Regulation and Economic Performance: Product Market Reforms and Productivity in the OECD

Giuseppe Nicoletti,

Stefano Scarpetta

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By Giuseppe Nicoletti and Stefano Scarpetta

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ABSTRACT/RESUMÉ

This paper assesses the implications of past and ongoing reforms in OECD product markets for the labour productivity gap, a key component of cross-country differences in GDP per capita. After a brief review of the theoretical literature, we bring together the results obtained in some of our empirical work over the past few years, discussing econometric approaches and their drawbacks. We then use these results to gauge the likely effect of further reforms. We distinguish effects on capital deepening and technical progress by examining the impact of regulations on investment (domestic and foreign) and multi-factor productivity. We focus on the effects of policies aimed at strengthening private governance (*e.g.* through privatization) and opening up access to markets where competition is economically viable. The results suggest that pro-competitive reforms tend to increase both investment and multifactor productivity and, through both these channels, they can lead to higher growth in GDP per capita.

JEL classification: O4, E22, F21, L5, C23

Keywords: Growth and aggregate productivity, Investment, International investment, Regulation, Panel data

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Ce papier analyse les implications des réformes dans les marchés des biens de la zone OCDE pour un des facteurs qui expliquent les différences internationales dans le PIB par tête : les écarts dans la productivité du travail. Après avoir examiné brièvement la littérature théorique, nous résumons les résultats de quelques unes des études empiriques que nous avons réalisées aux cours des dernières années, tout en discutant les approches économétriques utilisées et leurs limites. Nous utilisons ensuite ces résultats pour évaluer les effets qui pourraient être observés si les réformes étaient poussées plus loin à l'avenir. Nous distinguons les effets des réformes sur l'accroissement de l'intensité en capital et sur le progrès technique en nous appuyant sur trois études qui analysent l'impact de la régulation anti-concurrentielle sur l'investissement (national et de l'étranger) et la productivité multifactorielle. Nous nous concentrons sur les implications quantitatives au niveau macroéconomique des politiques visant à renforcer la gouvernance des entreprises (par exemple par la privatisation) et à éliminer les barrières réglementaires à l'accès dans les marchés où la concurrence est soutenable. Cet examen porte à conclure que les réformes qui accroissent les pressions concurrentielles sur les marchés des biens tendent à augmenter à la fois l'investissement et la productivité multifactorielle. Par ce biais, les réformes peuvent mener à une croissance plus soutenue du PIB par tête dans les pays qui les réalisent.

Classification JEL: O4, E22, F21, L5, C23

Mots clé: Croissance et productivité agrégée, Investissement, Investissement international, Regulation, Données de panel

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REGULATION AND ECONOMIC PERFORMANCE: PRODUCT MARKET REFORMS AND PRODUCTIVITY IN THE OECD

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1. Introduction

1.   Over the past decade, a large number of theoretical and empirical studies have highlighted the channels through which institutional settings can affect crucial dimensions of economic performance. The large majority of this literature has focused on the effects of different institutional settings between industrial and developing countries on their economic performances. Yet even within the industrial economies the gaps in income per capita remain large. For example, in the early 2000s, per-capita incomes were between 20% and 30% lower in Japan and the European Union than in the United States.[2] Moreover, growth episodes differed across industrial countries. For example, the acceleration in productivity growth observed in the United States since the mid-1990s has been shared only by a limited number of – generally small – OECD countries.[3]

2.   Such evidence raises the question as to why the process of economic convergence observed for some decades in the post-war period has been halted and even partially reversed. Is this a temporary phenomenon associated with the spread of the information and communication technology and its associated exuberance in investment, or is it rather a signal of more long-term forces that deserve a closer look by policy-makers? Recent growth theory suggests that catch up in real incomes is not mechanical. Rather it depends on factors such as market imperfections, agglomeration effects, or differences in endowments and institutional settings (see, for instance, Barro and Sala-i-Martin, 1998, and chapter 1 in this volume). Indeed, the institutional setting in which firms operate is likely to affect both their level of employment and labour productivity, and through those aggregate output.

