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Article

Regulation, resource reallocation and productivity growth

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ABSTRACT

In this paper, we review theory and evidence on the links between product market regulations that curb competitive pressures, the efficiency of resource allocation and productivity growth. We show that product market regulations differ across countries and industries and have evolved differently over time. We argue that differences in regulation have played an important role in driving resource allocation and productivity outcomes. Countries and industries where direct and indirect regulatory burdens are lighter have generally experienced the highest GDP per capita and productivity growth rates. Moreover, where regulatory burdens are lighter, the reallocation of resources towards the highest-productivity firms is stronger. The impacts of inappropriate regulations on aggregate and firm-level productivity performance are estimated to be quantitatively important and thus, reforming such regulations can provide a significant boost to potential growth in OECD economies.

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Regulation, resource reallocation and productivity growth

1. Introduction

The analysis of differences in economic performance across countries largely deals with the role played by market rigidities in curbing incentives to innovate and in preventing resources from flowing to the most productive uses. In some cases, rigidities can be directly related to the nature of some economic activities, but they are often induced by inappropriate policies or institutions. This paper focuses on the role of one particular set of policy-induced rigidities, those that are related to regulations that curb product market competition, where competitive forces would be advantageous for society. There is widespread anecdotal evidence that, in countries where policies unduly curb competition, performance is subpar. As an example, Figure 1 suggests a negative and significant correlation between GDP per capita and the OECD summary indicator of anticompetitive product market regulations across a number of OECD and emerging economies. Indeed, countries with more stringent and anticompetitive product market regulations (according to the OECD synthetic indicator) were also those with a relatively lower GDP per capita, and *vice versa*. Needless to say, this is only illustrative because there are many other factors beyond regulations that determine a country's economic performance. Figure 2, however, also shows a negative correlation between multi-factor productivity (MFP) growth and the stringency of product market regulations: countries that had procompetitive regulations seem to have been more able than others to accelerate productivity growth over the past quarter century. Furthermore, differences in productivity and productivity growth are the main determinant of cross-country gaps in levels and growth rates of GDP per capita. These simple correlations are sufficiently tight to merit further investigation: To what extent are they driven by the adverse effect of anticompetitive regulations on the ability to efficiently allocate resources and on the incentives to continuously improve efficiency (e.g. via innovation), which are at the heart of the growth process in market economies?



Jens Arnold

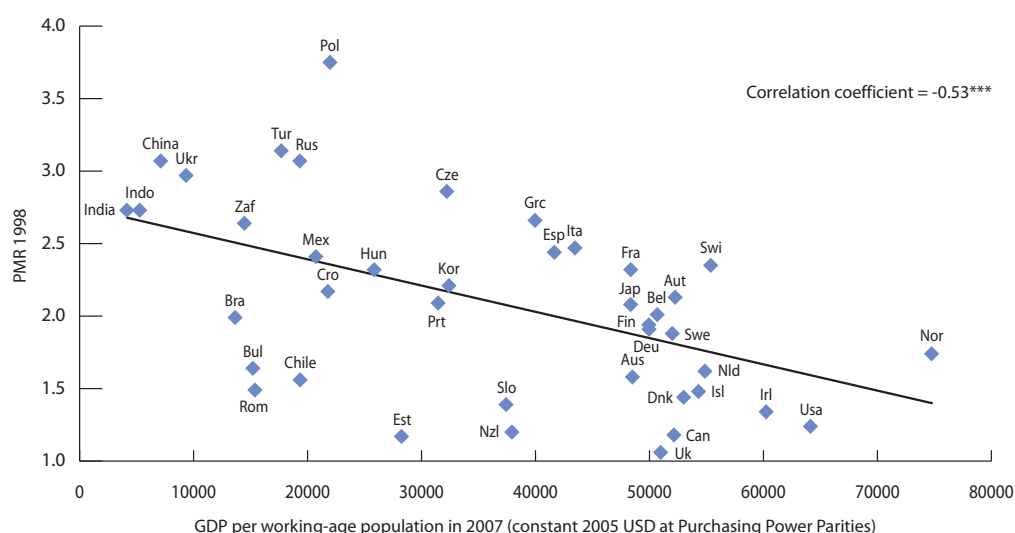


Giuseppe Nicoletti



Stefano Scarpetta

Figure 1. Anticompetitive product market regulation and GDP per capita



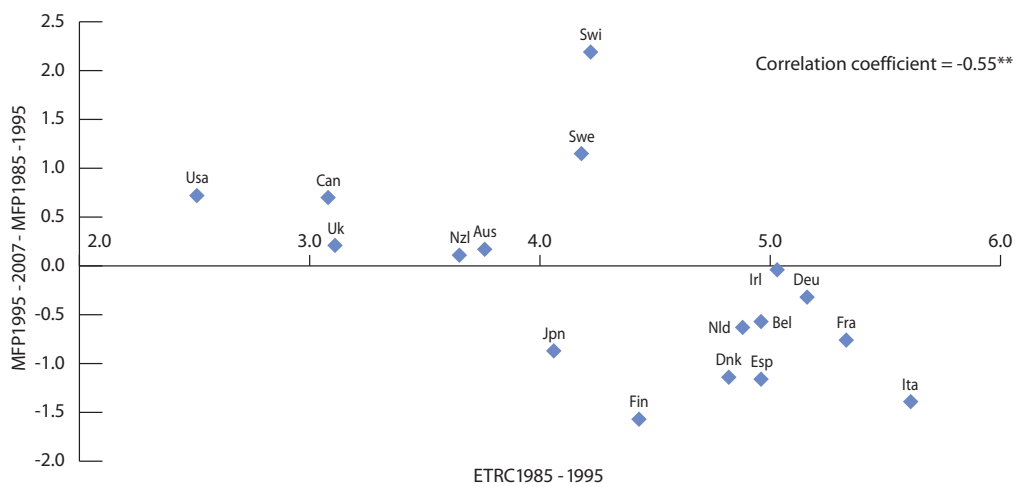
Source: Woelfl *et al.* (2010)

Note: The values on the vertical axis are based on a "simplified" OECD Product Market Regulation (PMR) indicator (see Woelfl *et al.* 2010). PMR measured in 1998 for OECD countries; 2008 for Chile, Estonia, Israel, Slovenia, Brazil, Russia and China; 2007 for Croatia, Indonesia, South Africa and Ukraine; 2006 for Bulgaria, India and Romania. "****" denotes significance at the 1-percent level.

We provide estimates of the extent to which regulations affect productivity, taking into account the heterogeneity of countries, sectors and firms.

In this paper, we address these issues by looking at the link between regulations, resource reallocation and productivity from different angles, *i.e.* aggregate, sectoral and firm-level. We survey some theory and evidence and, based on existing empirical research, we provide estimates of the extent to which regulations can affect productivity, checking whether this effect is economically relevant. Whenever possible, we discuss how the estimated effects of regulation on performance differ depending on the levels of development, industry characteristics and the relative efficiency of firms in terms of their dynamism or distance from the technological frontier. Indeed, heterogeneous performance (across countries, industries and firms) is a key feature of market economies and the influence of regulation on productivity is likely to differ across countries, industries and firms with different characteristics.

Figure 2. Productivity acceleration and regulation



Source: OECD Productivity Database and OECD International Regulation Database
 Note: MFP is a multifactor productivity index. The vertical axis shows the acceleration in average annual MFP growth from the period 1985-95 to the period 1995-2007 (in percentage points). The horizontal axis shows the 1985-95 average of the ETCR, the OECD regulation indicator of anticompetitive provisions and industry settings in electricity, transport and communication industries. ** denotes significance at the 5-percent level.

Throughout the paper, we focus on measures of product market policies provided by the OECD for consistency. These measures are based on laws and regulations that unduly curb competition and cover both general-purpose and sector-specific areas, such as administrative burdens on start ups and access to networks, respectively. They point to differences in the stringency of regulation that could potentially provide an explanation for differences in productivity developments. We also take into account intersectoral linkages, namely the possibility that sector-specific anticompetitive regulations can have an impact on performance beyond the regulated sector itself, due to the fact that regulated sectors are often important providers of intermediate inputs to other sectors.

The paper is organized as follows. First, we provide a short review of the main channels through which anticompetitive regulations can be expected to affect performance, focusing on their effect on technology adoption, innovation and the allocation of resources to the most productive firms as well as on intersectoral linkages. Second, we illustrate how regulations differ across countries and how they have changed over the past quarter century, pointing out the pervasive regulatory burdens that inappropriate sectoral regulations can impose on the economy as a whole. Third, we look at the cross-country evidence on the regulation-performance nexus, drawing on aggregate, industry-level and firm-level data. We start the analysis with a look at some recent evidence on the correlation between growth in GDP per capita and regulation. Then, we turn to industry-level evidence. We show how

cross-country productivity growth dispersion and average productivity growth performance can be related to regulation, with a focus on the divide between relatively “deregulated” English-speaking countries and relatively more regulated continental European countries. Finally, we report results relating the efficiency of resource allocation across firms and, in particular, the ability of the most dynamic firms to sustain high productivity growth rates, to the underlying regulatory environment.

2. How does regulation affect productivity?

Product market regulations, like other regulations, generally address public-interest concerns about market failures, including monopoly conditions, externalities and asymmetric information. In this context, product market regulation can promote competition in certain industries by ensuring that market power in natural-monopoly segments is not used abusively and by providing the correct incentives to market participants. However, regulatory frameworks may be flawed by several (possibly concurring) factors. Some regulations may drift away from their original public interest aims, resulting in the protection of special interest groups. Second, regulations (and their implementation) sometimes involve costs that exceed their expected benefits, leading to so-called “government failure”. Third, technical progress, the evolution of demand and progress in regulatory techniques can make the design of regulations obsolete.

Product market regulations address public-interest concerns but they may result in protecting special interests; have costs in excess of their benefits; or become obsolete.

Inappropriate regulations can affect the productivity performance of an economy in many ways. Given the multiple channels and the potentially conflicting effects, it is hard to provide a single and exhaustive taxonomy of the regulation-productivity linkages.¹ The focus in this paper is on regulations that curb market competition (henceforth “anticompetitive regulations”). In other words, we concentrate on ways in which ill-designed regulations can harm productivity. We do not discuss the potential benefits of appropriate regulations for productivity. Our analysis is therefore related to the large and growing literature on the effects of competition on growth (see Aghion and Griffith 2005 for a survey). Recent models of endogenous growth often include the feature that, with technology flows unfettered across countries, productivity growth in follower countries or industries depends on both the ability to catch up by adopting leading technologies available on the market and the ability to innovate, with the importance of innovation increasing as the country or industry gets closer to the world technology frontier (Aghion and Howitt 1998; Acemoglu *et al.* 2006).

