR	-	-	-	-	-	-	-	-	-	-	-	-	107679	252026
IT	7.84	5.47	4863	11152	0.03	0.01	1.33	2.35	4.09	11.11	-0.74	3.51	63459	68637
NL	7.30	7.13	1904	5157	0.03	0.01	2.22	5.62	3.97	10.72	-0.26	5.64	67672	72295
PT	9.58	10.00	875	1696	0.07	0.55	-	-	20.31	134.89	0.67	29.11	43022	57553
ES	4.12	2.11	592	662	0.03	0.01	0.98	1.58	5.34	9.62	0.95	5.24	60177	87803
UK	5.25	3.87	2286	3615	0.03	0.01	2.07	2.23	2.80	6.91	-2.88	5.39	55938	90287
USA	5.49	4.20	23926	40251	0.03	0.01	3.39	4.12	3.30	6.67	-0.73	3.78	143868	268537

Sources: STAN and ANBERD (OECD), own calculations.

Table A11. Entry Barriers: Descriptive statistics by year

Year	Capital Intensity		GFCF		Resource Intensity		R&D Intensity		Value Added Growth		Employment Growth		LPPE	
	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
1990	6.64	5.89	4982	14296	0.03	0.01	2.34	3.79	-	-	-	-	-	-
1991	6.96	6.33	5697	16369	0.03	0.01	2.55	3.78	4.91	12.43	-0.71	5.16	-	-
1992	6.69	6.36	5914	17301	0.03	0.01	2.17	3.26	3.15	8.45	-3.51	5.27	-	-
1993	6.29	5.81	5813	17927	0.03	0.01	2.13	3.27	0.44	9.65	-3.35	4.79	-	-
1994	6.03	5.62	6192	19868	0.03	0.01	1.91	3.04	6.22	10.66	-2.15	4.88	-	-
1995	6.52	6.01	6322	20491	0.06	0.56	1.85	3.11	6.24	11.06	-0.68	5.28	-	-
1996	6.58	5.72	6589	21131	0.03	0.03	1.93	3.73	10.41	122.58	-0.75	6.60	-	-
1997	6.66	5.69	7020	22607	0.03	0.02	1.78	3.34	4.76	8.66	0.16	4.74	59296	53986
1998	6.69	5.16	7923	24800	0.03	0.01	1.75	3.27	4.72	11.61	0.03	7.50	67467	82817
1999	6.63	5.50	8500	27258	0.03	0.01	1.75	3.35	2.76	25.36	1.18	27.50	80030	131043
2000	6.42	5.57	9156	29497	0.03	0.02	1.68	3.38	5.53	15.42	0.29	4.35	93678	179365
2001	6.91	5.65	10305	30303	0.03	0.01	1.63	2.61	2.37	8.26	0.06	4.56	108523	238657
2002	8.13	6.18	11141	31743	0.03	0.02	-	-	0.80	6.12	-1.17	3.56	-	-

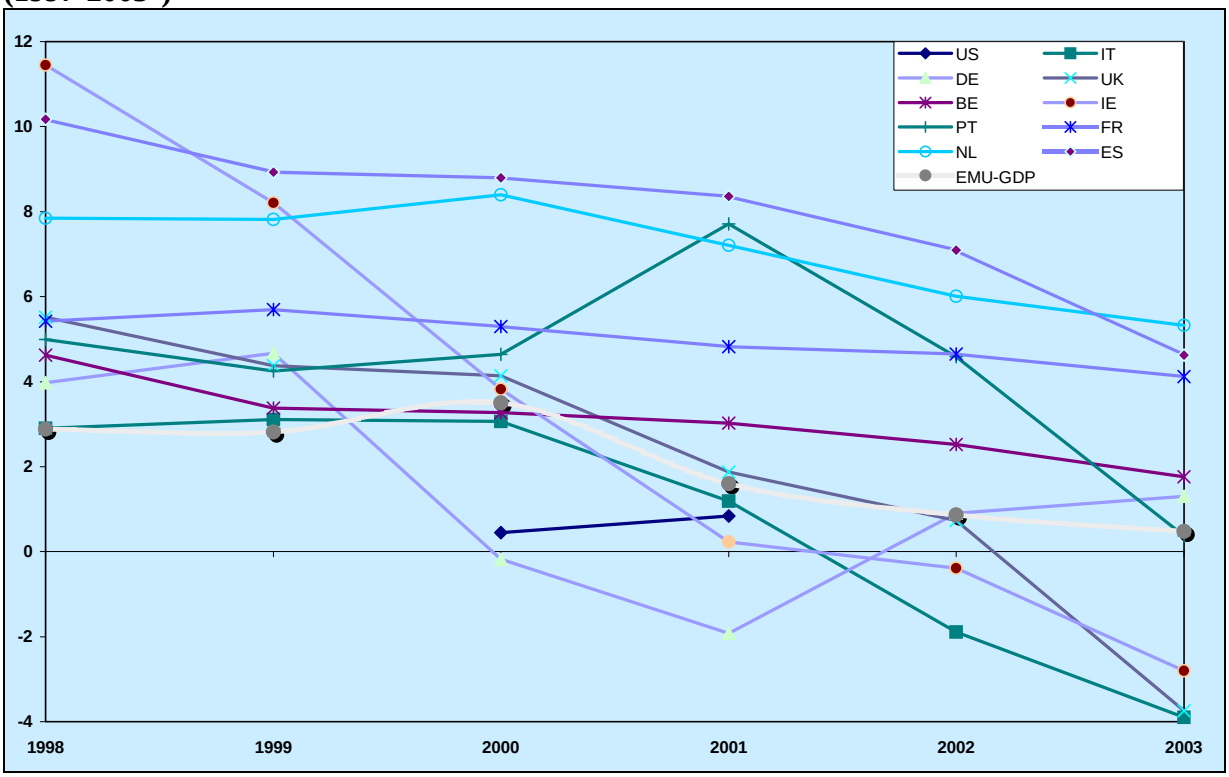
Sources: STAN and ANBERD (OECD), own calculations.

Table A12. Entry barriers: Correlation coefficients

	CI	GFCF	RI	RDI	ΔVA	ΔL	LPPE	Scal	Conc	Differ	Segmen
Capital Intensity	1.00										
GFCF	0.47*	1.00									
Resource Intensity	-0.04***	-0.04***	1.00								
R&D Intensity	-0.09*	-0.06*	-0.09*	1.00							
Value Added Growth	0.03	0.01	0.00	0.01	1.00						
Employment Growth	0.22*	0.20*	0.02	-0.01	0.20*	1.00					
LPPE	0.07**	0.04	-0.09*	0.34*	-0.01	0.02	1.00				
Scale economies	0.03	0.28*	0.38*	-0.15*	-0.02	0.02	-0.06***	1.00			
Concentration	0.14*	0.16*	0.15*	-0.04	-0.04	0.01	-0.02	0.32*	1.00		
Differentiation	0.20*	0.19*	0.07*	0.06**	-0.04	0.03	-0.07***	-0.01	0.56*	1.00	
Segmentation	0.09*	0.15*	0.17*	-0.03	0.01	0.03	0.08**	0.27*	0.52*	0.07*	1.00

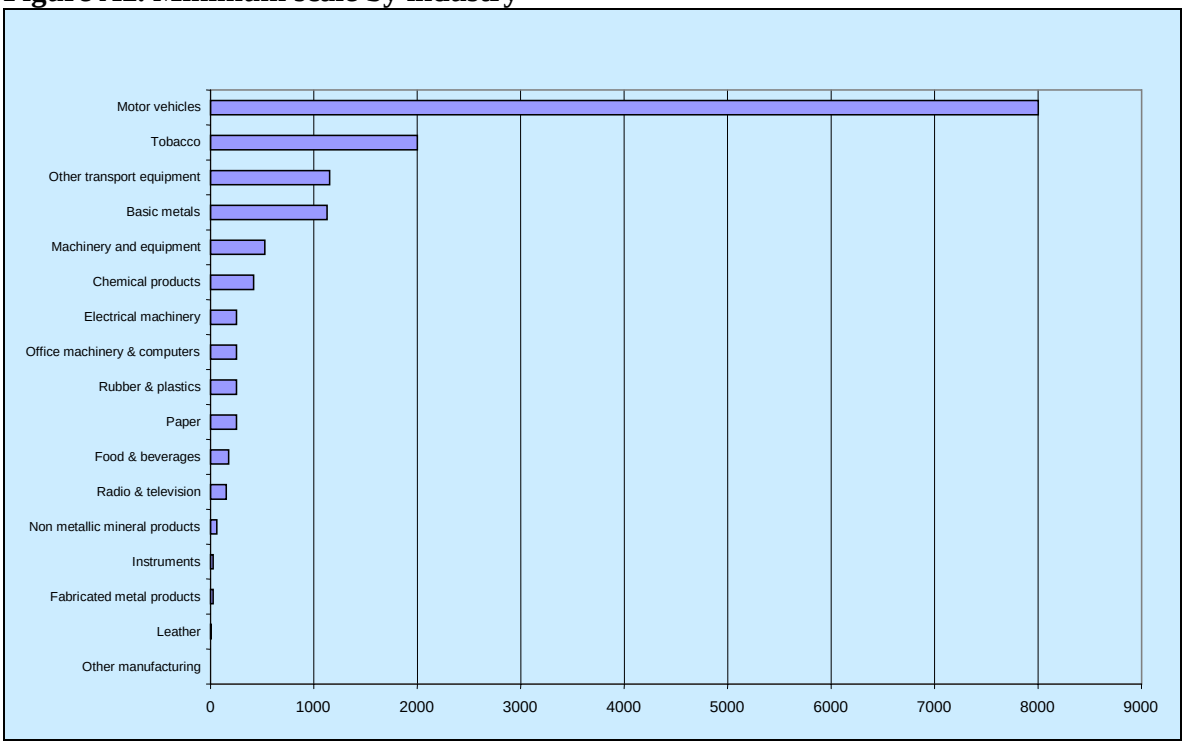
Sources: STAN, ANBERD (OECD) and Davies and Lyons (1996), own calculations.
Notes: * (**, ***) statistically significant at the 1% (resp. 5%, 10%) level.