3.   An essential component of the institutional framework is the extent of regulation in labour and product markets. A substantial literature has examined the impact of labour market policies on employment in OECD countries,[4] but the macroeconomic effects of regulations in the product market have received little attention. Such lack of attention is surprising for two reasons. First, the large cross-country variability in policy choices in this area and the magnitude of reforms aimed at promoting competition and productivity growth imply that such policies are good candidates for explaining cross-country differences in economic performance. Second, the effects of product market reforms on productivity and prices at the industry level have been well documented, but little is known about their macroeconomic implications. Yet as reforms spread out to an increasing number of industries and increasingly include changes in general purpose regulations, such as administrative procedures, their macroeconomic repercussions are likely to be significant.[5]

4.   This paper assesses the effect that the reforms of product market regulations undertaken by OECD countries over the past two decades have had on two determinants of growth, investment and multifactor productivity. The aim of the paper is twofold. First, we review the theoretical literature, taking

a bottom-up approach to go from microeconomic arguments to macroeconomic outcomes. Second, we bring together the results obtained in some of our empirical work over the past few years with the aim of assessing the overall impact of regulatory reforms, discussing econometric approaches and their potential drawbacks. Whenever possible, we compare our results with those found in other empirical studies.

5.   We focus on the effect of product market regulations on one of the two key components of the output gap across countries: the labour productivity gap. The latter can be further decomposed into the capital/labour ratio and the level of multi-factor productivity. Existing theories on the microeconomics of regulation tell us that regulations can affect both of these factors through its impact on investment, managerial behaviour, and the incentives to adopt new technologies and innovate. The effects are however complex and, at times, contradictory. For example, privatisation and liberalisation of public legal monopolies can help level the competitive playing field but may also reduce incentives to investment, make agency relationships more complex and increase the risk of regulatory failure; the regulation of natural monopolies can hinder entry of new firms, but may also prevent abusive use of market power. The signs of the overall effects on both capital accumulation and productivity are hence *a priori* ambiguous.

6.   In order to assess empirically the strength of the various effects, we draw on three studies that examine the impact of regulations on investment (domestic and foreign) and multi-factor productivity. The studies use a consistent set of quantitative indicators, recently developed at the OECD, that measure differences in product market reform across countries, at both the economy-wide and the industry level. We look especially at regulations in non-manufacturing, where restrictions to competition and reforms to alleviate them have been more extensive. Using the indicators of product market regulation developed at the OECD, we concentrate on the effects of policies aimed at strengthening private governance (*e.g.* through privatization) and opening up access to markets where competition is economically viable, though the empirical analyses we discuss often also look at the interactions between product market reforms and policy and institutions in other markets, in particular the labour market.

7.   The reported empirical results are based on panel estimates of fairly general specifications of investment and productivity across countries, time and (when possible) industries. To reduce the risk of parameter heterogeneity, we focus on a subset of relatively similar OECD countries and we account for differences in the response of sectoral productivities to regulations. Our crucial policy variables have a wide variability in all the dimensions of the panel, including over time, reflecting the significant privatizations and liberalisations that were implemented by OECD countries over the past three decades. We also pay particular attention to data and specification issues, such as sensitivity to outliers, changes in the set of explanatory variables and the presence of non linearities.

8.   Empirical results are reported in a summary form, concentrating on the quantitative implications for macroeconomic outcomes. They suggest that pro-competitive reforms tend to increase both investment and productivity. Through both these channels, product market reforms can lead to higher growth in GDP per capita. Clearly, quantitative assessments heavily depend on modelling choices and sample coverage. In particular, despite the focus on a homogeneous set of economies, unaccounted differences in the way they may respond to changes in regulation may bias the estimated coefficients. Therefore, implications based on such coefficients should be interpreted with caution, especially in view of the fact that the variables we consider are closely interdependent, and the global effects of reform can hardly be expressed as the sum of the effects estimated for each of them separately. Nonetheless, we believe that the reported results are sufficiently robust to provide at least an indication of the direction and possibly magnitudes involved.

9.   Our paper contributes to the recent literature on the institutional determinants of economic performance. In contrast to other empirical studies, we try to open the black-box of the link between institutions and growth by focusing on a very specific type of institutions. This allows us to assess some of the channels through which these institutions affect the determinants of growth. Two such channels,

foreign direct investment and catch up of industry-level multifactor productivities to OECD best practice, introduce an open economy element to the picture that is often missing in analyses of institutions and growth.