According to this line of research, anticompetitive regulations influence the productivity of existing firms by altering the incentives for technology adoption and investment in innovation. They can do so by reducing the rivalry among incumbents and by making the entry of new innovative firms difficult.² Conversely, the opening up of markets and increased competitive pressures provide both opportunities and incentives for firms to upgrade their capital stocks, adopt new technologies and innovate to reach, and possibly push out, frontier production techniques. While the empirical evidence is mixed, recent cross-country and micro-economic studies suggest that these effects are significant, especially where the absorptive capacity is high.³

1 For two recent attempts, see Griffith and Harrison (2004) and Crafts (2006).

2 The role of regulatory barriers and monopoly rights in curbing or preventing technology adoption has been illustrated by Parente and Prescott (*e.g.* 1994, 1999). Other models have focused on the role of new technologically advanced entrants. These may give incumbents the incentives to upgrade their capital through imitation. Aside from pure imitation, affiliates of foreign multinationals may also provide incumbents with positive externalities, such as exposure to foreign high-technology intermediate inputs (Rodríguez-Clare 1996), learning spillovers from multinationals to their domestic suppliers (Javorcik 2004) and skill spillovers for the host-country labour force (Fosfuri *et al.* 2001).

3 For instance, evidence suggests that an increase in the presence of foreign affiliates is likely to be associated with higher levels of multifactor productivity. This evidence was surveyed by Keller (2004) and Görg and Greenaway (2002). For studies finding positive spillovers, see, for instance, Haskel *et al.* (2007), Griffith *et al.* (2006), Javorcik (2004) and Arnold *et al.* (2011a). Recently, the attention has focused on the precise channels through which these spillovers occur (see, for instance, Crespi *et al.* 2007).

The links between anticompetitive regulations and productivity are likely to be influenced by the level of economic development of each country and by the characteristics of both firms and industries within each country. One strand of research has highlighted that the effects of regulations on productivity differ across countries, firms and industries depending on their proximity to, or their distance from, best-practice production techniques. Another strand of research emphasizes the importance of anticompetitive regulations for the process of reallocation of resources from less to more efficient firms, which underpins the aggregate growth of market economies.

2.1 Regulation, productivity and distance to best practice

At the aggregate level, the potentially different effect of anticompetitive regulations on growth depending on the stage of a country's development is just one element of the debate around "appropriate institutions" for growth (Acemoglu *et al.* 2006; Aghion and Howitt 2006). The idea here is that regulations that encourage market openness and entry of new firms (domestic or foreign) can have differential effects on performance depending on whether growth is mainly fuelled by innovation or by capital accumulation and technology adoption (*e.g.* via imitation), with the latter partly determined by the ability of a country to absorb, and adapt to, foreign technology. If the absorption and innovation capacity is low, as would happen in many developing countries, openness and entry may not have the same positive incentive effects that they usually have in more advanced countries. Thus, the adverse effect of anticompetitive regulations on growth would be expected to be stronger for countries that have higher levels of productivity and GDP per capita.

Anticompetitive regulations may slow down the take-up of new general-purpose technologies such as ICT.

At the industry level, the effects of anticompetitive regulations can also differ depending on the industry's propensity to use certain types of technologies. For instance, anticompetitive regulations may slow down the take-up of new general-purpose technologies, such as information and communication technologies (ICT). This is because with low competitive pressures, the incentives to invest in such technologies so as to increase productivity and retain market shares may be lower than in more competitive markets. Poschke (2010) shows that the reduction in such incentives due to regulatory barriers to entry can explain a good deal of the productivity differences between the United States and Europe, once technology choice at entry of new firms is accounted for. Moreover, regulatory burdens can make the necessary within- and cross-firm adjustments to new production techniques more costly than where such regulations are lighter (for instance, by protecting the rents of providers of high-technology intermediate inputs). Anticompetitive regulations, including border barriers, can also hinder the diffusion process, not least by preventing the prices of new general-purpose technologies from falling as rapidly as in the global market.

Most importantly, at the firm level, the impact of anticompetitive regulations on productivity can depend on the characteristics of incumbents, new entrants and exiting firms, particularly their position relative to frontier production techniques (Askenazy *et al.* 2008). In the aggregate, this can imply a non-linear link between regulation and productivity that depends on the overall degree of firm heterogeneity in regulated markets. In some cases, the relationship between aggregate innovation (and productivity) and competitive pressures can be hump-shaped, with too little or too much competition being harmful for innovative efforts (Aghion *et al.* 2005). For instance, the incentive effect of competition on incumbents' innovative activities is likely to be stronger for firms whose cost structure is close to that of their innovating rivals than for firms that have a large technological gap to fill (Aghion *et al.* 2004; Aghion *et al.* 2006). For firms that are far enough from the world frontier, the "Schumpeterian" discouragement effect due to an increase in entry (which can reflect competition in a market) can be strong enough to deter any innovation activity.

2.2 Regulation, productivity and resource reallocation

Regulation can also affect aggregate productivity growth by making reallocation of resources across heterogeneous firms less efficiency-enhancing. There is a sizeable heterogeneity in firms' characteristics and productivity performance even in narrowly-defined industries, and a larger heterogeneity in relatively newer industries characterised by faster technological progress (see e.g. Caves 1998; Bartelsman and Doms 2000; Bartelsman *et al.* 2004). These heterogeneity patterns are often associated with the idea that firms, whether new entrants or incumbents, are continuously evolving and experimenting with new ideas and technologies (broadly defined to include the use of advanced technologies but also organizational structures) in order to gain market shares or simply survive.⁴ Research based on firm-level data suggests that all market economies are characterized by a continuous process of reallocation of resources across such heterogeneous firms and that this process plays a major role for aggregate productivity and output growth (e.g. Olley and Pakes 1996; Foster *et al.* 2002; Griliches and Regev 1995; Bartelsman *et al.* 2004, 2009a). Resource reallocation is driven by incumbent firms adapting to market and technological changes, but also by firm dynamics – the entry of new firms, their expansion in the initial years of life and the exit of obsolete units. Firm turnover is a particularly important vehicle for the implementation of innovations in industries characterised by faster technological progress,⁵ where technology adoption often requires (more than in other industries) significant changes in the organization of production and skill composition.⁶ Many of the new firms that enter the market fail in the initial years of life, but those that survive tend to grow, often at a higher pace than incumbent firms (see e.g. Geroski 1995; Sutton 1997; Bartelsman *et al.* 2004, 2009a). Interestingly, while the magnitude of firm turnover is fairly similar across countries, the characteristics of entrants and exiters, their growth performance and overall contributions to technological adoption and, ultimately, to productivity growth vary considerably (Foster *et al.* 2002; Bartelsman *et al.* 2004, 2009a; Griffith *et al.* 2006).

Firm turnover – the entry of new and exit of obsolete firms – is particularly important for the implementation of innovations in sectors with rapid technological progress.

A growing body of empirical research has been relating differences in the contribution of resource reallocation to productivity growth to differences in policies and institutions that shape the business environment. The list of policy and institutional factors that are likely to promote experimentation and efficient resource allocation across sectors and firms is long. A substantial literature has examined the impact of credit constraints on firm dynamics and technology adoption (e.g. Rajan and Zingales 1998; Beck *et al.* 2004; Klapper *et al.* 2006; Aghion *et al.* 2007). A more limited number of studies have looked at the role of labour market regulations in influencing labour reallocation and the adaptability of firms to technological shocks (Haltiwanger *et al.* 2006; Micco and Pagés 2006). More recently, the focus has increasingly been on regulations in the product market, especially those that affect the intensity of competitive pressures.

Anticompetitive regulations are likely to influence the incentives for new firms to enter a given market, as well as for incumbents to engage in experimentation and the associated reallocation of resources. Such regulations can hinder the reallocation of resources across firms with different productivities.

4 Different theoretical models and growing empirical evidence support the idea that firms – both incumbents and new firms – are engaged in a continuous process of “experimentation” in which they choose whether to enter, or to stay in, the market, and whether or not to expand and adopt new technologies that may have higher potentials but also run greater risks (see e.g. Sutton 1997, Pakes and Ericson 1998 and Geroski 1995 for surveys). Indeed, entering a new market always involves significant uncertainties, especially if this is associated with the adoption of a new, potentially more productive but also more uncertain, technology.

5 Bartelsman *et al.* (2004) as well as Bartelsman *et al.* (2005) indeed find that the entry of new firms plays a stronger role in boosting aggregate productivity in high-tech industries as compared to medium and low-tech industries.

6 Newcomers may have a comparative advantage over existing firms in implementing new technologies in as much as they do not have to incur any adjustment costs. The wider range of technology options available to entrant firms, but also the greater uncertainty concerning business plans explains the observed greater variance in the performance of young businesses compared to older incumbents.

The exit of low-productivity firms and the expansion in domestic and foreign markets of more productive firms result in higher aggregate productivity growth.

A number of theoretical studies have tried to account for firm heterogeneity and modelled distortions to entry and exit as well as reallocation. For example, Bernard *et al.* (2003) and Melitz (2003) highlight the role of border barriers affecting the degree of competition in the product market. Building on models by Melitz and Ottaviano (2008) and Del Gatto *et al.* (2006), Corcos *et al.* (2007) find that lifting behind-the-border barriers may be even more important for productivity. In their models with heterogeneous firms, easing trade barriers generates a reallocation of resources in favour of more productive firms. The exit of low-productivity firms and the expansion in the domestic and foreign markets of more productive firms lead to an increase in aggregate productivity growth. Bergoening *et al.* (2002) also allow for idiosyncratic differences in firm productivity and focus on the effect of a productivity shock on aggregate productivity when there are government-induced frictions in the reallocation of resources. Their simulations suggest that such frictions lengthen the period in which output is below potential. A few additional studies have further developed models with adjustment frictions that prevent resources from immediately being allocated to the most productive firms (see *e.g.* Restuccia and Rogerson 2007; Hsieh and Klenow 2007; Bartelsman *et al.* 2009b). Static and dynamic frictions partly depend on market characteristics and technological factors but are also clearly related to inappropriate product market regulations. In particular, frictions may represent the costs of adjustment – either in the form of entry and exit costs, or adjustment costs to reallocate factors of production such as capital and labour.⁷ In these models as well, both policy-induced entry costs and regulations that raise the adjustment costs to technological shocks reduce aggregate productivity.

As stressed by Bartelsman *et al.* (2009b), inappropriate regulations may affect the reallocation dynamics on different margins in a variety of ways. For example, high start-up costs are likely to reduce firm turnover and potentially lead to a less efficient allocation of resources, but those firms that finally enter the market may have higher productivity than otherwise due to a tighter selection at entry. In turn, the average productivity of incumbents and exiting businesses will be lower. Similarly, certain market distortions might weaken the selection process at entry and exit leading to less systematic differences between entering, exiting and incumbent businesses. There is also an important time dimension: market conditions that promote experimentation and trial and error processes may be associated with more risk and uncertainty in the short run, leading to a lower immediate contribution from entry to productivity, but a higher long-run contribution once the trial and error process of experimenting firms has worked its way out through learning and selection effects.