Figure A1. Annual growth rate of the total number of firms (in %) by country (1997-2003[a])



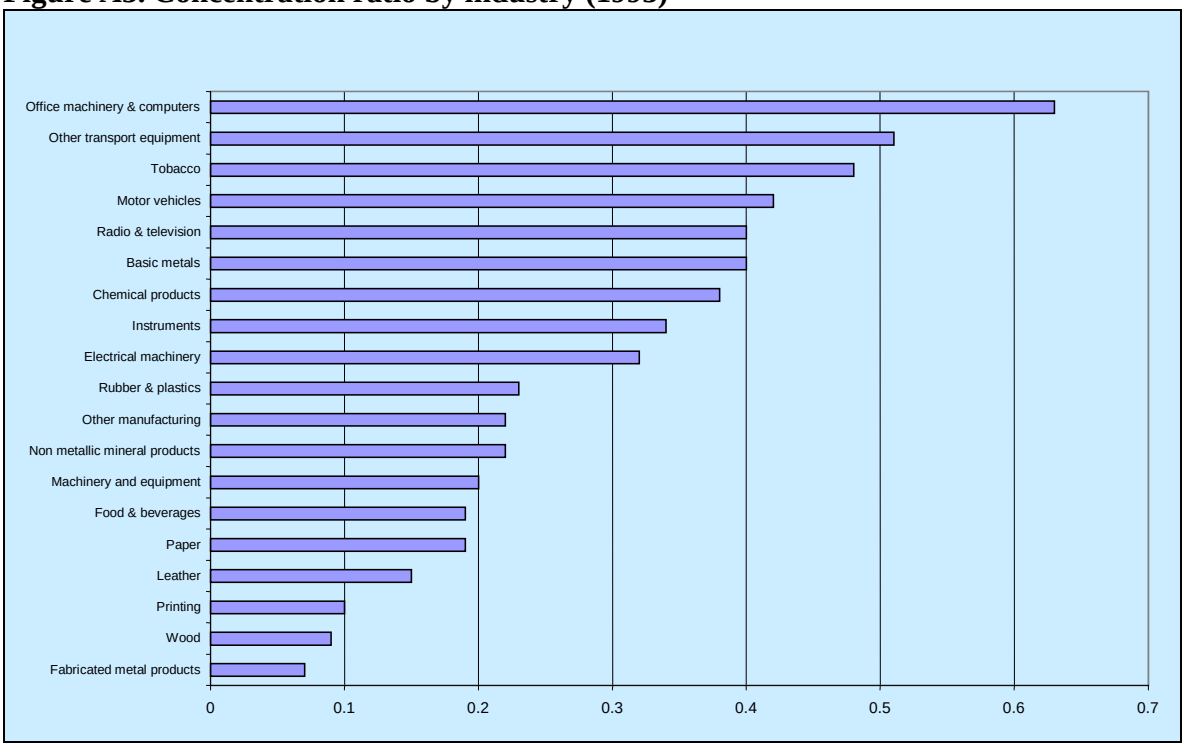
Sources: Entry-exit data set, own calculations.
Notes: a) First 11 months for 2003, 1999-2001 for the US.

Figure A2. Minimum scale by industry



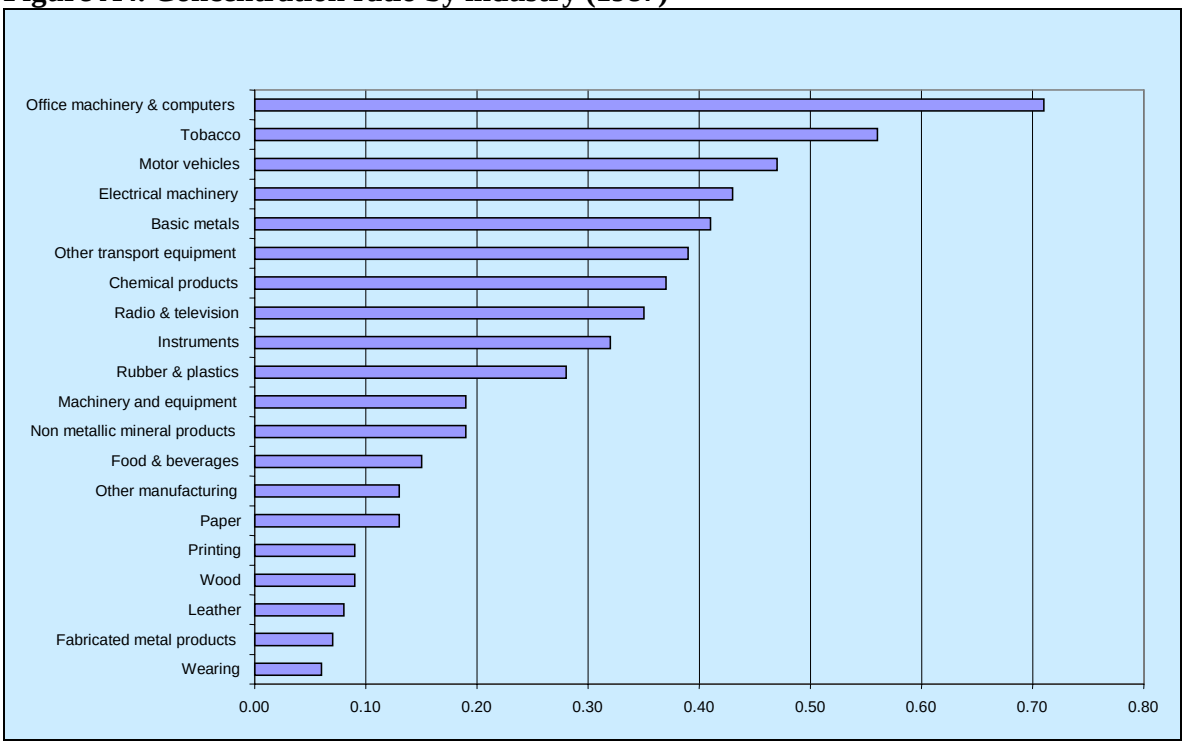
Source: Martins et al. (1996), own calculations.

Figure A3. Concentration ratio by industry (1993)



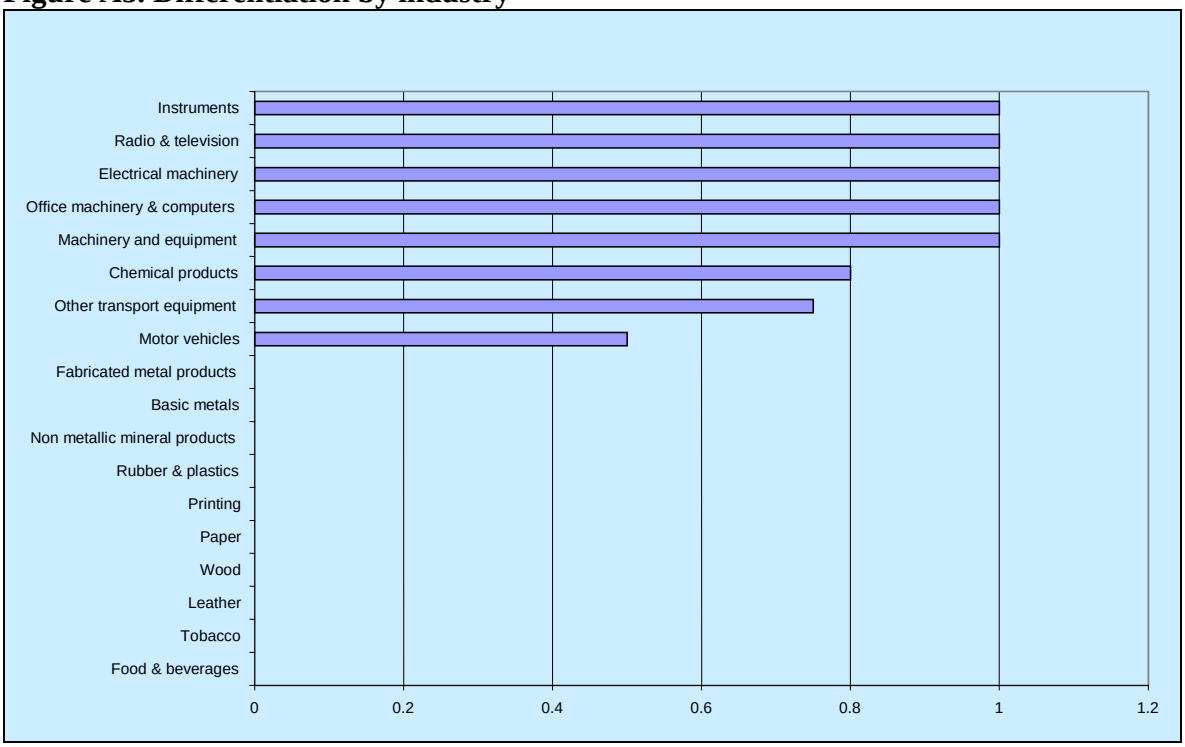
Source: Davies and Lyons (1996), own calculations.