10.   The plan of the paper is as follows. In Section 2 we provide a brief review the literature on the economics of regulation and examine the main channels through which product market policies can affect investment and productivity, and consequently output. Section 3 describes the indicators of product market regulation used in the empirical analysis, as well as the trends in regulation observed in the OECD over the past two decades. We then discuss the econometric approaches – and their drawbacks – used in the empirical analyses that are summarised in Section 4. We provide the main concluding remarks in Section 5, where we also indicate possible avenues for further research.

2. Regulation and the determinants of output growth and income per capita

2.1 Output growth and income per capita

11.   A country's level of output per capita can be mechanically decomposed into the average number of hours worked by the workforce multiplied by the level of labour productivity. Differences in per capita output levels across countries can then be explained by the extent of utilisation of labour and by differences in labour productivity. Figure 1 presents a decomposition of real income levels relative to the United States in OECD countries, and indicates that discrepancies in both hours worked and output per hour worked remain large even within this group of countries.

[Figure 1. The sources of real income differences, 2002]

12.   Differences in the institutional setting in which firms operate, and in particular differences in the extent of regulation in labour and product markets, are likely to affect both employment and labour productivity, and hence are candidate explanations for the divergent economic performances. Figure 2 illustrates the way in which such regulation can impact output levels. Labour market policies are a major determinant of both the employment rate and the number of hours worked, and the macroeconomic effects of labour market reforms have been extensively studied. However, little attention has been devoted to the impact of product market reforms despite the fact that recent policy changes in European product markets have sometimes been deeper than reforms in labour markets, as noted by Koedijk and Kremers (1996).

[Figure 2. The proximate determinants of GDP per capita]

13.   Product market regulations are likely to have macroeconomic effects mainly through their impact on labour productivity growth.[6] Labour productivity growth can be decomposed into changes in the capital/labour ratio – a measure of capital deepening – and changes in Multi Factor Productivity (MFP), whose "broad" definition measures the residual growth in output that cannot be attributed to changes in the quantity of labour and capital used in production.[7] Changes in broad MFP growth can be further decomposed into changes in the "quality" of factor inputs – so called embodied technological progress – and a residual factor that accounts for organizational changes and disembodied technological progress. Available information suggests that both improvements in the human capital of workers and shifts to more productive technologies and forms of organisation have contributed to changes in productivity growth.[8] In particular, the shift towards information and communication technology (ICT) equipment has been a strong factor behind the acceleration of productivity growth in some countries. At the beginning of the century, the share of ICT equipment in total investment was higher than in the previous decade in all countries for which data are available except Spain and Italy, and OECD countries' experience suggests a positive correlation between labour productivity acceleration and the increase in ICT investment over the 1990s

(Figure 3), reflecting both a surge in the level of investment (and in the capital-labour ratio) as well as an increase in the productivity of capital.[9]

[Figure 3. Pick-up in hourly labour productivity growth and increase in ICT investment]

14.   Even narrowing down the definition of product market regulations to policies that affect competition among producers, it is easy to see that their effects are complex. They can curb competitive pressures and hinder (or prevent) entry of new firms in potentially-competitive markets, but they can also favour 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. The next two subsections examine the main channels through which regulatory reforms in product markets impact on investment and multifactor productivity, and hence on productivity growth. In doing so, we will think of three broad categories of policies - barriers to domestic competition, barriers to foreign trade and investment, and cumbersome administrative procedures - all of which are likely to affect labour productivity.

2.2 Regulation, competition, and investment

Capital spending

15.   Changes in the regulatory environment may affect both domestic and foreign investment. Regulatory reforms of domestic product markets often take the form of a reduction of entry barriers in markets where competition is viable. As argued by Blanchard and Giavazzi (2003) and Alesina *et al.,* (2003), a reduction in barriers to entry will increase the number of firms, leading to a decrease in the markup of prices over marginal costs and, therefore, of the shadow cost associated with capital and output expansion. This is likely to expand activity levels and stimulate capital formation. At the same time, less red tape and lighter regulatory burdens lower the costs of adjusting the capital stock, thereby boosting the capacity of firms to react to changes in fundamentals by expanding their productive capacity.