2.3 Intersectoral linkages

Regulations that hinder competition via the channels highlighted above can affect productivity not only in each regulated industry but also in other industries through intersectoral linkages. Lack of competitive pressures in a sector can generate trickle-down effects on other sectors by raising the costs, lowering the quality or reducing the availability of intermediate inputs, particularly in the case of service inputs where import competition is limited. Recent research has explored the indirect effects that barriers to competition in (upstream) sectors may have on the efficiency of resource allocation and the productivity performance in other (downstream) sectors (Bourlès *et al.* 2010; Barone and Cingano 2011, Arnold *et al.* 2011a).

The main idea is that upstream regulation generates market power for intermediate-good providers. This power is used to extract rents from downstream firms and restrict their access to key markets, which reduces their opportunities and incentives for productivity improvements. Based on a variant of the innovation model by Aghion *et al.* (1997), Bourlès *et al.* (2010) show that anticompetitive upstream

⁷ Labour reallocation might involve a range of costs including the search and matching frictions that have been the focus of much of the recent literature on the dynamics of the labour market (see *e.g.* Davis *et al.* 1996; Restuccia and Rogerson 2007; Hsieh and Klenow 2006).

Regulations can reduce competitive pressures and incentives to improve efficiency also in client ('downstream') sectors.

regulations can reduce competitive pressures in downstream markets by increasing the cost of finding an intermediate supplier, thereby reducing the number of downstream firms. For instance, lack of competition in an upstream sector can generate barriers to entry that also curb competition in downstream sectors: tight licensing requirements in retail trade or transport can narrow the distribution channels for downstream firms and overly restrictive regulation in banking can reduce the range of available sources of financing for client firms, thereby curbing new entry and firm growth. Moreover, the incentives to improve efficiency downstream are reduced by the ability of upstream firms to appropriate a share of the rents that downstream firms would earn from such improvements. This is because, if the markets for intermediate inputs are imperfect, downstream firms may have to negotiate with (and can be held up by) suppliers. In a similar vein, but based on a model of industry interdependence and international specialization, Barone and Cingano (2011) show that regulations restricting competition in upstream sectors for which import competition is weak (e.g. services) affect the cost and/or quality of products used as intermediate inputs in downstream industries or firms. This imposes unnecessary costs of adjustment to downstream firms wishing to improve efficiency and biases industry specialization away from industries that are intensive in the regulated inputs.⁸ Resource allocation across industries and aggregate productivity growth are obviously also affected.

3. Tracking differences in regulation across countries, industries and over time

3.1 Measuring regulation

Studying the quantitative effects of regulation on productivity requires measuring regulation in a relevant, consistent and comparable way across countries, industries and time. In the context of this study, relevance means only considering regulations that have an impact on competitive outcomes in markets, industries and countries. Consistency and comparability can be reached in a variety of ways. For instance, Griffith *et al.* (2004) and Aghion *et al.* (2006) have recently used EU data on anti-monopoly cases and the implementation of the Single Market Programme to address the potential policy determinants of competition, while Buccirosi *et al.* (2009) have used variability in competition law provisions and enforcement rules in a subset of OECD countries. In this paper, we focus on indicators of anticompetitive product market regulations drawn from the OECD international product market regulation database.⁹ These indicators measure to what extent competition and firm choices are restricted where there are no *a priori* reasons for government interference, or where regulatory goals could plausibly be achieved by less coercive means. They are based on detailed information on laws, rules and industry settings (e.g. the extent of vertical integration or monopoly power), and cover both general-purpose regulations (such as administrative burdens on start-ups) and sector regulations in energy (gas and electricity), transport (rail, road and air), communication (post, fixed and cellular telecommunication), retail distribution, professional services and banking, with country and time coverage varying across industries. This information covers both domestic anticompetitive regulations and industry-specific FDI restrictions in all OECD countries as well as in the BRIICS (Brazil, Russia, India, Indonesia, China and South Africa).¹⁰

8 Indeed, in theoretical models of industry interdependence, the underdevelopment of markets for non-tradeable inputs has been shown to constrain (or even prevent) the diffusion of input-intensive technologies, thus affecting the patterns of resource allocation and international specialization (Rodríguez-Clare 1996; Okuno-Fujiwara 1988). Barone and Cingano's work is related to the growing literature on the relevance of institutions for resource allocation and comparative advantages (see e.g. the references in Barone and Cingano 2011).

9 The data and underlying documentation are publicly available at www.oecd.org/eco/pmr. The most recent observations are currently for 2007/2008.

10 The basic regulatory data include: economy-wide indicators for all OECD countries and several non-OECD ones for 1998, 2003 and 2007; indicators for energy, transport and communication that cover most OECD countries over the 1975-2007 period (several non-OECD countries are also covered for the most recent period); indicators for retail distribution and professional services that cover most OECD countries and several non-OECD countries for 1998, 2003 and 2007; the

The main advantages of using these indicators in empirical analysis are that they can be held to be exogenous to productivity developments and that they are directly related to underlying policies, a feature that business survey data do not have.¹¹ Another advantage is that, since they are composite constructs based on detailed information on specific policies, they address multicollinearity problems in estimation. At the same time, they make it possible to focus on the specific aspects of policies that are considered to be relevant for productivity. For instance, most of the analysis reported below deals with barriers to entry (including administrative burdens), sometimes explicitly distinguishing between border and non-border policies that affect these barriers. Yet another advantage of the OECD indicators is that they vary over countries, industries and time, though full time variability is limited to a subset of non-manufacturing industries.¹²

The OECD regulation indicators are used to summarize the potential burden of non-manufacturing regulations imposed on all business sectors via intersectoral linkages.

The OECD indicators are also used to summarize the potential burden of non-manufacturing regulations imposed on all business sectors via intersectoral linkages. This is particularly important because the non-manufacturing sector is undoubtedly the most regulated and sheltered part of the economy, while few explicit barriers to competition remain in markets for manufactured goods of OECD economies. However, as discussed above, even low-regulated industries may suffer from regulation-induced inefficiencies in non-manufacturing because all industries are heavy intermediate consumers of non-manufacturing inputs. Sectoral "Regulation impact" (RI) indicators of the indirect burden of anti-competitive regulation in upstream non-manufacturing industries for downstream industries (including the regulated non-manufacturing industries themselves) are calculated for each country using information from input-output tables:¹³

$$(1) \quad RI_{kt} = \sum_j (NMR_{jt} + FDI_{jt}) \cdot w_{jk} \quad 0 < w_{jk} < 1$$

where the variable NMR_{jt} is an indicator of domestic anticompetitive regulation in non-manufacturing sector j at time t , FDI_{jt} is an indicator of FDI restrictions in non-manufacturing sector j at time t , and weight w_{jk} is the total input requirement of sector k for intermediate inputs from non-manufacturing sector j . These Regulation impact indicators allow tracking the "trickle-down" effects of inappropriate regulations in non-manufacturing industries on productivity in all sectors of the economy.¹⁴

indicator for banking that covers 30 OECD countries for 2003. The indicator of FDI restrictions covers a larger set of sectors over the 1981-2007 period.

- 11 Naturally, endogeneity cannot be completely ruled out if, for instance, policies are affected by productivity outcomes through political-economy channels. On the relative advantages of policy-based and survey-based composite indicators, see Nicoletti and Pryor (2006).
- 12 Griffith *et al.* (2006) formulate a number of criticisms concerning the OECD indicators, the most compelling being that their time dimension is limited to a subset of non-manufacturing sectors that they do not think are sufficiently representative of economy-wide regulatory developments. Conway and Nicoletti (2006) show that the OECD indicator of non-manufacturing regulation is closely correlated, both across countries and over time, with a popular time-series indicator of economy-wide business regulation, the Economic Freedom of the World index by Gwartney and Lawson (2003). This is not surprising since most OECD product market reforms have been implemented in the non-manufacturing industries over the past decades.
- 13 The resulting Regulation impact indicator covers 39 sectors that use the outputs of these non-manufacturing industries as intermediate inputs for the 1975-2007 period. Given that some sectoral indicators (retail, professional services and banking) have a limited time coverage, we use their 2003 value to compute the regulation impact indicators. But the empirical results reported in the next section do not change if values for 1998, 2003 and 2007 are used instead, with interpolation between periods. This technique for calculating the regulation impact indicators has also been used by Faini *et al.* (2006) and Barone and Cingano (2011).
- 14 All OECD indicators take continuous values on a scale going from least to most restrictive of competition. A detailed description of the indicators of economy-wide regulation can be found in Woelfl *et al.* (2009, 2010) while a detailed description of domestic non-manufacturing regulation and the trickle-down indicators of "regulation impact" is provided in Conway and Nicoletti (2006). Indicators of FDI restrictions are described in Golub (2003) and Golub and Koyama (2006). The indicator of domestic anticompetitive regulations in banking is described in de Serres *et al.* (2006).

3.2 Regulation: Cross-country patterns and historical developments

Figure 3 shows cross-country patterns and the evolution of economy-wide product market regulation and FDI restrictions across non-manufacturing sectors. It suggests that, overall, regulatory approaches have converged across OECD countries over the past two decades towards a more procompetitive stance. Looking at specific non-manufacturing sectors, convergence has taken place in particular in energy, transport and communication as well as in border barriers to FDI (for the latter see Figure 3b), while the available time-series data for retail trade and business services point to persistent differences in the regulatory stance across countries in these sectors. Despite convergence in many areas and sectors, differences in regulation persisted at the end of the period, suggesting that competitive pressures still differ considerably across both countries and sectors.

While regulations have converged towards a more procompetitive stance in many areas of OECD economies, differences persist in retail trade and business services.