Figure A4. Concentration ratio by industry (1987)



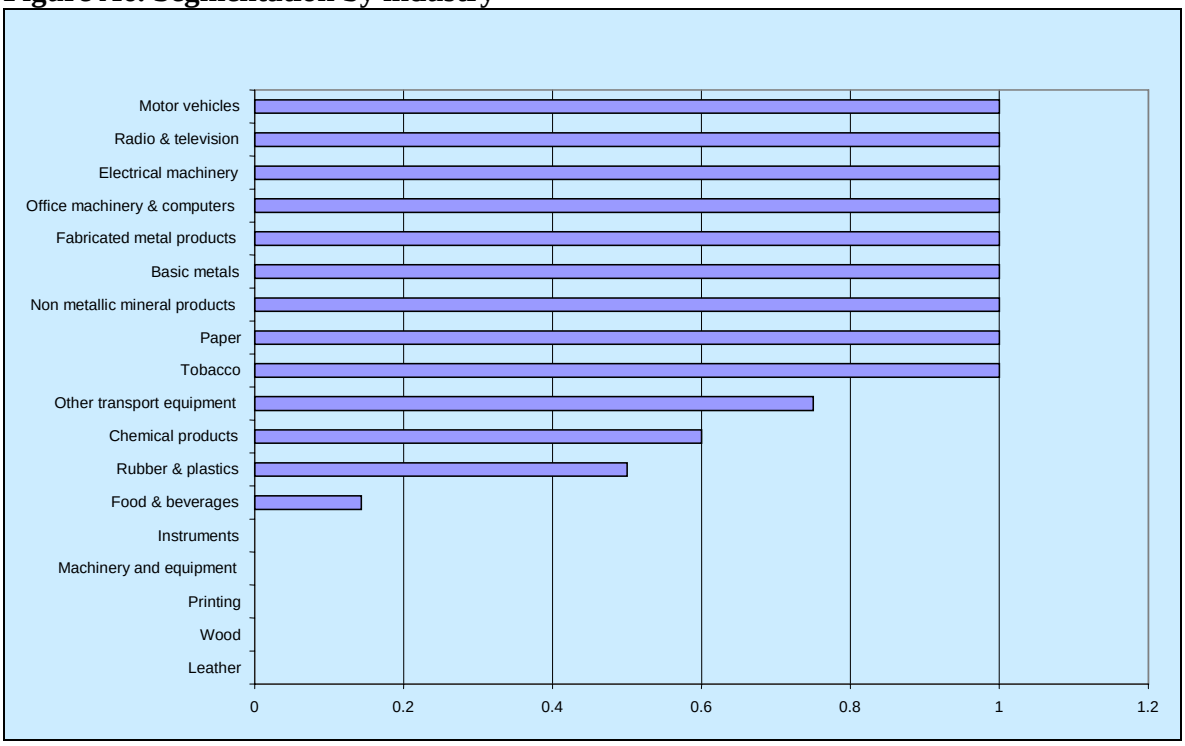
Source: Davies and Lyons (1996), own calculations.

Figure A5. Differentiation by industry



Source: Martins et al. (1996), own calculations.

Figure A6. Segmentation by industry



Source: Martins et al. (1996), own calculations.

Table A13. Economy-wide regulation indicators

YEAR		1995	1996	1997	1998	1999	2000	2001	2002	2003	Source
1. Ease of starting a new business											
Starting a new business is generally easy	BE	4.6	5.0	5.3	5.7	6.0	6.4	4.2	5.2	6.2	Fraser
	DE	5.0	5.3	5.6	5.8	6.1	6.4	5.1	5.5	5.9	
	FR	3.4	3.8	4.1	4.5	4.8	5.2	3.5	3.7	3.9	
	IE	7.6	7.5	7.3	7.2	7.0	6.9	6.4	6.2	6.0	
	IT	4.1	4.3	4.5	4.7	4.9	5.1	4.4	4.2	4.0	
	NL	7.5	7.5	7.5	7.6	7.6	7.6	6.1	6.7	7.3	
	PT	4.3	4.6	4.9	5.1	5.4	5.7	5.1	3.8	2.5	
	SP	5.3	5.4	5.5	5.5	5.6	5.7	4.6	5.2	5.8	
	UK	8.1	8.0	7.9	7.9	7.8	7.7	7.5	7.2	6.9	
	US	8.4	8.4	8.4	8.4	8.4	8.4	8.1	8.0	7.9	
2. Trade											
Mean tariff rate	BE	8.7	8.9	9.0	9.2	9.3	9.5	9.2	9.2	9.2	Fraser
	DE	8.7	8.9	9.0	9.2	9.3	9.5	9.2	9.2	9.2	
	FR	8.7	8.9	9.0	9.2	9.3	9.5	9.2	9.2	9.2	
	IE	8.7	8.9	9.0	9.2	9.3	9.5	9.2	9.2	9.2	
	IT	8.7	8.9	9.0	9.2	9.3	9.5	9.2	9.2	9.2	
	NL	8.7	8.9	9.0	9.2	9.3	9.5	9.2	9.2	9.2	
	PT	8.7	8.9	9.0	9.2	9.3	9.5	9.2	9.2	9.2	
	SP	8.7	8.9	9.0	9.2	9.3	9.5	9.2	9.2	9.2	
	UK	8.7	8.9	9.0	9.2	9.3	9.5	9.2	9.2	9.2	
	US	8.8	8.9	9.0	9.0	9.1	9.2	9.2	9.2	9.2	
Hidden import barriers: No barriers other than published tariffs and quotas	BE	8.3	8.3	8.3	8.2	8.2	8.2	8.2	8.2	8.2	Fraser
	DE	8.3	8.3	8.4	8.4	8.5	8.5	7.9	8.2	8.5	
	FR	7.7	7.8	8.0	8.1	8.3	8.4	6.9	7.7	8.5	
	IE	8.9	8.8	8.6	8.5	8.3	8.2	8.3	7.7	7.1	
	IT	7.0	7.1	7.3	7.4	7.6	7.7	7.0	6.7	6.4	
	NL	8.9	9.0	9.1	9.1	9.2	9.3	8.5	8.2	7.9	
	PT	8.2	8.1	8.0	7.9	7.8	7.7	8.9	8.0	7.1	
	SP	7.6	7.6	7.6	7.6	7.6	7.6	7.9	7.3	6.7	
	UK	8.0	8.2	8.4	8.6	8.8	9.0	8.2	8.3	8.4	
	US	7.8	7.9	7.9	8.0	8.0	8.1	7.7	6.8	5.9	
3. State involvement in the economy											
Transfers and subsidies as a % of GDP	BE	3.0	3.1	3.2	3.2	3.3	3.4	3.8	3.8	3.8	Fraser
	DE	4.3	4.3	4.4	4.4	4.5	4.5	2.3	2.3	2.3	
	FR	2.5	2.5	2.4	2.4	2.3	2.3	3.4	3.4	3.4	
	IE	5.1	4.9	4.7	4.6	4.4	4.2	4.2	4.2	4.2	
	IT	2.3	2.7	3.1	3.6	4.0	4.4	4.6	4.6	4.6	
	NL	2.0	2.2	2.3	2.5	2.6	2.8	4.2	4.2	4.2	
	PT	6.5	6.4	6.3	6.3	6.2	6.1	5.9	5.9	5.9	
	SP	5.1	5.1	5.1	5.2	5.2	5.2	5.8	5.8	5.8	
	UK	5.3	5.4	5.4	5.5	5.5	5.6	6.3	6.3	6.3	
	US	6.3	6.4	6.5	6.5	6.6	6.7	6.8	6.7	6.6	

Table A13. Economy-wide regulation indicators (cont.)

YEAR		1995	1996	1997	1998	1999	2000	2001	2002	2003	source
Government enterprises and investment as a % of GDP	BE	6.0	6.0	6.0	6.0	6.0	6.0	10.0	10.0	10.0	Fraser
	DE	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
	FR	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
	IE	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
	IT	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
	NL	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
	PT	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
	SP	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
	UK	8.0	8.0	8.0	8.0	8.0	8.0	10.0	10.0	10.0	
	US	8.0	8.4	8.8	9.2	9.6	10.0	10.0	10.0	10.0	
3. State involvement in the economy											
Price controls: extent to which businesses are free to set their own prices	BE	5.0	5.2	5.4	5.6	5.8	6.0	5.0	5.0	5.0	Fraser
	DE	9.0	8.8	8.6	8.4	8.2	8.0	6.0	7.0	8.0	
	FR	8.0	8.0	8.0	8.0	8.0	8.0	7.0	7.0	7.0	
	IE	9.0	9.0	9.0	9.0	9.0	9.0	7.0	6.0	5.0	
	IT	6.0	6.0	6.0	6.0	6.0	6.0	5.0	5.0	5.0	
	NL	7.0	7.2	7.4	7.6	7.8	8.0	7.0	6.0	5.0	
	PT	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
	SP	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
	UK	9.0	8.8	8.6	8.4	8.2	8.0	6.0	6.0	6.0	
	US	9.0	8.8	8.6	8.4	8.2	8.0	8.0	7.0	6.0	
4. Administrative burdens on business											
Senior management spends a substantial amount of time dealing with government bureaucracy	BE	6.5	7.0	7.5	7.9	8.4	8.9	3.5	6.8	10.0	Fraser
	DE	6.5	6.9	7.3	7.7	8.1	8.5	6.5	6.5	6.5	
	FR	6.3	6.7	7.0	7.4	7.7	8.1	6.3	6.5	6.7	
	IE	7.6	7.7	7.7	7.8	7.8	7.9	5.3	6.5	7.7	
	IT	4.7	5.0	5.3	5.5	5.8	6.1	6.8	6.8	6.8	
	NL	7.4	7.7	8.1	8.4	8.8	9.1	5.5	6.3	7.1	
	PT	5.5	5.8	6.2	6.5	6.9	7.2	4.8	5.8	6.8	
	SP	6.4	6.7	7.0	7.3	7.6	7.9	7.0	7.3	7.6	
	UK	7.8	7.8	7.9	7.9	8.0	8.0	7.0	6.0	5.0	
	US	7.5	7.6	7.8	7.9	8.1	8.2	6.5	6.8	7.1	
5. Regulatory quality											
price controls/ inadequate bank supervision/ burdens imposed by excessive regulation in foreign trade/ business development	BE	7.2	7.2	7.2	7.1	6.8	6.5	7.1	7.8	8.4	World Bank
	DE	7.7	7.6	7.5	7.4	7.5	7.7	8.0	8.2	8.4	
	FR	7.0	7.0	6.9	6.9	6.7	6.5	7.0	7.5	8.0	
	IE	7.5	7.7	7.9	8.1	8.2	8.3	8.3	8.3	8.2	
	IT	6.3	6.4	6.5	6.6	6.6	6.5	6.9	7.3	7.7	
	NL	8.0	8.0	8.0	8.0	8.4	8.8	8.7	8.7	8.7	
	PT	7.5	7.4	7.4	7.4	7.2	7.1	7.5	8.0	8.4	
	SP	6.7	6.9	7.1	7.3	7.5	7.7	7.8	7.8	7.9	
	UK	8.0	8.1	8.1	8.2	8.3	8.3	8.4	8.5	8.6	
	US	7.4	7.6	7.8	8.0	8.0	8.0	8.0	8.0	8.0	