16.   Regulation can affect investment through two additional channels, which can potentially offset the above mechanisms. One consists of the Averch-Johnson (1962) effect. Certain regulations, such as ceilings on the rate of return on capital, encourage firms to over accumulate capital in order to increase their overall remuneration. The removal of the ceilings will hence result in a downward adjustment of the capital stock. Lastly, ill-designed de-regulation can fail to provide the right incentives to expand capacity. In particular, certain sectors such as network industries have been subject to a re-design of price regulation (*e.g.,* from rate of return to price caps or inappropriate access pricing regimes) or to changes in industry structure (*e.g.,* vertical separation of networks from service provision). Moreover, ill-designed deregulation may allow public enterprises to raise barrier to new entrants and curb competition.[10]

Foreign direct investment

17.   The impact of regulation on foreign direct investment (FDI) is particularly relevant, as FDI not only raises the capital/labour ratio but may also be an important source of technological transfer (see below). While the reasons to expect a negative effect of FDI restrictions on foreign investment are obvious, the role played by domestic regulations is *a priori* more ambiguous. Indeed, by raising production costs or entry barriers, domestic regulations can affect FDI in conflicting ways. On the one hand, regulations that increase costs in the host country can deter FDI by lowering its expected rate of return if the foreign subsidiary is used as a platform for re-exporting final or intermediate goods back home or to other less regulated countries. On the other, if FDI aims at accessing the local market, cost-increasing regulations in the host country may encourage FDI because the foreign affiliate can take advantage of the production structure of the parent firm, which may be more efficient than in local firms if regulations in the investor country are more pro-competitive.[11]

18.   Similar conflicting influences can be exerted by regulations that raise entry barriers in host countries. Such entry barriers clearly deter "greenfield" FDI aimed at establishing new firms or creating new production plants. However, by endowing local firms with market power, they can actually encourage inward FDI aimed at acquiring existing local firms, or merging foreign parents with these firms.

2.3 Regulation and multi-factor productivity

19.   There are basically three ways in which MFP improvements can be achieved: eliminating slack in the use of resources; adopting more efficient technologies; and increasing innovative effort. By affecting the incentives to innovate and improve efficiency, regulations that promote product market competition can have important effects on MFP performance.

Reducing slack

20.   There is an increasing consensus that product market policies that promote entrepreneurship and competition may contribute to shift the (country-specific) efficiency frontiers by raising the efficiency with which the inputs are used.[12] Regulatory policies may, in particular, help to eliminate X-inefficiencies through a number of different channels.[13] For example, competition creates greater opportunities for comparing performance, making it easier for the owners or the market to monitor managers. Competition is also likely to raise the risk of losing market shares at any given level of managerial effort, inducing managers to work harder so as to avoid this outcome.[14] Moreover, business-friendly regulations make it easier to implement efficiency improvements by reshuffling resources within and across firms.

21.   It should be stressed that theoretical predictions of the effects of greater competition on managers' incentives are often "subtle and ambiguous" (Vickers, 1995). Models using explicit incentives under information asymmetry do not lead to clear-cut implications (see *e.g.,* Holmström, 1982), while inter-temporal models using implicit (*i.e.,* market-based) rewards suggest a positive link between competition and managerial effort if productivity shocks are more correlated across competitors than managerial abilities (Meyer and Vickers, 1997). But, competition could also lead to more slack if managers are highly responsive to monetary incentives, as the scope for performance-related pay is reduced (Scharfstein, 1988).

Technology diffusion and adoption.

22.   The opening up of markets and increased competitive pressures provide both opportunities and strong incentives for firms to upgrade their capital stock and adopt new technologies to reach frontier production techniques. New entrants into a sector are likely to bring new vintages of technology, often embodied in capital goods, and this gives incumbents the opportunity to upgrade their capital through imitation. Moreover, the threat of losing market share *vis-à-vis* these more advanced competitors motivates existing firms to adopt new technologies and upgrade their machinery (Schmidt, 1997; Aghion and Howitt, 1998).

23.   Technology diffusion may also be induced by spillovers from increased trade and foreign direct investment resulting from the reduction of border and non-border barriers. Theoretical models highlight a number of mechanisms: the transfers of technology between parents and subsidiaries of multinationals, learning externalities for the host-country labour force, and spillovers related to the provision of high-technology intermediate inputs from the origin country. While the empirical evidence is mixed, recent cross-country and micro-economic studies suggest that these effects are significant, indicating that an increase in FDI is likely to be associated with higher levels of multifactor productivity.[15]

Innovation

24.   There are three basic mechanisms that affect the incentives that firms have to innovate.[16] First, the attempt to acquire a competitive edge on rival firms often results in a stronger innovation effort. This can be due to the fact that in highly competitive markets, small price differences have big effects on market shares; competition thus raises the "bang for the buck" from cost-reducing productivity enhancements providing greater incentives to innovate. Alternatively, Klette and Griliches (2000) note that incumbents might be pushed to innovate in order to pre-empt rivals. Second, easier entry in (and exit from) innovative markets fosters market testing of new ideas and the process of "creative destruction".