Figure 3a. Economy-wide product market regulation
OECD indicator, scale 0-6 from least to most restrictive

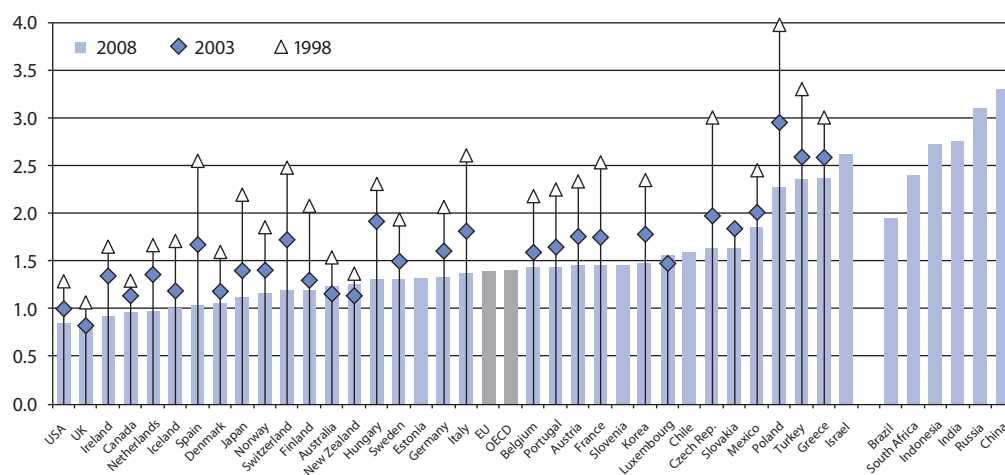
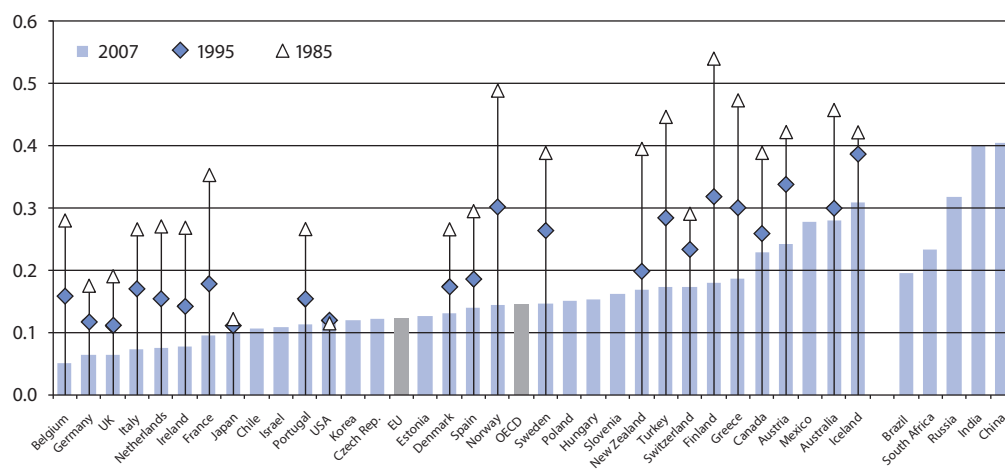


Figure 3b. FDI restrictions in the business sector
OECD indicator, scale 0-1 from least to most restrictive



Source: OECD International Regulation Database

The figure also suggests that, in the most recent period for which data are available, regulations often tended to remain more adverse to competition in emerging economies than in OECD countries, though not necessarily in all sectors. Unfortunately, historical data are lacking and it is not possible to

use the OECD indicators for tracking whether emerging economies have been converging in regulatory practices towards more advanced economies.

These patterns raise a number of issues that are relevant from both a research and policy point of view. First, to what extent is the more restrictive stance in a number of countries, including the emerging economies, slowing down their GDP per capita and productivity growth rates? Second, can differences in competitive pressures across industries that are induced by different regulatory approaches explain the wide cross-country and cross-industry dispersion of productivity growth rates observed in the OECD area? Third, to what extent can regulations that curb competitive pressures and generate unnecessary burdens for businesses hinder reallocation towards the most efficient firms? Fourth, do these regulations affect all countries, industries and firms equally, irrespective of their technological characteristics, dynamism and distance to best practice? We now turn to the cross-country empirical evidence on these issues.

4. Evidence on regulation and productivity

A growing number of recent empirical studies have focused on the effects of product market conditions on growth in productivity and GDP per capita. Some studies have focused on the impact of product market conditions on capital accumulation (Alesina *et al.* 2005) and its asset composition (Gust and Marquez 2004; Conway *et al.* 2006; Bloom *et al.* 2010) as well as on their effects on innovation (Aghion *et al.* 2005; Aghion and Griffith 2005). Here we focus on those cross-country studies that have directly related measures of anticompetitive regulation to GDP per capita and productivity growth. The review does not have the ambition to be exhaustive.

4.1 Some aggregate evidence

Country-level evidence confirms the negative effects of anticompetitive regulations on GDP per capita and MFP growth but the results are somewhat fragile.

Empirical research linking anticompetitive regulations to aggregate growth has found negative effects on GDP per capita, GDP per worker or multifactor productivity (MFP) growth, but the results are not always robust and consistent across studies. These studies have taken empirical approaches based either on static cross-country growth regressions *à la* Barro and Sala-i-Martin or on dynamic panel regressions. Static models have been estimated with either a fixed number of explanatory variables (in addition to regulation) or with methods that allow identifying the variables that are most likely to affect growth among a vast number of possible factors, including regulation (so-called Bayesian Model Averaging – BMA). Studies also differ in terms of the sample of countries used. As shown in Babetskii and Campos (2007), differences in methodology and sample coverage can significantly affect the size (and sometimes the sign) of the growth effects of changes in institutional variables.

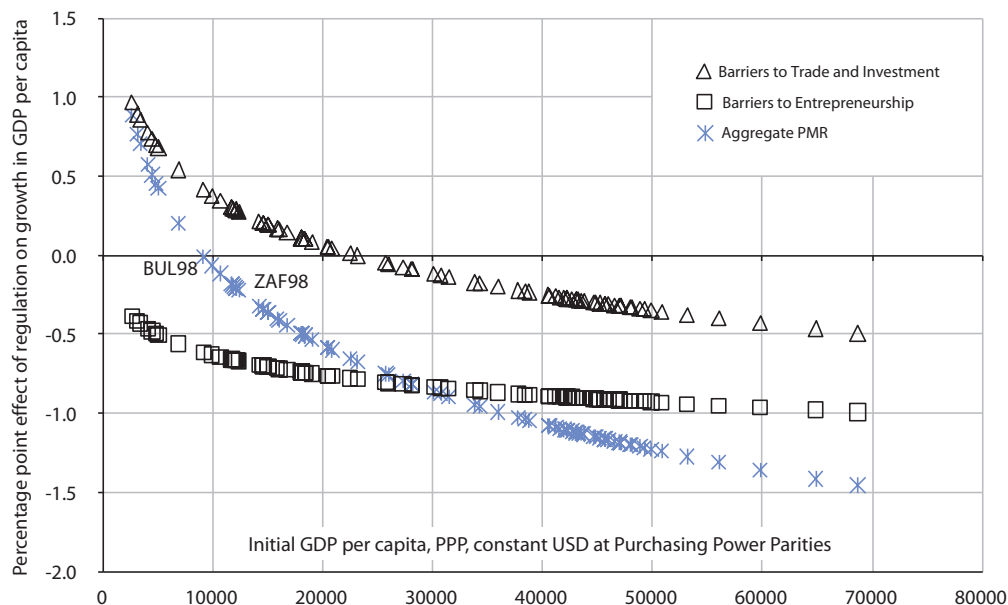
A few recent studies illustrate well the fragility of aggregate findings. Using a BMA methodology and focusing on GDP per capita, Woelfl *et al.* (2010) find that easing anticompetitive regulations by an amount equivalent to moving from the regulatory stance of Brazil to that of the average OECD country could yield a 0.3 percent higher average annual rate of growth in per capita GDP. Boulhol *et al.* (2008) previously found similar results based on simple dynamic panel regressions. However, the statistical significance of results from both these studies is relatively weak. Using a more complex dynamic approach based on Bloom *et al.* (2002), Bouis *et al.* (2011) also find that anticompetitive regulations curb GDP per capita via their effect on MFP, but they are unable to sharply distinguish the influence of regulation from that of other institutional variables within their estimation framework. Finally, specifically focusing on MFP in the context of static cross-country growth regressions, Aghion *et al.* (2009) also find adverse effects of market rigidities (expressed as a combination of labour and product

market regulation) on aggregate performance. A common feature of all these studies is that, among the various kinds of regulations that were tested, barriers to entry and entrepreneurship are found to be those having the most significant and damaging effects on performance.

One possible reason for the lack of robustness of results from aggregate studies is that the effects of regulation, and of different kinds of regulations, may vary with levels of development (Aghion and Howitt 2006). This implies a “composition” effect that blurs the link between regulation and performance when this non-linearity is not accounted for in estimation. Some estimates from dynamic panels with thresholds (or simple dummies) differentiating among effects of regulations across income levels suggest that anticompetitive regulations may have particularly adverse effects on more advanced countries, while having lesser negative effects and even positive ones at low levels of development. For instance, Figure 4 shows how the effects of different kinds of regulations vary across countries with different initial GDP per capita levels according to the panel estimates of Woelfl *et al.* (2010). Negative effects of overall anticompetitive regulations (PMR) begin to be observed at GDP per capita levels just above those of Bulgaria (BUL) or South Africa (ZAF) in 1998, with certain barriers to trade and investment still having positive effects even at higher income levels. Nonetheless, as already mentioned, barriers to entrepreneurship have uniformly negative effects on growth in all countries independent of GDP per capita. But the effects of all types of regulations on growth become increasingly adverse as income levels rise, and particularly steeply so for those regulations that affect international openness. Aghion *et al.* (2009) find similar threshold effects of market rigidities on aggregate MFP growth, with rigidities decreasing growth only in countries with income close to the level of the United States. No such threshold effects were found, however, in the dynamic panel estimated by Bouis *et al.* (2011), suggesting that the jury is still out concerning the relevance of such effects for policy analysis and recommendations.

Some studies suggest that anticompetitive regulations have more harmful effects on more advanced countries than on countries at low levels of development.

Figure 4. The impact of regulation on growth at different levels of initial GDP per capita



Source: Woelfl *et al.* (2010)

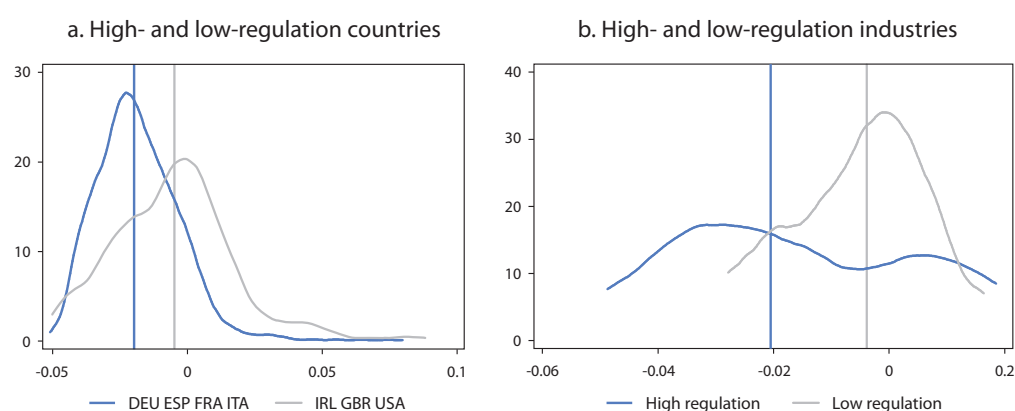
4.2 Regulation and industry-level productivity

To begin exploring the link between regulation and industry-level productivity, Figure 5a shows the cross-industry distribution of labour productivity growth rates over the 1995-2005 period in two groups of countries for which we have consistent data: three relatively “deregulated” English-speaking countries

– the United States, the United Kingdom and Ireland – and four relatively “restrictive” large European countries – Germany, France, Italy and Spain. The figures focus on trend productivity growth rates to abstract from short-term fluctuations. Moreover, the growth rates have been purged of idiosyncratic effects across countries and industries to make it possible to pool the productivity data in a meaningful way.¹⁵ Therefore, the values on the horizontal axis are not directly interpretable, while their dispersion (overall and across industries) is.