Table A14. Correlation matrix of economy-wide PMR indicators

	civ5	aii4	bi4	b1	c1	ci5	ciii5	rqs
civ5	1							
aii4	0.03	1						
bi4	0.38*	0.01	1					
b1	0.34*	0.03	-0.24**	1				
c1	0.73*	0.02	0.34*	0.17***	1			
ci5	0.50*	-0.15	0.45*	0.03	0.21**	1		
ciii5	0.52*	0.25**	0.31*	-0.03	0.16	0.39*	1	
rqs	0.54*	0.16	0.33*	0.26*	0.65*	0.21**	0.26*	1

Sources: Fraser and Worldbank databases, own calculations.

Notes: * (**, ***) statistically significant at the 1% (resp. 5% and 10%) level;
civ5 = ease of starting a new business; aii4 = mean tariff rate;
bi4 = hidden import barriers; b1 = transfers and subsidies as a % of GDP;
c1 = government enterprises and investment as a % of GDP;
ci5 = price controls; ciii5 = time spent with bureaucracy;
rqs = regulatory quality.

Table A15. Industry-specific product market reform indicators (1998)

Country	ISIC rev.3	Industry sector	Summary indicators	
			Total[a]	Net of public ownership[b]
BE	40_41	Electricity, gas & water	4.3	3.0
BE	50_51	Sale maintenance & wholesale		
BE	52	Retail trade	7.2	7.2
BE	60_63	Transport	9.0	9.0
BE	64	Post & Telecom	5.0	5.2
BE	74	Other business services	7.6	7.6
FR	40_41	Electricity, gas & water	2.2	1.9
FR	50_51	Sale maintenance & wholesale		
FR	52	Retail trade	5.4	5.4
FR	60_63	Transport	8.8	8.8
FR	64	Post & Telecom	5.0	5.5
FR	74	Other business services	8.1	8.1
IT	40_41	Electricity, gas & water	2.2	2.1
IT	50_51	Sale maintenance & wholesale		
IT	52	Retail trade	6.6	6.6
IT	60_63	Transport	8.6	8.6
IT	64	Post & Telecom	5.5	5.2
IT	74	Other business services	8.2	8.2
NL	40_41	Electricity, gas & water	2.8	3.2
NL	50_51	Sale maintenance & wholesale		
NL	52	Retail trade	7.5	7.5
NL	60_63	Transport	9.1	9.1
NL	64	Post & Telecom	6.8	7.2
NL	74	Other business services	8.9	8.9
SP	40_41	Electricity, gas & water	5.3	4.7
SP	50_51	Sale maintenance & wholesale	8.6	
SP	52	Retail trade	7.7	7.7
SP	60_63	Transport	8.9	8.9
SP	64	Post & Telecom	6.1	5.9
SP	74	Other business services	7.1	7.1
PT	40_41	Electricity, gas & water	4.0	4.3
PT	50_51	Sale maintenance & wholesale		
PT	52	Retail trade	8.2	8.2
PT	60_63	Transport	8.9	8.9
PT	64	Post & Telecom	4.8	4.5
PT	74	Other business services	7.1	7.1
US	40_41	Electricity, gas & water	5.5	4.4
US	50_51	Sale maintenance & wholesale		
US	52	Retail trade	9.1	9.1
US	60_63	Transport	9.4	9.4
US	64	Post & Telecom	8.4	8.9
US	74	Other business services	8.0	8.0

Source: OECD, own calculations.

Notes:

a) including all dimensions of regulation covered in an industry;

b) including all dimensions of regulation covered in an industry except public ownership.

Table A16. Restrictions on foreign direct investment

CTY	year	manufacturing	electricity	construction	distribution	transport	telecoms	business services	total
BE	1981	8.5	0.0	8.5	7.8	3.9	0.0	8.5	7.1
BE	1986	8.5	0.0	8.5	7.8	3.9	0.0	8.5	7.1
BE	1991	8.5	0.0	8.5	7.8	3.9	0.0	8.5	7.1
BE	1998	9.8	7.3	9.8	9.1	7.6	7.0	9.8	9.1
FR	1981	9.5	9.5	9.5	8.8	5.8	0.0	9.5	8.2
FR	1986	9.5	9.5	9.5	8.8	5.8	0.0	9.5	8.2
FR	1991	9.5	9.5	9.5	8.8	5.8	2.1	9.5	8.3
FR	1998	9.8	4.8	9.8	9.1	8.2	7.8	9.8	9.2
DE	1981	7.5	0.0	7.5	6.5	3.3	0.0	4.9	5.1
DE	1986	8.6	0.0	8.6	7.6	4.4	0.0	7.1	6.9
DE	1991	9.3	0.0	9.3	7.4	6.0	0.0	8.8	7.8
DE	1998	9.8	0.0	9.8	8.8	7.5	7.5	9.6	8.9
IE	1981	8.5	0.0	8.5	8.0	3.9	0.0	8.5	6.5
IE	1986	9.0	0.0	9.0	8.5	5.9	0.0	9.0	7.3
IE	1991	9.0	0.0	9.0	8.5	5.7	0.0	9.0	7.5
IE	1998	9.8	0.0	9.8	9.3	9.0	8.8	9.8	9.3
IT	1981	9.5	0.0	9.5	8.8	4.4	0.0	9.5	7.4
IT	1986	9.5	0.0	9.5	8.8	4.4	0.0	9.5	7.4
IT	1991	9.5	0.0	9.5	8.8	4.4	0.0	9.5	7.4
IT	1998	9.8	0.0	9.8	9.1	8.4	9.3	9.8	9.0
NL	1981	9.0	0.0	9.0	9.0	3.9	0.0	9.0	7.4
NL	1986	9.0	0.0	9.0	9.0	3.9	0.0	9.0	7.4
NL	1991	9.0	0.0	9.0	9.0	4.4	0.0	9.0	7.6
NL	1998	9.8	0.0	9.8	9.8	8.3	8.6	9.8	9.2
PT	1981	5.5	0.0	7.5	6.8	2.6	0.0	7.3	4.3
PT	1986	9.0	0.0	9.0	8.3	3.6	0.0	8.8	7.1
PT	1991	9.0	0.0	9.0	8.3	7.1	4.0	8.8	7.9
PT	1998	9.3	1.8	9.3	8.6	7.3	6.5	9.1	8.4
SP	1981	8.5	0.0	8.5	8.0	5.3	1.0	8.3	6.6
SP	1986	9.0	0.0	9.0	8.5	5.4	1.1	8.8	7.1
SP	1991	9.0	0.0	9.0	8.5	6.3	4.5	8.8	7.8
SP	1998	9.3	4.3	9.3	8.8	6.3	7.3	9.0	8.3
UK	1981	8.5	0.0	9.5	8.8	5.7	0.0	9.5	7.9
UK	1986	8.5	0.0	9.5	8.8	5.7	8.5	9.5	8.2
UK	1991	8.5	0.0	9.5	8.8	6.7	8.5	9.5	8.4
UK	1998	9.8	9.8	9.8	9.1	8.4	9.8	9.8	9.4
US	1981	9.8	5.3	9.8	9.8	3.2	6.3	9.8	8.3
US	1986	9.8	5.3	9.8	9.8	3.2	6.3	9.8	8.3
US	1991	9.5	5.0	9.5	9.5	4.6	6.0	9.5	8.3
US	1998	9.5	5.0	9.5	9.5	4.6	6.0	9.5	8.3

Source: OECD, own calculations.

APPENDIX 3. Empirical findings: Additional results

Table A17. Principal component factors and scores on Fraser PMR indicators

principal component factors				
Factor	Name	Eigenvalue	Cumul. R^2	
1	REG1	2.55	0.64	
2	REG2	0.72	0.82	
3	REG3	0.48	0.94	
4	REG4	0.25	1.00	
Factor loadings				
Variable	REG1	REG2	REG3	REG4
ciii5	0.77	0.51	0.34	0.21
ci5	0.80	0.17	-0.58	0.06
civ5	0.91	-0.06	0.15	-0.39
rqs	0.72	-0.66	0.10	0.21
Nob	427			

Notes: ciii5 = time spent with bureaucracy; ci5 = price controls;
civ5 = ease of starting a new business; rqs = regulatory quality.