25.   Lastly, Aghion *et al.,* (2001) model the pro-innovation impact of competition by noting that stronger competition may force managers to speed up the adoption of new technologies in order to avoid loss of control rights due to the risk of bankruptcy. Even when firms have similar cost structures (the case of "neck and neck" competition) and technological progress is more gradual, stronger competition may induce firms to increase R&D investment (conditional on the level of protection of intellectual property rights) in order to acquire a lead over their rivals. This channel, however, may be 'bell-shaped' in the sense that the pressure for more innovation may be the highest at intermediate levels of competition (see Boone 2000*a,b*; and Aghion *et al.*, 2002), as "too much" competition may dissipate innovation rents curbing incentives to innovate.

2.4 Summing up

26.   The effect of product market reform on investment, both domestic and foreign, is ambiguous as there is a trade-off between the positive incentives generated by lower entry barriers or easier administrative procedures and the negative ones due to the removal of regulations that had led to over-investment or market power for foreign firms. Concerning MFP, there are strong arguments suggesting that increased competitive pressures resulting from product market reform are likely to stimulate productivity. However, offsetting factors and uncertainties inherent in the channels described above –in particular, the ambiguous effect on managerial incentives- indicate that the strength, if not the direction, of the link between product market competition and productivity performance remains an empirical issue.

27.   It is also important to note that the investment and productivity gains induced in certain industries may lead to productivity gains for the economy as a whole. The domestic business environment is likely to be particularly important for efficiency in utilities and service industries, where competition from abroad is weaker and a difficult balance has to be struck between regulations and market forces due to market imperfections (*e.g.,* in network industries). Enhancing competition in these industries can provide a "double dividend" because it may increase both the direct contribution of non-manufacturing to overall productivity growth and contribute to overall productivity growth indirectly, via improvements in the productivity of industries that use non-manufacturing products as intermediate inputs.[17]

3. Data and econometric specifications

3.1 Patterns of product market reform

28.   Most OECD countries have implemented sweeping regulatory reforms over the past two decades, with the aim of promoting entrepreneurship and competition. However, they did so at different speed and to a different degree. The main elements of these reforms were: *i)* privatisation, *ii)* entry and price liberalisation in potentially competitive domestic markets, *iii)* pro-competitive regulation of natural monopoly markets (*e.g.,* by regulating access to networks), and *iv)* further liberalisation of international trade and foreign direct investment.[18]

29.   To gauge the extent of these reforms, we use a set of cross-country quantitative indicators of regulatory reform. The 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. The indicators are constructed to measure regulation in either particular areas of the economy, specific industries, or the overall economy. Many of them focus on the non-manufacturing sector, which is the most regulated and sheltered part of the economy. Indeed, few explicit barriers to competition remain in markets for manufactured goods in the OECD countries.

30.   All indicators take continuous values on a scale going from least to most restrictive of private governance and competition and report the situation at the end of the past decade, the latest period for which complete cross-country information was available at the time of writing.[19] Box 1 provides a cursory view of the main indicators used in the empirical analyses surveyed below. The first three consists of indicators measuring the strength of barriers to trade, FDI restrictions, and the degree of regulation in non-manufacturing industries. These indicators have a full time-series dimension. We also use an economy-wide indicator covering product market regulations in both domestic markets and traded goods which provides a summary view of the extent to which both economic and administrative regulations affected competition and private governance in each country. It is important to note that these indicators are not intended to measure how effective regulations are in meeting their stated public policy goals; they merely quantify the "market unfriendliness" of regulations.

Box 1. Indicators of product market regulation

Barriers to trade

These include tariff and non-tariff barriers over the 1993-1998 period. The indicator of non-tariff barriers is a frequency ratio: it corresponds to the proportion of the (6-digit) tariff lines to which non-tariff barriers apply. Non-tariff barriers have been aggregated into indicators for 2-digit industries using import-weights corresponding to 1998 trade flows across OECD countries. A similar indicator for tariff barriers has been constructed. Details are provided in Nicoletti and Scarpetta (2003).