In Figure 5b, observations are classified into low or high regulation if they fall into the first and last quintiles, respectively, of the distribution of the regulation impact indicator. This indicator reflects the trickle-down effects of anticompetitive regulation in non-manufacturing sectors on industries that use the output of these sectors as intermediate inputs into the production process.

Figure 5. Labour productivity growth distributions across countries, industries and time, 1995-2005



Source: Authors' calculations based on EU-KLEMS, March 2007, and OECD International Regulation Database
 Notes: The horizontal axis shows trend productivity growth, Hodrick-Prescott (HP) filtered (to eliminate the cyclical component) and purged of country and industry means. Agriculture, forestry, fishing, mining and construction are excluded, as are public administration, education and health sectors. The vertical bars represent sub-sample medians.

English-speaking countries have a higher concentration of fast-growing sectors than continental EU countries.

Several features emerge from Figure 5. For both groups of countries, the overall distribution is skewed to the left, indicating prevalence of weak productivity growth rates, but has a long right tail, suggesting cases of high productivity growth. Interestingly, the right tail of fast growing industries is longer and thicker in English-speaking countries than in continental EU countries that have a higher concentration among relatively more slowly-growing industries. As a consequence, English-speaking countries tend to have a higher median productivity growth than continental EU countries (as shown by the distance between the vertical lines).

In the light of our previous discussion, it is natural to relate these differences in the distribution of productivity growth to underlying product market regulations that are more or less prone to help sustain efficiency improvements within each industry. As a first check on this conjecture, Figure 5b replicates the productivity growth distributions pooling together all countries, but now distinguishing between high- and low-regulated cases (each observation being for a country/sector/year, again purged of idiosyncratic factors). Low- and high-regulated cases are defined as those falling within the first and fifth quintiles, respectively, of the distribution of the OECD regulation impact indicator. As explained above, using these indicators makes it possible to account for both the direct effects of anticompetitive regulations in each industry and the indirect effects via intersectoral linkages.

¹⁵ In other words, the figure shows the distribution of the residual of a regression of productivity growth rates on country and sector dummies after applying a Hodrick-Prescott filter and eliminating outliers (top and bottom percentile of the distribution). The resulting distributions are based on country-industry-year observations.

The figure suggests that regulation plays a role in shaping the distribution of productivity growth rates. Where regulation encourages competition and does not impose any excessive costs to businesses, both the density of high productivity growth rates and median productivity growth are higher than where regulations are restrictive and costly. Moreover, the dispersion of productivity growth rates is much higher in highly-regulated situations and low productivity growth is much more frequent.

The wide industry-level dispersion of productivity growth rates is a potentially important source of identification for econometric studies of the regulation-productivity link. A large number of such industry-level studies have been implemented over the past decade, mostly relying on dynamic panel data analyses (e.g. Scarpetta and Tressel 2002; Nicoletti and Scarpetta 2003; Conway *et al.* 2006; Griffith *et al.* 2006; Inklaar *et al.* 2008; Buccirossi *et al.* 2009; Bourlès *et al.* 2010) within the general framework proposed by Aghion and Howitt (2006). In this framework, sectoral productivity growth in a given country depends on the ability to keep pace with growth in the country with the highest level of productivity (the leader) by either innovating or taking advantage of the best technology available. Productivity growth depends on both knowledge spillovers from the leader's innovation drive and the speed at which the productivity gap is closing due to, for instance, technology diffusion and adoption. In turn, the effect of anticompetitive regulation on productivity growth in follower countries is assumed to depend on the size of the sectoral productivity gap.¹⁶

While the basic estimation framework is similar, the various studies differ in data and coverage, control variables and, especially, in the measurement of product market policies, with the most recent studies focusing on the indirect burdens imposed by (upstream) non-manufacturing regulations on all (downstream) business sectors (see Arnold *et al.* 2008 for a survey). The match between the industry productivity dimension and the industry-level regulation impact indicators constructed by the OECD, as well as their time-series variability, has proved to be particularly useful for the estimation.

Given the differences in data and specification, the results from industry-level studies are not easily comparable. However, a number of common conclusions emerge:

- In all studies, regulations that restrict competition are found to curb labour productivity or MFP growth significantly, even though the point estimates vary.
- Studies that obtain separate estimates for different sectors (Conway *et al.* 2006; Inklaar *et al.* 2008) tend to find stronger negative effects in ICT-intensive industries.
- Regulations that appear to be most damaging for sectoral productivity growth are barriers to entry, consistent with the results found in aggregate growth regressions (see above).
- Studies that account for regulatory burdens implied by intersectoral linkages (Conway *et al.* 2006; Inklaar *et al.* 2008; Bourlès *et al.* 2010) find these burdens to provide an important explanation of the dispersion in productivity growth rates across countries, industries and over time.

Focusing on labour productivity, Conway *et al.* (2006) show that regulatory burdens have been particularly harmful to productivity improvements in ICT-intensive sectors, largely because they slowed down the catch-up process to best practice productivity. Conway and Nicoletti (2007) estimate the productivity growth "deficit" that would be suffered by countries whose anticompetitive regulations would hinder the catching-up following a global positive productivity shock such as that experienced in the OECD area during the diffusion of ICT. In all countries, the detrimental effect of anticompetitive regulation, again expressed by the regulation impact indicator, is larger in ICT-intensive sectors given

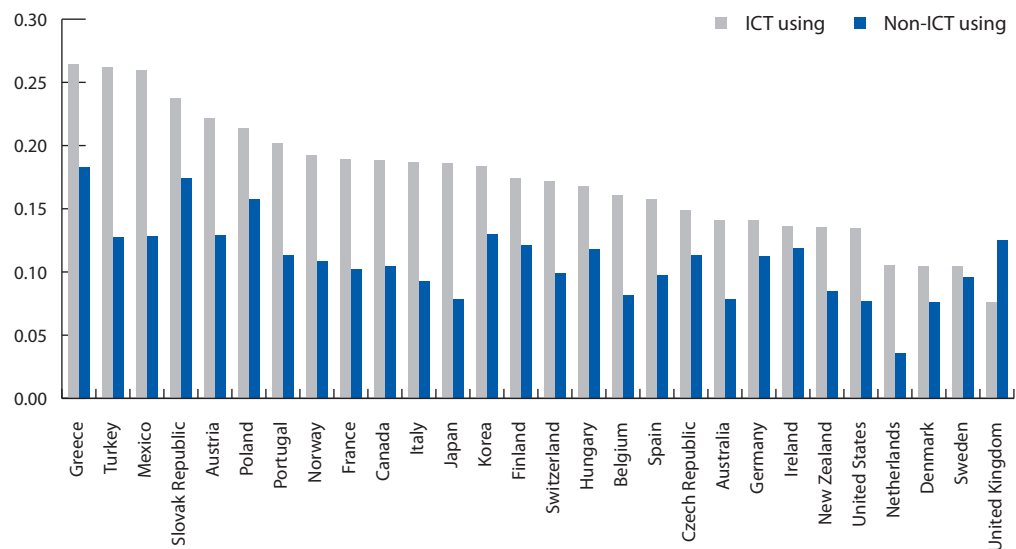
Regulations are most harmful when they affect ICT-intensive sectors; come as barriers to entry; or concern sectors providing key inputs for other sectors.

¹⁶ All these studies include country- and sector-fixed effects. However, due to the presence of the interaction term between the productivity gap and regulation, the source of identification of the regulation effects is variability across all dimensions of the panel: time, industries and countries.

that the regulatory burden is estimated to be higher in these sectors in comparison to non-ICT intensive sectors (Figure 6). The estimated gap in productivity catch-up in ICT-intensive sectors is particularly sizeable in Austria, Greece, Italy, Germany, Norway and Belgium, all of which remain 30 to 40 percent below potential five years after the initial shock.

Figure 6. The burden of non-manufacturing regulation on ICT-using and non-ICT using sectors, 2003

Scale normalised to 0-1 from least to most burdensome



Source: OECD International Regulation Database

Notes: The figure shows the regulation impact indicator, which reflects the burden of anticompetitive regulation in non-manufacturing sectors on industries that use the output of these sectors as intermediate inputs into the production process.

The strength of the adverse growth effects may depend on the distance from the technological frontier, but whether close followers or laggards are more affected is under debate.

While virtually all industry-level studies of the regulation-productivity link, on average, find adverse effects of anticompetitive policies on growth, there is less agreement on whether these effects are uniform across countries (or sectors) independent of their distance to the technological frontier. Among the studies that have conditioned the effects of regulation on distance to frontier, Conway *et al.* (2006) and Nicoletti and Scarpetta (2003) find that regulation tends to slow down productivity growth more strongly in countries (or sectors) that are further away from global best-practice productivity. They ascribe this result to the tendency of weak competitive pressures and burdens implied by regulation to lower incentives and opportunities and increase the costs of adopting best-practice production technologies and methods. Average developments in industry productivity would thereby suffer from weak growth in the most efficient firms and a low contribution of firm turnover to efficiency improvements.¹⁷

Recent studies (Bourlès *et al.* 2010) suggest, however, that anticompetitive regulations in up-stream industries tend to have a more damaging effect on the multifactor productivity growth of sectors sufficiently close to the global productivity frontier. This is consistent with the neo-Schumpeterian view that lack of competition is particularly harmful where the “escape-competition” effect benefiting an innovating firm is the strongest – that is in a situation of neck-and-neck rivalry among firms

¹⁷ Since Conway *et al.* (2006) focus on labour productivity, the greater harm to productivity growth caused by anticompetitive regulations for countries and sectors that are further away from the global frontier can also be ascribed to the tendency of such regulations to curb capital formation (Alesina *et al.* 2005) and ICT investment (Gust and Marquez 2004).