Table A18. Interaction terms between PMR and industry effects (over time 'averaged' sample)

	ENTRY RATE		*EXIT RATE*	
Variable	Coefficient	t-statistic	Coefficient	t-statistic
LCAP	-0.42*	-2.95	0,11	0,74
LRD	-0.15**	-2.49	-0,17**	-2,29
Food products and beverages	-0.11**	-2.29	0,75*	12,75
Tobacco products	1.23*	7.97	2,85*	15,93
Textiles	0.08	0.57	0,20**	2,08
Wearing apparel; dressing and dyeing	-0.08	-0.16	0,28	1,12
Tanning and dressing of leather	-0.03	-0.06	0,04	0,29
Wood and products of wood	0.07	0.59	0,32**	2,17
Pulp, paper and paper products	-0.19	-1.36	-0,32	-1,38
Publishing, printing etc	0.28	1.08	0,04	0,52
Coke, refined petroleum products	0.41*	3.47	0,19**	2,31
Chemicals and chemical products	0.27*	2.89	0,11	0,97
Rubber and plastic products	0.18	1.43	0,13	1,49
Other non-metallic and mineral	0.17	1.15	0,22**	2,51
Basic metals	0.29**	2.52	0,21	1,12
Fabricated metal products	0.00	0.02	0,26	1,45
Machinery and equipment n.e.c.	0.15	1.34	0,27**	2,14
Office machinery and computers	-0.28*	-2.92	-0,06	-0,35
Electrical machinery and apparatus	0.18*	2.98	0,17	1,43
Radio, television and communication	0.02	0.25	0,08	0,85
Medical, precision and optical	0.06	0.86	0,33*	3,95
Motor vehicles, trailers	0.18*	8.13	0,07	0,62
Other transport equipment	0.18*	3.16	0,19	1,20
Furniture; manufacturing n.e.c.	0.22*	2.83	0,17	1,60
Electricity, gas & water supply	0.30***	1.77	0,37	0,81
Construction	-0.12	-0.94	0,22**	2,07
Wholesale & retail trade; repairs	0.09	1.21	0,05	0,47
Transport & storage	-0.05	-0.47	0,71*	5,68
Post and telecommunications	0.00	0.00	0,00	0,00
Real estate; renting & business	0.21	1.63	0,49	1,08
R^2a	0.26		0.22	
F-statistic	F(26, 71) = 3.8*		F(26, 71) = 3.5	
Hausman-statistic	$\chi^2(6) = 62.6$*		$\chi^2(4) = 14.6$*	
Nob	128		128	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level;
Nob = number of observations; R^2a = adjusted R-squared.

Table A19. Interaction terms between PMR and country effects (average over time)

	ENTRY RATE		*EXIT RATE*	
Variable	Coefficient	t-statistic	Coefficient	t-statistic
LCAP	0.09	0.79	-0.29***	-1.84
LRD	-0.08**	-2.06	0.00	-0.08
Belgium	0.77**	2.18	3.65*	7.29
Germany	-0.52*	-4.91	-0.35*	-3.90
France	0.55**	2.26	1.91*	5.30
Italy	0.40*	7.09	0.14**	2.10
Spain	34.41*	3.25	-108.67*	-8.73
United Kingdom	0.00	0.00	0.00	0.00
R^2a	0.28		0.27	
F-statistic	F(26, 89) = 2.9*		F(26, 89) = 2.4*	
Hausman statistic	$\chi^2(3) = 1.1$		$\chi^2(3) = 1.2$	
Nob	128		128	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; Nob = number of observations; R^2a = adjusted R-squared.

Table A20. Interaction terms between PMR and industry effects (full sample)

	ENTRY RATE		*EXIT RATE*	
Variable	Coefficient	t-statistic	Coefficient	t-statistic
ER_t-1	0.86*	19.12	0.44*	7.20
LCAP	0.04	1.37	-0.10**	-2.26
LRD	0.01	1.52	0.01	0.81
Food products and beverages	0.22***	1.64	0.48	0.73
Tobacco products	-5.90*	-19.28	-4.15*	-12.64
Textiles	0.01	0.26	0.09	1.24
Wearing apparel; dressing and dyeing	-0.01	-0.11	-0.03	-0.13
Tanning and dressing of leather	0.02	0.22	0.19	0.80
Wood and products of wood	0.05	0.99	0.16**	2.22
Pulp, paper and paper products	0.13**	2.28	-0.03	-0.21
Publishing, printing etc	0.10**	2.04	-0.09	-0.62
Coke, refined petroleum products	0.01	0.20	0.27*	3.73
Chemicals and chemical products	0.05	1.61	0.07	1.40
Rubber and plastic products	0.04	0.59	0.17*	4.62
Other non-metallic and mineral	0.05**	2.13	0.08	1.17
Basic metals	0.17*	3.20	0.11	1.49
Fabricated metal products	-0.01	-0.30	0.13**	1.79
Machinery and equipment n.e.c.	0.04	0.98	0.20*	4.24
Office machinery and computers	0.00	0.00	-0.20	-1.11
Electrical machinery and apparatus	0.04	1.57	0.09	1.31
Radio, television and communication	0.01	0.16	0.08	1.25
Medical, precision and optical	0.04	0.81	0.13	1.56
Motor vehicles, trailers	0.00	-0.09	0.10	1.10
Other transport equipment	0.07**	2.21	0.13	1.32
Furniture; manufacturing n.e.c.	0.04	0.91	0.09	1.20
Electricity, gas & water supply	0.04	0.70	0.14**	2.04
Construction	-0.01	-0.43	0.18**	1.98
Wholesale & retail trade; repairs	-0.04**	-1.86	0.02	0.22
Transport & storage	0.51*	3.01	-0.87*	-2.82
Post and telecommunications	0.00	0.00	0.00	0.00
Real estate; renting & business	0.04	0.80	0.15*	2.89
R^2a	0.67		0.28	
F-statistic	F(52, 355) = 7.9*		F(52, 355) = 3.4*	
Hausman statistic	$\chi^2(9)$ = 26.5*		$\chi^2(9)$ = 6.0	
Nob	427		427	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; Nob = number of observations; R^2a = adjusted R-squared.

Table A21. Interaction terms between PMR and country effects (full sample)

	ENTRY RATE		***EXIT RATE***	
Variable	Coefficient	t-statistic	Coefficient	t-statistic
ER_t-1	0.72*	11.15	0.15*	2.33
LCAP	0.06	0.99	-0.21*	-2.67
LRD	-0.03	-1.53	0.00	-0.10
Belgium	-0.09*	-2.90	0.32*	4.53
Germany	-0.01	-0.14	0.00	0.00
France	-0.05	-0.19	-0.61	-1.65
Italy	0.13*	3.36	-0.02	-0.38
Spain	-0.43*	-2.61	1.43*	4.60
United Kingdom	0.04**	2.06	0.27*	8.23
R^2a	0.68		0.27	
F-statistic	F(26, 373) = 7.6*		F(26, 373) = 3.8*	
Hausman statistics	$\chi^2(6) = 3.6$		$\chi^2(8) = 3.6$	
Nob	427		427	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; Nob = number of observations; R^2a = adjusted R-squared.

Table A22. Impact of Individual PMRs and Entry Barriers on Entry and Exit Rates (full sample)

Variable	Entry rate		Exit rate		Variable	Entry rate		Exit rate	
	Coeff.	t-statistic	Coeff.	t-statistic		Coeff.	t-statistic	Coeff.	t-statistic
LER1	0.77*	13.81	0.39*	5.97	LER1	0.81*	15.42	0.42*	6.15
LCAP	-0.04	-0.82	-0.22*	-3.34	LCAP	-0.04	-0.70	-0.19*	-2.86
LRD	0.02	1.34	-0.01	-0.38	LRD	0.01	0.84	-0.01	-0.17
b1	-0.01*	-2.73	0.01**	2.06	ciii5	0.00	0.22	0.02	0.85
R^2a	0.68		0.26			0.67		0.25	
F-statistic	F(26, 382) = 2.5*		F(26, 382) = 1.0			F(26, 382) = 2.2*		F(26, 382) = 0.92	
H-statistic	$\chi^2(4) = 2.8$		$\chi^2(5) = 4.2$			$\chi^2(4) = 0.71$		$\chi^2(4) = 2.5$	
LER1	0.81*	15.59	0.41*	6.14	LER1	0.80*	15.11	0.36*	5.70
LCAP	-0.04	-0.77	-0.21*	-3.16	LCAP	-0.02	-0.43	-0.11	-1.75
LRD	0.01	0.92	0.00	0.04	LRD	0.01	0.38	-0.04	-1.54
aii4	-0.15*	-5.21	-0.03	-0.43	civ5	0.03**	2.16	0.16*	8.93
R^2a	0.67		0.25			0.68		0.31	
F-statistic	F(26, 382) = 2.2*		F(26, 382) = 0.93			F(26, 382) = 2.2*		F(26, 382) = 1.2	
H-statistic	$\chi^2(4) = 0.23$		$\chi^2(4) = 2.5$			$\chi^2(4) = 0.41$		$\chi^2(4) = 8.5$***	
LER1	0.82*	15.75	0.40*	5.71	LER1	0.78*	14.00	0.36*	5.68
LCAP	0.01	0.25	-0.17*	-2.36	LCAP	0.00	-0.05	-0.08	-1.16
LRD	-0.01	-0.59	-0.02	-0.67	LRD	0.00	0.26	-0.03	-0.93
bi4	0.11*	3.84	0.10***	1.67	RQS	0.07*	2.71	0.23*	6.82
R^2a	0.68		0.25			0.68		0.30	
F-statistic	F(26, 382) = 2.2*		F(26, 382) = 0.98*			F(26, 382) = 2.2*		F(26, 382) = 1.1	
H-statistic	$\chi^2(4) = 2.0$		$\chi^2(4) = 2.5$			$\chi^2(4) = 0.36$		$\chi^2(4) = 7.1$	
LER1	0.83*	15.27	0.38*	5.56	LER1	0.81*	15.60	0.41*	6.09
LCAP	0.00	-0.04	-0.16*	-2.32	LCAP	-0.04	-0.77	-0.21*	-3.17
LRD	0.01	0.43	-0.01	-0.54	LRD	0.01	0.88	0.00	-0.07
ci5	0.03*	2.34	0.06*	2.49	RESFDI	0.01	0.53	0.03	1.26
R^2a	0.68		0.26			0.68		0.25	
F-statistic	F(26, 382) = 2.2*		F(26, 382) = 0.96			F(26, 382) = 2.2*		F(26, 382) = 1.0	
H-statistic	$\chi^2(4) = 0.16$		$\chi^2(4) = 2.3$			$\chi^2(4) = 8.1$		$\chi^2(5) = 4.2$	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; R^2a = adjusted R-squared;
b1 = transfers and subsidies as a % of GDP; aii4 = mean tariff rate; bi4 = hidden import barriers; ci5 = price controls; ciii5 = time spent with bureaucracy; civ5 = ease of starting a new business; RQS = regulatory quality; RESFDI = restrictions on foreign direct investment.