(Aghion *et al.* 1997; Aghion and Howitt 2006). Nevertheless, Broulès *et al.* also find that this closeness-to-frontier effect vanishes in the most recent period (1995-2007) characterised by increased integration of global markets and the widest diffusion of ICT technologies. In other words, countries (and sectors) uniformly suffered from anticompetitive regulations in the more recent past independent of whether they are close to or well behind the frontier. Over the whole estimation period, regulation is found to curb productivity for more than 85 percent of the observations while significantly increasing it only for a small share of them (3 percent), namely for firms whose MFP levels are less than half of those of the global technology leader. Using the average level of regulation and the average level of the productivity gap, regulation is estimated to curb annual MFP growth by around 1 percentage point over the whole period and by around 1.7 percentage points more recently.

4.3 Regulation, firm-level reallocation and productivity

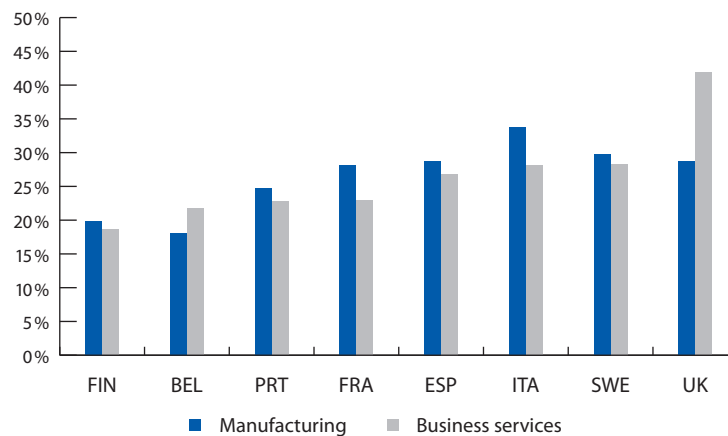
As discussed above, industry-level productivity growth hides a widespread heterogeneity in firms' performance within each industry and a continuous process of reallocation across them, through the entry of new firms, the exit of obsolete ones and the reallocation of factor inputs among continuers. All industries display persistent productivity dispersion, pointing to a (more or less) wide heterogeneity in the performance of firms. In this context, a natural question is whether market forces tend to reallocate resources towards firms with higher efficiency levels. A simple way of assessing the importance of reallocation for productivity is to ask the question – are resources efficiently allocated in a sector/country in the cross-section of firms at a given point in time? To answer this question, we focus on multi-factor productivity, which is the appropriate measure of firm-level efficiency in the use of inputs, and we use the simple cross-sectional decomposition of MFP levels for a sector at a point in time developed by Olley and Pakes (1996). Aggregate MFP is decomposed into two terms involving the un-weighted average of firm-level MFP plus a cross term that captures allocative efficiency since it reflects the extent to which firms with greater efficiency have a greater market share.¹⁸

To see whether the resource allocation across firms in a sector is efficient, we check to what extent firms with greater efficiency have greater market shares.

This decomposition essentially involves comparing the un-weighted average MFP to the weighted average MFP. To minimise the measurement problems involved in comparing these MFP levels across sectors or countries, we focus on the relative contribution of allocative efficiency to the observed aggregate productivity level. This requires comparing productivity levels of firms in the same industry and country, thus ensuring that most measurement problems are controlled for. Specifically, we estimate a production function in logarithmic form for each sector and country and take the residual, *i.e.* the part of output that is not explained by factor inputs, as a measure of MFP. Figure 7 presents the estimated indicator of efficiency ($OP=WP/(AP+WP)$) in the allocation of resources in a sample of EU countries for which we have consistent firm-level data from the Amadeus database over the early 2000s. It focuses on manufacturing and business services separately and for each of the two broad sectors, a weighted average of 2-digit industry level OP cross terms is used.

18 Formally, the decomposition is given by: $P_t = (1/N_t) \sum_i P_{it} + \sum_i \Delta \theta_{it} \Delta P_{it} = AP_t + WP_t$ where N is the number of businesses in the sector and Δ is the operator that represents the deviation of, respectively, the firm-level measure of productivity (P) and the business market share (θ) from their respective industry simple average in a given year.

Figure 7. Contribution of resource allocation to sectoral MFP levels (early 2000s)
Based on Olley-Pakes productivity decomposition



Source: Authors' calculations based on Amadeus database

Notes: The data reported in the figure represent the share of the total MFP level that is due to an efficient allocation of resources. The degree of efficiency in resource allocation is measured by the cross-term of the Olley and Pakes decomposition (see the main text), which is defined as the log difference between the weighted (P_i) and un-weighted averages (AP_i) of firm-level productivity.

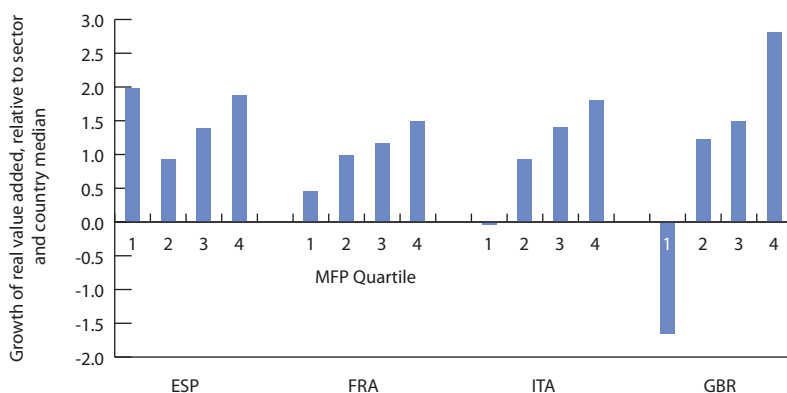
The OP decomposition suggests that, in all countries, allocative efficiency accounts for a significant fraction of the overall observed MFP levels: between 20-40 percent of the observed productivity levels can be ascribed to the actual allocation of resources compared to a situation in which resources would be randomly allocated across firms in each sector. However, there are also differences across the two broad sectors and across countries. The United Kingdom stands out with the highest degree of allocative efficiency in services, almost 15 percentage points above that of the second-highest country in the service sector (Sweden).

More productive firms generally grow faster than less productive ones, but some countries do better than others in channelling resources to high performers.

To shed some further light on the allocative efficiency, Figure 8 plots average firm growth by the quartile of the firm-level MFP distribution. The quartiles divide firms according to their MFP relative to the median of the sector and country for which the production function was estimated, on average over 1998-2004). Thus, the top quartile represents the 25 percent most productive firms in each industry. Firm growth is measured in terms of real value added, averaged over 1998-2004, and normalised by the country/sector average (which is set equal to 1 in the figure). In other words, a value of 3 for the highest quartile in the United Kingdom means that these firms grew on average three times as fast as their peers in the same country and sector. Naturally, this is a partial analysis that does not consider dynamic processes – for example, some of the low-productivity firms may be new ventures that are involved in a learning-by-doing process and catching up with the efficiency of more mature businesses, while some of the highly productive businesses may have less scope for further expansion. Bearing this caveat in mind, the figure suggests that in all countries but one (Spain), more productive firms indeed experience higher growth than their lower-productivity counterparts. However, the growth differences between low- and high-productivity firms vary significantly across countries. This confirms our finding based on the cross-sectional OP productivity decomposition, namely that some countries are better able to channel resources towards high-productivity firms, thereby encouraging them to grow rapidly and strongly contributing to the overall productivity performance.

Figure 8. Do better firms grow faster?

Value-added growth by quartiles of the MFP distribution of firms



Source: Authors' calculations based on the Amadeus database

Notes: The figure presents the average real value added growth of the four quartiles of the MFP (relative to the median of the sector and country for which it was estimated) distribution of firms in each country. Firm level real value added growth is normalised by country/sector average to improve the comparability.

Two questions emerge at this point: Why have some countries been more able than others to reallocate resources towards fast-growing firms, especially in industries with a high potential for exploiting new general-purpose technologies? What are the mechanisms through which inappropriate regulations might affect reallocation across sectors and firms? A first step towards answering these questions is to correlate our OP indicator of allocative efficiency across countries, sectors and time with the OECD indicators of the regulatory burden imposed by non-manufacturing regulation on all sectors of the economy. In other words, we investigate whether there is an association between anticompetitive regulations (in both upstream and downstream sectors) and the efficiency of the reallocation process within each industry.¹⁹

The results are shown in Table 1. For the overall business sector, they point to a negative effect of regulatory burdens on the efficiency of resource allocation. However, breaking down the sample into manufacturing and services suggests that the negative effect of regulation originates from services. This is not surprising, since cross-country differences in the regulatory environment and regulatory reforms over the past decade mostly concerned the service sector. Interestingly, if we split the industry sample between ICT-intensive and non-ICT intensive sectors, we find that regulatory burdens affect the ICT-intensive sectors more strongly, where such burdens are often higher (see Figure 6 above). In other words, in those sectors where there was more heterogeneity in firm performance because of greater experimentation and learning by doing around this new general-purpose technology, regulations that restricted competition and entry of new firms have had a strong negative effect on the ability of the market to channel resources towards firms with the best performance. This illustrates one channel through which restrictive regulations that impinge on ICT-intensive sectors may have curbed the ability of some countries to fully benefit from the diffusion of new technologies over the past decade, as suggested by Conway *et al.* (2006) based on industry-level data.

Regulatory burdens affect the efficiency of resource allocation, especially in services and ICT-using sectors with their greater need for experimentation and learning-by-doing.

¹⁹ We use a fixed-effect specification where, in addition to our regulation impact indicator, we include a full set of time-varying country-specific and sector-specific effects. The sample includes a set of OECD countries for which the Amadeus database has a good coverage of firms: Austria, Belgium, Finland, France, Germany, Italy, Portugal, Spain, Sweden, United Kingdom; the period is 1998-2004.

Table 1. Product market regulation and allocative efficiency

Dependent variable: Olley-Pakes indicator	Business sector	Manufacturing only	Services only	ICT-using sectors	Non-ICT using sectors
Regulation impact indicator	-0.33*** (0.10)	0.54 (1.44)	-0.37** (0.16)	-0.30** (0.14)	-0.26 (0.17)
Country-year fixed effect	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	894	703	191	417	477
R2	0.20	0.21	0.19	0.21	0.20

Source: Updated from Arnold *et al.* (2008)

Note: Standard Errors in parentheses. *, **, *** indicate statistical significance at the 10, 5 and 1 percent levels, respectively. Agriculture, forestry, fishing, mining and construction are excluded, as are public administration, education and health sectors. ICT-intensive sectors include both ICT-producing and ICT-using sectors.