Table A23. Growth of output (production) equation

Dependent variable: Δlny_t												
	1		2		3		4		5		5*	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
ENTRY RATE												
C	-0.02	-0.65	0.04	2.82	0.05*	3.00	0.02**	2.21	-0.01	-0.48	-0.00	-0.05
ER_t	1.15**	2.17					2.15**	2.05	2.10***	1.86	2.19**	2.04
ER_t-1			0.10	0.54			-1.44	-1.61	-1.24	-1.50	-1.42***	-1.74
ER_t-2					0.00	0.01	-0.15	-0.70	-0.31	-1.22	-0.24	-0.99
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.08		0.00		0.00		0.15		0.29		0.35	
F-statistic	F(1, 660) = 4.72**		F(1, 660) = 0.29		F(1, 480) = 0.00		F(3, 478) = 2.76**		F(38, 443) = 4.81*		F(38, 424) = 4.77*	
Nob	662		662		482		482		482		482	
Sargan											20.44 (0.37)	
Nir											19	
EXIT RATE												
C	0.04*	4.77	0.06*	5.64	0.06*	5.03	0.07*	4.53	0.01	0.38	0.03	1.27
XR_t	-0.01	-0.04					0.24	0.81	0.17	0.39	0.15	0.36
XR_t-1			-0.70**	-2.06			-0.82**	-2.51	-0.86***	-1.87	-0.79***	-1.73
XR_t-2					-0.78***	-1.75	-0.65***	-1.73	-0.40	-1.07	-0.45	-1.26
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.00		0.01		0.01		0.02		0.16		0.23	
F-statistic	F(1, 660) = 0.00		F(1, 660) = 4.25**		F(1, 480) = 3.07***		F(3, 478) = 2.57***		F(38, 443) = 5.27*		F(38, 424) = 5.24*	
Nob	662		662		482		482		482		482	
Sargan											16.04 (0.65)	
Nir											19	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; Nob = number of observations;

Equations 1-5: OLS; R^2a = adjusted R-squared;

Equation 5*: 2SLS; R^2a = centred R-squared; Sargan-Hansen J statistic of overidentification test of all instruments and P-value in brackets;

Nir = number of overidentifying restrictions.

Table A24. Interaction terms between entry and exit rates and industry effects

	Δ output eq.				Δ labour productivity eq.			
	ER (1)		XR (2)		ER (3)		XR (4)	
{ER; XR}_t			0.53***	1.69			0.42	1.04
{ER; XR}_t-1	-0.68	-1.27			-0.09	-0.37	0.29	0.74
{ER; XR}_t-2	-0.25	-1.31	-0.24	-0.79	0.55*	2.44		
Constant	0.02	0.81	0.02	1.34	0.02	0.84	0.04***	1.75
Food products and beverages	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tobacco products	0.51	0.84	-1.61	-1.04	-0.28	-1.37	-0.57	-1.38
Textiles	-0.36	-0.61	-2.81*	-4.82	-0.53	-1.33	-1.41**	-2.42
Wearing apparel; dressing and dyeing	0.52	0.79	-1.77*	-4.15	-0.21	-0.62	-0.48	-0.99
Tanning and dressing of leather	-0.30	-0.44	-2.83*	-3.42	-0.03	-0.06	-0.63	-0.93
Wood and products of wood	1.16**	2.07	-0.87	-0.96	-0.58	-1.44	-1.36	-1.49
Pulp, paper and paper products	1.37**	2.36	-0.58	-1.00	-0.39	-1.11	-0.63	-0.78
Publishing, printing etc	1.02***	1.79	-0.83	-1.27	-0.08	-0.21	-0.57	-0.79
Coke, refined petroleum products	4.44*	4.10	1.86	1.50	-1.51	-0.87	-3.27***	-1.70
Chemicals and chemical products	1.37**	2.43	-0.59	-1.06	-0.17	-0.61	-0.68	-1.19
Rubber and plastic products	0.74	1.47	-1.28**	-2.02	-0.53**	-2.43	-1.42*	-2.69
Other non-metallic and mineral	1.30**	2.19	-0.73	-0.89	-0.64**	-2.08	-1.37***	-1.92
Basic metals	0.62	0.98	-2.12*	-2.60	-0.51	-1.62	-1.47**	-2.08
Fabricated metal products	0.94	1.60	-1.37**	-2.03	-0.47	-1.30	-1.19***	-1.77
Machinery and equipment n.e.c.	0.81	1.49	-1.30***	-1.90	-0.65***	-1.78	-1.73**	-2.19
Office machinery and computers	2.74**	2.18	-0.93*	-2.77	3.15*	8.73	3.34*	2.75
Electrical machinery and apparatus	0.93	1.61	-1.01	-1.33	-0.37	-1.30	-0.90	-1.43
Radio, television and communication	1.88*	2.57	0.78	0.42	6.90*	7.79	16.49*	7.78
Medical, precision and optical	1.08***	1.88	-0.73	-0.99	-1.03*	-2.70	-2.65*	-2.71
Motor vehicles, trailers	1.02***	1.81	-0.62	-1.01	-0.69**	-2.00	-1.68**	-2.29
Other transport equipment	1.22**	2.24	-0.71	-0.61	-0.48	-1.21	-1.03	-1.03
Furniture; manufacturing n.e.c.	1.21**	2.06	-0.91	-1.21	-0.46	-1.39	-1.24***	-1.69
Electricity, gas & water supply	1.02***	1.93	-0.10	-0.14	0.25	0.97	1.74**	1.84
Construction	1.27**	2.40	-0.66***	-1.63	-0.40	-1.47	-1.36***	-1.71
Wholesale & retail trade; repairs	1.34*	2.50	-0.37	-0.61	-0.77*	-2.88	-1.78**	-2.18
Transport & storage	1.56*	2.62	-0.21	-0.21	-0.41*	-2.54	-1.23	-1.12
Post and telecommunications	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Real estate; renting & business	1.43*	2.69	0.88	1.12	-0.77*	-3.45	-3.40*	-2.91
R^2a	0.35		0.13		0.46		0.32	
F-stat	F(37, 444) = 6.60*		F(37, 444) = 5.68*		F(37, 610) = 8.04*		F(37, 610) = 4.20*	
nob	482.00		482.00		648.00		648.00	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level;
Nob = number of observations; R^2a = adjusted R-squared.

Table A24. Interaction terms between entry and exit rates and industry effects (cont.)

	Δ employment eq.				Δ R&D eq.					
	ER		ER		ER		ER		ER	
	(5)		(6)		(7)		(8)		(9)	
{ER; XR}_t			2.66***	1.81			-1.24	-1.56	-1.44***	-1.79
{ER; XR}_t-1	-1.07*	-2.47			-1.91***	-1.63			0.75	0.57
{ER; XR}_t-2	-0.24	-1.55	-0.20	-0.63	1.10	1.57	0.11	0.08		
Constant	0.01	0.52	-0.03***	-1.77	0.05	0.90	0.12**	2.10	0.14**	2.28
Food products and beverages	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tobacco products	-0.17	-0.33	-0.03**	-2.23	-0.03	-0.02	2.18	0.71	-0.04	-0.02
Textiles	-0.30	-0.78	-0.02*	-2.92	3.46***	1.76	2.49	0.91	0.77	0.27
Wearing apparel; dressing and dyeing	0.32	0.62	-0.02**	-2.36	5.01	1.15	3.16	0.78	3.84	0.93
Tanning and dressing of leather	0.29	0.74	-0.02**	-2.41	0.22	0.09	-3.12	-0.41	-6.85	-1.14
Wood and products of wood	1.01*	2.73	-0.01	-1.41	-0.30	-0.15	-2.65	-1.23	-4.34	-1.62
Pulp, paper and paper products	1.09*	3.02	-0.01	-1.52	-1.46	-0.67	-4.05	-1.30	-3.61	-1.31
Publishing, printing etc	0.97**	2.11	-0.02	-1.62	1.33	0.47	-0.05	-0.01	-3.32	-0.72
Coke, refined petroleum products	1.35*	2.93	-0.01	-0.98	1.93	0.90	1.91	1.10	1.12	0.45
Chemicals and chemical products	1.16*	3.19	-0.01	-1.54	2.31**	2.13	1.82	1.17	0.29	0.19
Rubber and plastic products	1.18*	3.22	-0.01	-1.47	0.99	0.82	0.20	0.08	-0.73	-0.29
Other non-metallic and mineral	1.23*	3.41	-0.01	-1.36	2.23	1.34	-0.05	-0.02	-1.31	-0.39
Basic metals	1.10*	2.66	-0.01	-1.56	1.11	1.03	-0.95	-0.54	-2.37	-1.24
Fabricated metal products	1.54*	4.05	-0.01	-1.05	2.64***	1.76	0.93	0.42	-0.56	-0.25
Machinery and equipment n.e.c.	1.41*	3.66	-0.01	-1.30	2.13**	1.96	2.53	1.42	0.63	0.30
Office machinery and computers	4.10*	3.72	-0.02	-1.50	1.72**	2.19	0.03	0.02	1.19	0.77
Electrical machinery and apparatus	0.97*	2.53	-0.02	-1.59	1.45	1.02	1.32	0.62	-0.28	-0.13
Radio, television and communication	1.45*	3.66	-0.01	-1.29	1.79***	1.64	2.18	1.39	0.50	0.28
Medical, precision and optical	1.39*	3.67	-0.01	-1.19	1.81	1.56	2.87	1.26	-0.13	-0.06
Motor vehicles, trailers	1.07*	2.90	-0.02***	-1.65	2.04	1.33	1.33	0.69	0.26	0.11
Other transport equipment	1.38*	3.45	-0.01	-1.13	1.90	1.60	1.45	0.55	0.84	0.44
Furniture; manufacturing n.e.c.	1.11*	2.70	-0.01	-1.50	3.21***	1.67	2.84	0.74	0.86	0.22
Electricity, gas & water supply	0.69	1.58	-0.02**	-2.08	1.48	0.52	-1.23	-0.14	-7.78	-1.30
Construction	1.57*	4.19	-0.01	-1.25	3.07	1.20	0.32	0.09	-1.63	-0.35
Wholesale & retail trade; repairs	1.38*	3.66	-0.01	-1.30	7.55	1.47	5.97	0.72	5.27	0.57
Transport & storage	1.98*	4.31	-0.01	-0.93	5.36	1.18	12.94	1.01	12.31	0.91
Post and telecommunications	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Real estate; renting & business	1.68*	4.11	-0.01	-1.27	3.26**	2.02	5.33	1.25	4.62	0.76
R^2a	0.59		0.38		0.03		0.00		0.00	
F-stat	F(37, 426) = 8.26*		F(37, 426) = 6.14*		F(35, 388) = 1.03		F(35, 388) = 1.28		F(35, 388) = 1.09	
Nob	464.00		464.00		424.00		424.00		424.00	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level;
Nob = number of observations; R^2a = adjusted R-squared.