Further light on the link between regulation, reallocation and productivity growth can be provided by formal econometric analysis using firm-level data. This makes it possible to explore the effects of inappropriate regulations on firm-level productivity while accounting for heterogeneity in firm characteristics. Limits in the availability of comparable firm-level data have so far restricted the number of cross-country empirical studies of this kind. Most available studies have therefore focused on firm-level panels in individual countries. Moreover, most firm-level studies of the competition-performance nexus have used measures of competition based on market outcomes, such as entry rates, mark-ups, market shares or concentration indices (Nickell 1996; Blundell *et al.* 1999; Aghion *et al.* 2004, 2005, 2006; Forlani 2011). Here we report results from three recent multi-country firm-level studies that have explicitly focused on the role of barriers to entry imposed by regulation.

Depending on their design, entry regulations play the roles of screening the best entrants or protecting inefficient incumbents.

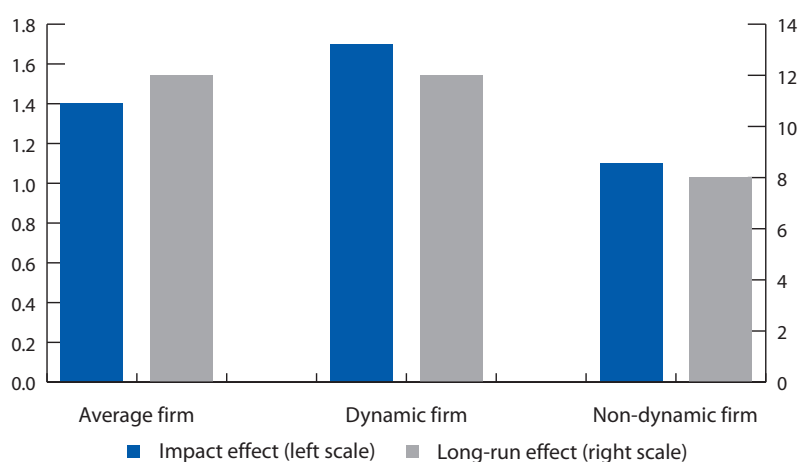
Klapper *et al.* (2006) look at the effect of entry regulations, as measured by the World Bank Doing Business indicators (World Bank 2004), on entry rates, the size of entrants and their labour productivity growth rates in a two-year (1998-1999) panel of European firms covered by the Amadeus database. They note that depending on their design, entry regulations can play the alternative roles of screening the most efficient firms or protecting inefficient incumbents. They test which of these roles has been predominant using a difference-in-difference approach. They find evidence that regulations curb entry, increase the average size of firms at entry and lower the labour productivity growth of incumbents, strongly suggesting that these regulations are sheltering them from competitive pressures. The implications for resource reallocation are clear: inappropriate entry regulations tend to hamper the efficiency-enhancing role of firm demographics, distort the size distribution of firms and negatively affect aggregate productivity by lowering the incentives to improve efficiency in existing firms.

Daveri *et al.* (2010) focus on the direct effects of entry regulations on MFP growth of service sector firms in Italy and France over the 1995-2007 period. They measure regulations with detailed service sector information provided by the OECD for retail distribution, transport, communication and professional services. They proceed in two steps: First they estimate the impact of entry restrictions on the market power of incumbents in these regulated sectors (as measured by mark-ups), and then they relate this indicator of market power to the MFP growth of incumbents in the same sectors. They find indeed that regulations curb firm-level productivity growth in regulated industries via a higher mark-up, that is, regulations weaken competitive pressures and weaker competitive pressures slow down efficiency improvements.

Arnold *et al.* (2011b) take a broader approach to investigate the impact of entry regulations on MFP growth. They take into account both the direct effects of regulations on firms' productivity in regulated non-manufacturing sectors and the indirect effects of such regulations on firms in other ("downstream") sectors via intersectoral linkages, using the OECD indicators of regulation impact. They also account for firm heterogeneity by distinguishing between "dynamic" firms that catch up rapidly to the global frontier (for their sector) and firms that do not (the "non-dynamic" firms).²⁰ Their main results are summarised in Figure 9. Anticompetitive regulations are found to curb the productivity growth of all firms, dynamic and non-dynamic in both upstream and downstream sectors. On average, a substantial easing of such regulations is estimated to increase the productivity growth by over 1 percent, implying an increase of more than 10 percent in the level of multifactor productivity in the long run. Interestingly, the estimated increase is significantly stronger for dynamic firms. Hence, regulation may have negative effects on the efficiency of resource reallocation by disproportionately hitting those firms that are driving improvements in aggregate productivity.

Substantially easing regulations could boost productivity growth by over 1 percent on average, raising the level of MFP by more than 10 percent in the long run.

Figure 9. Percentage increase in MFP from easing anticompetitive regulation
Reduction by one standard deviation in domestic and border entry barriers



Source: Table 1, columns 1 and 3 in Arnold *et al.* (2011b)

Notes: Dynamic firms are defined as firms that catch up to the global frontier in their respective sector. A One-standard-deviation change is equivalent to moving from the level of regulation prevailing in Greece (one of the most regulated countries according to the OECD regulation impact indicators) to a situation of best-practice regulation corresponding to adopting the least anticompetitive regulations observed in the OECD area in all sectors.

5. Concluding remarks

In this paper, we discuss theory and evidence that relate differences in the efficiency of resource reallocation and productivity performance across countries to anticompetitive product market regulations. We provide evidence that such regulations differ across countries and industries and have changed over time. Drawing on recent empirical studies, we find that regulations are of importance for performance.

²⁰ Arnold *et al.* (2011b) also distinguish between two sources of entry restrictions, domestic and border barriers (proxied by FDI restrictions). They find that these barriers are more harmful for dynamic firms that approach the global frontier more rapidly.

***Reforming
anticompetitive
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We highlight three main sets of results:

- There is solid evidence that the pace and depth of product market reforms are important for understanding both productivity and resource allocation outcomes. Countries and industries where direct and indirect regulatory burdens are lighter have generally experienced the highest GDP per capita and productivity growth rates in the studies we have surveyed.
- Evidence at the firm level suggests that, where regulatory burdens are lighter, the reallocation of resources towards the highest-productivity firms is stronger. Moreover, firm-level productivity growth is also curbed by anticompetitive regulations.
- The implications of inappropriate regulations for productivity performance are estimated to be quantitatively important. Therefore, reforming such regulations can provide a significant boost to potential growth in OECD economies.

The adverse effects of anticompetitive regulation on performance are often found to be non-linear, with their intensity depending on the characteristics of countries, industries and firms. Some studies find the effects to be more severe for industries closer to international best practice and/or using more intensively new information technologies and for firms that are more dynamic. However, there is no consensus on the extent and direction of such differential effects and further research is needed to elucidate the interaction of regulation with levels of development and the heterogeneity of industries and firms.

References

- Acemoglu, D., Aghion, P. and Zilibotti, F. (2006). "Distance to frontier, selection and economic growth". *Journal of the European Economic Association*, (4:1), pp. 37-74.
- Aghion, P., Askenazy, P., Cetto, G., Dromel, N. and Boursès, R. (2009). "Education, market rigidities and growth". *Economics Letters*, (102:1), pp. 62-65.
- Aghion, P., Bloom, N., Blundell, R., Griffith, R. and Howitt, P. (2005). "Competition and innovation: An inverted U relationship". *Quarterly Journal of Economics*, (120:2), pp. 701-728.
- Aghion, P., Blundell, R., Griffith, R., Howitt, P. and Prantl, S. (2004). "Entry and productivity growth: Evidence from microlevel panel data". *Journal of the European Economic Association*, (2:2-3), pp. 265-276.
- Aghion, P., Blundell, R., Griffith, R., Howitt, P. and Prantl, S. (2006). "The effects of entry on incumbent innovation and productivity". NBER Working Paper No. 12027.
- Aghion, P., Fally, T. and Scarpetta, S. (2007). "Credit constraints as a barrier to the entry and post-entry growth of firms". *Economic Policy*, (22), pp. 731-779.
- Aghion, P. and Griffith, R. (2005). *Competition and Growth*, MIT Press, Cambridge MA, USA.
- Aghion, P., Harris, C., Howitt, P. and Vickers, J. (1997). "Competition and growth with step-by-step innovation: An example". *European Economic Review*, (41:3-5), pp. 771-782.
- Aghion, P. and Howitt, P. (1998). *Endogenous Growth Theory*, MIT Press, Cambridge MA, USA.
- Aghion, P. and Howitt, P. (2006). "Joseph Schumpeter lecture: Appropriate growth policy: A unifying framework". *Journal of the European Economic Association*, (4:2-3), pp. 269-314.
- Alesina, A., Ardagna, S., Nicoletti, G. and Schiantarelli, F. (2005). "Regulation and investment". *Journal of the European Economic Association*, (3:4), pp. 791-825.
- Arnold, J., Javorcik, B. and Mattoo, A. (2011a). "Does services liberalization benefit manufacturing firms? Evidence from the Czech Republic". *Journal of International Economics* (forthcoming).
- Arnold, J., Nicoletti, G. and Scarpetta, S. (2008). "Regulation, allocative efficiency and productivity in OECD countries: Industry and firm-level evidence". OECD Economics Department Working Paper No. 616.
- Arnold, J., Nicoletti, G. and Scarpetta, S. (2011b). "Does anti-competitive regulation matter for productivity? Evidence from European firms". IZA Discussion Paper No. 5511.
- Askenazy P., Cahn, C. and Irac, D. (2008). "Competition, R&D and the cost of innovation". PSE Working Paper No. 2008-32, Ecole normale supérieure, Paris School of Economics.
- Babetski, I. and Campos, N.F. (2007). "Does reform work? An econometric examination of the Reform-Growth Puzzle". IZA Discussion Paper No. 2638.
- Barone G. and Cingano, F. (2011). "Service regulation and growth: Evidence from OECD countries", *Economic Journal*, (121:555), pp. 931-957.
- Bartelsman, E.J. and Doms, M. (2000). "Understanding productivity: Lessons from longitudinal microdata", *Journal of Economic Literature*, (38:3), pp. 569-595.
- Bartelsman, E.J., Haltiwanger, J. and Scarpetta, S. (2004). "Microeconomic evidence of creative destruction in industrial and developing countries". IZA Discussion Paper No. 1374.