Table A25. Interaction terms between entry and exit rates and country effects

	Δ output eq.				Δ labour productivity eq.			
	ER		XR		ER		XR	
	(1)		(2)		(3)		(4)	
{ER; XR}_t			0.11	0.24			0.13	0.52
{ER; XR}_t-1	0.33	-0.40			-0.34	-1.38	-0.54	-1.60
{ER; XR}_t-2	0.18	-0.42	-0.62	-1.22	0.18	0.91		
Constant	-0.02	-0.84	0.00	-0.08	0.03	1.46	0.03**	2.26
Germany	0.10	0.32	-0.82***	-1.91	0.51	1.24	0.62	1.39
France	0.37	1.26	-0.77	-1.54	0.28	1.26	0.57***	1.78
Ireland					1.35**	2.35	7.50	1.12
Italy	0.08	0.20	-0.94	-1.52	0.30	0.86	0.00	-0.01
Portugal	2.86**	2.25	-3.88**	-1.93	0.81**	2.31	2.53*	2.46
Spain	0.63**	2.25	0.13	0.20	0.07	0.37	-0.22	-0.50
United Kingdom	-0.35	-1.26	-1.66*	-4.58	0.24	1.16	0.49	1.45
R^2a	0.32		0.17		0.57		0.55	
F-stat	F(37, 444) = 4.82*		F(37, 444) = 4.97*		F(37, 610) = 9.21*		F(37, 610) = 9.60*	
Nob	482		482		648		648	

	Δ Employment eq.				Δ R&D eq.					
	ER		ER		ER		ER		ER	
	(5)		(5)		(7)		(8)		(9)	
{ER; XR}_t			2.00	1.55			-1.88**	-2.29	-1.63**	-2.15
{ER; XR}_t-1	-0.83**	-2.09			0.02	0.02			0.98	0.65
{ER; XR}_t-2	-0.07	-0.41	-0.80	-1.38	0.65	0.91	0.10	0.07		
Constant	0.01	0.70	-0.02	-1.22	0.07	1.07	0.07***	1.63	0.07***	1.80
Germany	0.45	1.54	-0.01***	-1.89	-1.67	-1.29	1.06	0.89	-0.15	-0.14
France	0.56***	1.85	-0.01	-1.50	-1.91	-1.47	-2.45*	-2.53	-3.14	-1.62
Italy	0.63**	2.00	-0.01	-1.48	-1.64	-0.99	0.04	0.02	-0.96	-0.49
Portugal	3.24**	2.16	-0.01**	-2.02						
Spain	1.10*	2.76	-0.00	-0.99	-1.16	-0.80	-1.54	-0.64	-3.42	-1.21
United Kingdom	0.16	0.46	-0.01*	-2.57	-1.82	-1.45	-0.85	-0.71	-2.24	-1.52
R^2a	0.47		0.34		0.00		0.00		0.00	
F-stat	F(37, 426) = 7.20*		F(37, 426) = 4.23*		F(35, 388) = 0.86		F(35, 388) = 1.02		F(35, 388) = 1.03	
Nob	464		464		424		424		424	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level;
Nob = number of observations; R^2a = adjusted R-squared.

Table A26. Growth of labour productivity equation

Dependent variable: Δ_{lnlp_t}												
	1		2		3		4		5		5*	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
ENTRY RATE												
C	0.02***	1.69	0.02	1.44	0.02	1.57	0.01	1.00	-0.01	-0.34	-0.04***	-1.77
ER_t	0.38	1.41					0.62	1.14	0.60***	1.70	0.62***	1.78
ER_t-1			0.42***	1.81			-0.47	-0.82	-0.30	-0.96	-0.32	-1.05
ER_t-2					0.42**	2.12	0.42	1.42	0.14	0.69	0.16	0.84
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.01		0.01		0.01		0.02		0.56		0.59	
F-statistic	F(1, 862) = 1.98		F(1, 862) = 3.26***		F(1, 646) = 4.51**		F(3, 644) = 2.40***		F(38, 609) = 8.84*		F(38, 590) = 8.88*	
Nob	864		864		648		648		648		648	
Sargan											25.45 (0.15)	
Nir											19	
EXIT RATE												
C	0.03*	3.56	0.04*	4.46	0.04	3.30	0.04*	3.00	0.00	0.27	-0.02	-1.35
XR_t	0.50***	1.63					0.80**	2.36	0.16	0.59	0.17	0.65
XR_t-1			0.00	0.01			-0.77	-1.50	-0.36	-1.02	-0.39	-1.11
XR_t-2					0.28	0.56	0.21	0.39	0.68**	2.10	0.65**	2.06
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.01		0.01		0.00		0.01		0.55		0.58	
F-statistic	F(1, 862) = 2.66*		F(1, 862) = 0.00		F(1, 646) = 0.32		F(3, 644) = 2.23***		F(38, 609) = 9.21*		F(38, 590) = 9.18*	
Nob	864		864		648		648		648		648	
Sargan											24.72 (0.17)	
Nir											19	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; Nob = number of observations;

Equations 1-5: OLS; R^2a = adjusted R-squared;

Equation 5*: 2SLS; R^2a = centred R-squared; Sargan-Hansen J statistic of overidentification test of all instruments and P-value in brackets;

Nir = number of overidentifying restrictions.

Table A27. Growth of employment equation

Dependent variable: Δlnl_t												
	1		2		3		4		5		5*	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
ENTRY RATE												
C	-0.06***	-1.80	-0.01	-0.60	0.00	0.23	-0.01	-1.24	0.00	0.08	0.01	0.56
ER_t	1.08***	1.70					2.64***	1.88	2.67**	2.01	2.71**	2.12
ER_t-1			0.15	0.70			-2.24***	-1.83	-2.20**	-2.10	-2.25**	-2.18
ER_t-2					-0.04	-0.17	0.00	0.02	-0.29	-1.09	-0.29	-1.15
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.09		0.00		0.00		0.32		0.43		0.48	
F-statistic	F(1, 628) = 2.88***		F(1, 628) = 0.49		F(1, 462) = 0.03		F(3, 460) = 1.63		F(38, 425) = 5.52*		F(38, 406) = 5.46*	
Nob	630		630		464		464		464		464	
Sargan											9.19 (0.97)	
Nir											19	
EXIT RATE												
C	0.00	0.42	0.01	0.55	0.02***	1.75	0.03	1.62	0.01	0.21	0.02	0.96
XR_t	-0.20	-0.77					-0.18	-1.06	-0.45	-0.92	-0.43	-0.93
XR_t-1			-0.34	-0.84			-0.26	-0.83	-0.43	-0.81	-0.46	-0.88
XR_t-2					-0.96**	-2.18	-0.83**	-2.24	-0.71	-1.43	-0.74	-1.39
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.00		0.00		0.02		0.02		0.13		0.20	
F-statistic	F(1, 628) = 0.59		F(1, 628) = 0.71		F(1, 462) = 4.75**		F(3, 460) = 1.73		F(38, 425) = 8.49*		F(38, 406) = 8.51*	
Nob	630		630		464		464		464		464	
Sargan											12.51 (0.86)	
Nir											19	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; Nob = number of observations;

Equations 1-5: OLS; R^2a = adjusted R-squared;

Equation 5*: 2SLS; R^2a = centred R-squared; Sargan-Hansen J statistic of overidentification test of all instruments and P-value in brackets;

Nir = number of overidentifying restrictions.

Table A28. Growth of physical capital investment

Dependent variable: Δ_{lni_t}												
	1		2		3		4		5		5*	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
ENTRY RATE												
C	0.01	0.54	0.02	0.98	-0.00	-0.10	-0.01	-0.35	-0.10	-1.49	0.00	0.05
ER_t	0.41	0.76					0.28	0.37	0.48	0.56	1.07	1.07
ER_t-1			0.21	0.45			0.15	0.14	-0.18	-0.12	-1.10	-0.67
ER_t-2					0.45	0.86	0.22	0.36	-0.04	-0.08	0.26	0.41
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.00		0.00		0.00		0.00		0.06		0.14	
F-statistic	F(1, 558) = 0.57		F(1, 558) = 0.20		F(1, 419) = 0.73		F(3, 417) = 0.33		F(37, 383) = 2.47*		F(37, 364) = 2.54*	
Nob	560		560		421		421		421		421	
Sargan											22.68 (0.25)	
Nir											19	
EXIT RATE												
C	0.09*	5.75	0.09*	3.05	0.04	1.06	0.11**	2.16	-0.08	-0.91	0.03	0.44
XR_t	-2.13*	-3.46					-1.23**	-2.26	-0.35	-0.49	-0.62	-0.85
XR_t-1			-2.03***	-1.68			-2.31***	-1.75	-2.16	-1.28	-1.61	-0.97
XR_t-2					-0.79	-0.43	0.31	0.19	1.95	0.79	1.90	0.82
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.03		0.01		0.00		0.04		0.08		0.16	
F-statistic	F(1, 558) = 11.94*		F(1, 558) = 2.84***		F(1, 419) = 0.18		F(3, 417) = 4.18*		F(37, 383) = 2.40*		F(37, 364) = 2.41*	
Nob	560		560		421		421		421		421	
Sargan											22.08 (0.28)	
Nir											19	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; Nob = number of observations;

Equations 1-5: OLS; R^2a = adjusted R-squared;

Equation 5*: 2SLS; R^2a = centred R-squared; Sargan-Hansen J statistic of overidentification test of all instruments and P-value in brackets;

Nir = number of overidentifying restrictions.

Table A29. Growth of R&D investments

Dependent variable: Δlnr_t												
	1		2		3		4		5		5*	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
ENTRY RATE												
C	0.01	0.36	0.04	1.25	0.03	0.86	0.03	0.55	0.06	0.80	0.06	0.81
ER_t	0.73	0.97					2.66**	2.19	3.06**	2.30	3.20**	2.41
ER_t-1			0.25	0.45			-3.05*	-2.52	-2.83**	-2.24	-2.84**	-2.28
ER_t-2					0.29	0.41	0.86	1.27	1.60***	1.95	1.51**	1.95
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.00		0.00		0.00		0.01		0.01		0.09	
F-statistic	F(1, 571) = 0.95		F(1, 571) = 0.20		F(1, 422) = 0.17		F(3, 420) = 2.29***		F(36, 387) = 1.03		F(36, 368) = 1.04	
Nob	573		573		424		424		424		424	
Sargan											29.24 (0.06)	
Nir											19	
EXIT RATE												
C	0.09*	3.77	0.08*	3.18	0.07***	1.61	0.10*	1.99	0.13**	2.36	0.14*	2.63
XR_t	-1.41*	-2.47					-1.50*	-2.33	-0.98	-1.09	-1.37	-1.49
XR_t-1			-1.31***	-1.81			0.33	0.32	1.22	0.89	1.56	1.07
XR_t-2					-1.00	-0.66	-0.95	-0.62	0.68	0.47	0.10	0.07
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.01		0.01		0.00		0.00		0.00		0.08	
F-statistic	F(1, 571) = 6.12*		F(1, 571) = 3.28***		F(1, 422) = 0.43		F(3, 420) = 1.99		F(36, 387) = 1.09		F(36, 368) = 1.10	
Nob	573		573		424		424		424		424	
Sargan											29.81 (0.05)	
Nir											19	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; Nob = number of observations;

Equations 1-5: OLS; R^2a = adjusted R-squared;

Equation 5*: 2SLS; R^2a = centred R-squared; Sargan-Hansen J statistic of overidentification test of all instruments and P-value in brackets;

Nir = number of overidentifying restrictions.

Table A30. Physical capital intensity equation

Dependent variable: capint3_t												
	1		2		3		4		5		5*	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
ENTRY RATE												
C	5.60*	13.11	5.63*	11.78	5.77*	10.70	4.90*	8.58	5.09*	6.95	5.05*	7.25
ER_t	16.24***	1.87					4.99	0.28	4.67	0.52	7.41	0.87
ER_t-1			15.02	1.63			34.84***	1.74	-6.08	-0.53	-7.38	-0.67
ER_t-2					12.52	1.25	-8.58	-1.06	-4.97	-0.91	-5.08	-0.94
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.01		0.01		0.00		0.02		0.81		0.83	
F-statistic	F(1, 677) = 3.49***		F(1, 530) = 2.65		F(1, 395) = 1.57		F(3, 393) = 2.28***		F(37, 359) = 40.48*		F(37, 340) = 40.25*	
Nob	679		532		397		397		397		397	
Sargan											29.44 (0.06)	
Nir											19	
EXIT RATE												
C	8.38*	20.57	8.83*	17.56	8.99*	13.95	10.83*	13.97	5.51*	10.23	5.67*	10.84
XR_t	-70.97*	-6.69					-39.45*	-3.57	-13.62**	-2.33	-14.83*	-2.52
XR_t-1			-93.13*	-6.25			-50.55*	-3.06	-9.77	-1.20	-12.53	-1.50
XR_t-2					-105.15*	-4.92	-82.08*	-4.27	-3.69	-0.36	-7.36	-0.69
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.06		0.07		0.07		0.14		0.81		0.83	
F-statistic	F(1, 677) = 44.78*		F(1, 530) = 39.09*		F(1, 395) = 24.19*		F(3, 393) = 16.65*		F(37, 359) = 40.25*		F(37, 340) = 40.29*	
Nob	679		532		397		397		397		397	
Sargan											23.64 (0.21)	
Nir											19	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; Nob = number of observations;

Equations 1-5: OLS; R^2a = adjusted R-squared;

Equation 5*: 2SLS; R^2a = centred R-squared; Sargan-Hansen J statistic of overidentification test of all instruments and P-value in brackets;

Nir = number of overidentifying restrictions.

Table A31. R&D intensity equation

Dependent variable: rdint_t												
	1		2		3		4		5		5*	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
ENTRY RATE												
C	1.46*	9.29	1.47*	8.28	1.39*	7.22	1.35*	5.54	0.29	1.23	0.29	1.32
ER_t	1.37	0.61					9.93	1.37	-6.25	-1.32	-7.79***	-1.66
ER_t-1			0.89	0.36			-10.18	-1.33	1.98	0.35	3.36	0.60
ER_t-2					1.68	0.66	3.01	0.99	-2.46	-0.92	-3.12	-1.18
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.00		0.00		0.00		0.00		0.74		0.77	
F-statistic	F(1, 664) = 0.37		F(1, 516) = 0.13		F(1, 371) = 0.43		F(3, 369) = 0.88		F(36, 336) = 18.89*		F(36, 317) = 18.82*	
Nob	666		518		373		373		373		373	
Sargan											16.50 (0.62)	
Nir											19	
EXIT RATE												
C	1.25*	8.47	1.25*	7.53	1.15*	5.01	0.85*	3.30	0.17	0.77	1.91	1.55
XR_t	10.82**	2.15					10.44***	1.85	-2.55	-0.79	-1.99	-0.65
XR_t-1			11.02***	1.83			0.28	0.04	-4.47	-1.17	-4.87	-1.30
XR_t-2					14.97	1.49	15.03	1.43	-3.30	-0.53	-1.12	-0.18
Industry									X		X	
Country									X		X	
Year									X		X	
R^2a	0.01		0.01		0.00		0.01		0.74		0.77	
F-statistic	F(1, 664) = 4.62**		F(1, 516) = 3.34***		F(1, 371) = 2.23		F(3, 369) = 2.33***		F(36, 336) = 18.74*		F(36, 317) = 18.67*	
Nob	666		518		373		373		373		373	
Sargan											19.36 (0.31)	
Nir											17	

Notes: Heteroskedastic-consistent standard errors; * (**, ***) significant at the 1% (resp. 5%, 10%) level; Nob = number of observations;

Equations 1-5: OLS; R^2a = adjusted R-squared;

Equation 5*: 2SLS; R^2a = centred R-squared; Sargan-Hansen J statistic of overidentification test of all instruments and P-value in brackets;

Nir = number of overidentifying restrictions.

Table A32. Explanatory power of instruments (first-stage regressions)

Variable	Shea Partial R^2	Partial R^2	F(28, 422)
ER_t	0.55	0.69	43.8*
ER_t-1	0.57	0.78	72.1*
ER_t-2	0.72	0.83	96.8*
XR_t	0.49	0.51	21.2*
XR_t-1	0.53	0.54	24.2*
XR_t-2	0.35	0.37	10.9*
n. obs.	482		
Instruments	b1_(t,t-1,t-2); aii4_(t,t-1,t-2); bi4_(t,t-1,t-2); ci5_(t,t-1,t-2); ciii5_(t,t-1,t-2); civ5_(t,t-1,t-2); RQS_(t,t-1,t-2); RESFDI_(t,t-1,t-2); A_(t,t-1,t-2); N_(t,t-1,t-2); D_(t,t-1,t-2); NE_(t,t-1,t-2); NER_(t,t-1,t-2); TURN_(t,t-1,t-2)		

Notes :
* Statistically significant at the 1% level.
b1 = transfers and subsidies as a % of GDP; aii4 = mean tariff rate;
bi4 = hidden import barriers; ci5 = price controls; ciii5 = time spent with bureaucracy;
civ5 = ease of starting a new business; RQS = regulatory quality;
RESFDI = restrictions on foreign direct investment; A = number of active firms;
N = number of new firms; D = number of exiting firms; NE = number of net entries;
NER = net entry rate; TURN = firm turnover.