- Bartelsman, E., Haltiwanger, J. and Scarpetta, S. (2009a). "Measuring and analyzing cross-country differences in firm dynamics", in Dunne, T., Jensen, J.B. and Roberts, M.J. (eds.), *Producer Dynamics: New Evidence from Micro Data*, National Bureau of Economic Research (NBER), Chicago University Press, Chicago, IL, USA.
- Bartelsman, E.J., Haltiwanger, J. and Scarpetta, S. (2009b). "Cross-Country differences in productivity: The role of allocation and selection", NBER Working Paper No. 15490.
- Bartelsman, E.J., Scarpetta, S. and Schivardi, F. (2005). "Comparative analysis of firm demographics and survival: Micro-level evidence for the OECD countries", *Industrial and Corporate Change*, (14:3), pp. 365-391.
- Beck, T., Demirgüç-Kunt, A. and Maksimovic, V. (2004). "Financial and legal constraints to firm growth: Does size matter?", *Journal of Finance*, (60:1), pp. 137-177.
- Bergoeing, R., Kehoe, P.J., Kehoe, T.J. and Soto, R. (2002). "Policy-driven productivity in Chile and Mexico in the 1980's and 1990's". *American Economic Review*, (92:2), pp. 16-21.
- Bernard, A., Eaton, J., Jensen, J.B. and Kortum, S. (2003). "Plans and productivity in international trade". *American Economic Review*, (93:4), pp. 1268-1290.
- Bloom, D.E., Canning, D. and Sevilla, J. (2002). "Technological diffusion, conditional convergence, and economic growth", NBER Working Paper No. 8713.
- Bloom, N., Draca, M., Kretschmer, T. and Sadun, R. (2010). "The economic impact of ICT". Final Report, Centre for Economic Performance, SMART N 2007/0020.
- Blundell, R., Griffith, R. and van Reenen, J. (1999). "Market share, market value and innovation in a panel of British manufacturing firms", *Review of Economic Studies*, (66:3), pp. 529-554.
- Bouis, R., Duval, R. and Murin, F. (2011). "The policy and institutional drivers of economic growth across OECD and non-OECD economies: New evidence from growth regressions". OECD Economics Department Working Paper No. 843.
- Boulhol, H., de Serres, A. and Molnar, M. (2008). "The contribution of economic geography to GDP per capita". *OECD Journal: Economic Studies*, (2008), pp. 284-346.
- Bourlès, R., Cette, G., Lopez, J., Mairesse, J. and Nicoletti, G. (2010). "Do product market regulations in upstream sectors curb productivity growth? Panel data evidence for OECD countries". NBER Working Paper No. 16520.
- Buccirossi, P., Ciari, L. Duso, T., Spagnolo, G. and Vitale, C. (2009). "Competition policy and productivity growth: An empirical assessment". CEPR Discussion Paper No. 7470.
- Caves, R.E. (1998). "Industrial organization and new findings on the turnover and mobility of firms". *Journal of Economic Literature*, (36:4), pp. 1947-1982.
- Conway, P., de Rosa, D., Nicoletti, G. and Steiner, F. (2006). "Product market regulation and productivity convergence". *OECD Economic Studies*, (43), pp. 39-76.
- Conway, P. and Nicoletti, G. (2006). "Product market regulation in the non-manufacturing sectors of OECD countries: Measurement and highlights". OECD Economics Department Working Paper No. 530.
- Conway, P. and Nicoletti, G. (2007). "Product market regulation and productivity convergence: OECD Evidence and implications for Canada". *International Productivity Monitor*, (15).
- Corcos, G., Del Gatto, M., Mion, G. and Ottaviano, G. (2007). "Productivity and firm selection: Intra- vs. international trade". Core Discussion Paper No. 2007/60. Université Catholique de Louvain.

- Crafts, N. (2006). "Regulation and productivity performance". *Oxford Review of Economic Policy*, (22:2), pp. 186-202.
- Crespi, G., Criscuolo, C., Haskel, J. and Slaughter, M. (2007). "Productivity growth, knowledge flows and spillovers". CEP Discussion Paper No. 785. London School of Economics, Centre for Economic Performance.
- Daveri F., Lecat, R. and Parisi, M.L. (2010). "Service deregulation, competition and the performance of French and Italian firms". Paper presented at the OECD-Banque de France conference on "Structural reforms, crisis exit strategies and growth", 9-10 December, <http://www.banque-france.fr/gb/publications/telechar/seminaires/2010/Daveri-Lecat-Parisi.pdf>.
- Davis, S., Haltiwanger, J. and Schuh, S. (1996). *Job Creation and Destruction*, MIT Press, Cambridge, MA, USA.
- De Serres, A., Kobayakawa, S., Slok, T. and Vartia, L. (2006). "Regulation of financial systems and economic growth in OECD countries: An empirical analysis". *OECD Economic Studies*, (43), pp. 77-113.
- Del Gatto, M., Mion, G. and Ottaviano, G.I.P. (2006). "Trade integration, firm selection and the costs of non-Europe". CEPR Discussion Paper No. 5730.
- Faini, R., Haskel, J., Barba Navaretti, G., Scarpa, C. and Wey, C. (2004). "Contrasting Europe's decline: Do product market reforms help?". Report presented at the 6th European Conference of the Fondazione Rodolfo De Benedetti, Lecce, Italy, June.
- Forlani, E. (2011). "Competition in the service sector and the performances of manufacturing firms: Does liberalization matter?". CESifo Working Paper No. 2942.
- Fosfuri, A., Motta, M. and Ronde, T. (2001). "Foreign direct investment and spillovers through workers' mobility". *Journal of International Economics*, (53:1), pp. 205-222.
- Foster, L., Haltiwanger, J. and Krizan, C.J. (2002). "The link between aggregate and micro productivity growth: Evidence from retail trade". NBER Working Paper No. 9120.
- Geroski, P. (1995). "What do we know about entry?". *International Journal of Industrial Organization*, (13:4), pp. 421-440.
- Golub, S. (2003). "Measures of restrictions on inward foreign direct investment for OECD Countries". *OECD Economic Studies*, (36).
- Golub, S. and Koyama, T. (2006). "OECD's FDI regulatory restrictiveness index: Revision and extension to more economies". OECD Economics Department Working Paper No. 525.
- Görg, H. and Greenaway, D. (2002). "Foreign direct investment and intra-industry spillovers: A review of the literature". GEP Research Paper 01/37, University of Nottingham.
- Griffith, R. and Harrison, R. (2004). "The link between product market reform and macro-economic performance". *European Economy, Economic Paper* No. 209.
- Griffith, R., Harrison, R. and Simpson, H. (2006). "Product market reform and innovation in the EU". CEPR Discussion Paper No. 5849.
- Griffith, R., Redding, S. and Van Reenen, J. (2004). "Mapping the two faces of R&D: Productivity growth in a panel of OECD industries". *Review of Economics and Statistics*, (86:4), pp. 883-895.
- Griliches, Z. and Regev, H. (1995). "Firm productivity in Israeli industry: 1979-1988". *Journal of Econometrics*, (65:1), pp. 175-203.
- Gust, C. and Marquez, J. (2004). "International comparisons of productivity growth: The role of information technology and regulatory practices". *Labour Economics*, (11:1), pp. 33-58.

- Gwartney, J. and Lawson, R. (2003). "The concept and measurement of economic freedom". *European Journal of Political Economy*, (19:3), pp. 405-430.
- Haltiwanger, J., Scarpetta, S. and Schweiger, H. (2006). "Assessing job flows across countries: The role of industry, firm size and regulations". IZA Discussion Paper No. 2450.
- Haskel, J., Pereira, S. and Slaughter, M. (2007). "Does inward foreign direct investment boost the productivity of domestic firms?". *Review of Economics and Statistics*, (89:3), pp. 482-496.
- Hsieh, C-T. and Klenow, P. (2007). "Misallocation and manufacturing productivity in China and India". NBER Working Paper No. 13290.
- Inklaar R., Timmer, M.P. and van Ark, B. (2008). "Market services productivity across Europe and the US". *Economic Policy*, (23), pp. 139-194.
- Javorcik, B. (2004). "Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages". *American Economic Review*, (94:3), pp. 605-627.
- Keller, W. (2004). "International technology diffusion". *Journal of Economic Literature*, (42:3), pp. 752-782.
- Klapper, L., Laeven, L. and Rajan, R. (2006). "Entry regulation as a barrier to entrepreneurship". *Journal of Financial Economics*, (82:3), pp. 591-629.
- Melitz, M. (2003). "The impact of trade on intra-industry reallocations and aggregate industry productivity". *Econometrica*, (71:6), pp. 1695-1725.
- Melitz, M. and Ottaviano, G. (2008). "Market size, trade, and productivity". *Review of Economic Studies*, (75:1), pp. 295-316.
- Micco, A. and Pagés, C. (2006). "The economic effects of employment protection: Evidence from international industry-level data". IZA Discussion Paper No. 2433.
- Nickell, S. (1996). "Competition and corporate performance". *Journal of Political Economy*, (104:4), pp. 724-746.
- Nicoletti, G. and Scarpetta, S. (2003). "Regulation, productivity and growth". *Economic Policy*, (36), pp. 11-72.
- Nicoletti, G. and Pryor, F. (2006). "Subjective and objective measures of governmental regulations in OECD nations". *Journal of Economic Behavior & Organization*, (59:3), pp. 433-449.
- Okuno-Fujiwara, M. (1988). "Interdependence of industries, coordination failure and strategic promotion of an industry". *Journal of International Economics*, (25:1-2), pp. 25-43.
- Olley, G.S. and Pakes, A. (1996). "The dynamics of productivity in the telecommunications equipment industry". *Econometrica*, (64:6), pp. 1263-1297.
- Pakes, A. and Ericson, R. (1998). "Empirical implications of alternative models of firm dynamics". *Journal of Economic Theory*, (79:1), pp. 1-45.
- Parente, S.L. and Prescott, E.C. (1994). "Barriers to technology adoption and development". *Journal of Political Economy*, (102:2), pp. 298-321.
- Parente, S.L. and Prescott, E.C. (1999). "Monopoly rights: A barrier to riches". *American Economic Review*, (89:5), pp. 1216-1233.
- Poschke, M. (2010). "The regulation of entry and aggregate productivity". *Economic Journal*, (120:549), pp. 1175-1200.

- Rajan, R. and Zingales, L. (1998). "Financial dependence and growth". *American Economic Review*, (88:3), pp. 559-586.
- Restuccia, D. and Rogerson, R. (2007). "Policy distortions and aggregate productivity with heterogeneous plants". NBER Working Paper No. 13018.
- Rodríguez-Clare, A. (1996). "Multinationals, linkages, and economic development". *American Economic Review*, (86:4), pp. 852-873.
- Scarpetta, S. and Tressel, T. (2002). "Productivity and convergence in a panel of OECD industries: Do regulations and institutions matter?". OECD Economics Department Working Paper No. 342.
- Sutton, J. (1997). "Gibrat's legacy". *Journal of Economic Literature*, (35:1), pp. 40-59.
- Woelfl, A., Wanner, I., Kozluk, T. and Nicoletti, G. (2009). "Ten years of product market reform in OECD countries – Insights from a revised PMR indicator". OECD Economics Department Working Paper No. 695.
- Woelfl, A., Wanner, I., Roehn, O. and Nicoletti, G. (2010). "Product market regulation: Extending the analysis beyond OECD countries". OECD Economics Department Working Paper No. 799.
- World Bank (2004). *Doing Business in 2004*, Washington, DC.