FDI restrictions

Several types of restrictions are considered: limitations on foreign ownership, screening or notification procedures, and operational restrictions. These restrictions are reported for nine sectors, of which seven are services, and then aggregated into a single measure for the economy as a whole. The indicator covers the 1980-2001 period. Details can be found in Golub (2003).

Non-manufacturing regulation

The indicator covers regulations and market conditions in seven energy and service industries over the 1975-2003 period: gas, electricity, post, telecoms (mobile and fixed services), passenger air transport, railways (passenger and freight services) and road freight. The coverage of regulatory areas varies across industries. Barriers to entry are reported for all industries; public ownership is reported in all industries except road freight, vertical integration is documented for gas, electricity and railways; market structure is documented for gas, telecommunications and railways, and price controls are reported for road freight. The summary indicator is the simple average of the industry-level indicators. See Nicoletti and Scarpetta (2003) and Alesina *et al.,* (2004) for details.

Economy-wide indicators of product market regulations

These indicators describe the 1998-2003 policy environment in OECD product markets summarising information on 139 general-purpose and industry-specific regulatory provisions restricting domestic market mechanisms (in potentially competitive environments) and international trade and investment. Details on data sources, scoring and aggregation methods are provided in Nicoletti *et al.,* (1999) and Conway *et al.,* (2005).

In this paper we only report indicator values for the 1980-1998 period, which is covered by the empirical analyses discussed below.

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31.   The variability in product market regulation both across countries and over time is substantial. Figure 4 focuses on border policies, showing the evolution of tariff and non-tariff barriers (Panel A) and explicit restrictions to foreign direct investment (Panel B). Trade restrictions have generally fallen in the OECD area. Over the 1996-2001 period, average tariffs have further declined in most countries, though the dispersion of bilateral tariff rates remains wide, reflecting tariff discrimination across trading partners. Available information on non-tariff barriers up to 1996 suggests that these barriers have declined as well. However, they were still significant in many OECD countries, and more recent surveys suggest that such barriers have shifted from border restraints to domestic policies restricting access to markets. Foreign direct investment restrictions were also softened significantly over the past two decades, but cross-country differences remain large, with most EU countries showing greater openness than the United States and Japan (largely due to complete liberalisation of capital flows within the EU Single Market).[20]

[Figure 4. Openness to trade and foreign direct investment]

32.   Figure 5 highlights, by means of the summary indicator for non-manufacturing regulation, the general patterns of reform in non-manufacturing over the 1980-1998 period. The box plot shows the median level of regulation and the dispersion of regulatory approaches across countries in each year. There was some policy convergence over the past two decades in absolute terms, with policies generally becoming friendlier to market mechanisms. However, mainly due to differences in initial conditions and in the pace of reform, regulatory policies diverged in relative terms, with a widening variance of approaches across countries in the most recent period. Paradoxically, the divergence in policies over the 1995-1998 period was widest within the EU, despite efforts by the European Commission to harmonise the business environment in the Single Market.

[Figure 5. Regulatory reform in non-manufacturing]

33.   Cross-country differences in regulation, and hence differences in the implementation of regulatory reform, can also be gauged looking at the economy-wide indicator of regulations, (Figure 6). In 1998, the United Kingdom had both the lighter administrative burdens (*e.g.,* start-up costs) and the least restrictive market regulations (*e.g.,* barriers to entry, public ownership). It was followed closely by the other common-law countries, although economy-wide and/or industry-specific administrative regulations appeared to be somewhat heavier in some relatively liberal countries such as Ireland and New Zealand. At the opposite end, Italy was the most restrictive among the countries surveyed, with heavy administrative regulations also found in France, Belgium and, to a lesser extent, Japan and Germany. Interestingly, countries with tight economic regulations also had burdensome administrative procedures on business enterprises.

[Figure 6. Overall regulatory approaches across countries, 1998]

3.2 Empirical issues

34.   The next section presents empirical results relating cross-country differences in the scope and pace of product market reform to investment and productivity outcomes. We look at domestic capital formation and multifactor productivity developments at the industry-level and at bilateral and overall stocks of foreign direct investment. The phenomena addressed are different, and details on the empirical models estimated in each case are provided later. Nevertheless, the empirical approaches share some common features that we highlight here.

35.   First, as mentioned in the introduction, we try to move away from the estimation of aggregate growth relationships to look at some of the channels through which policies can affect GDP per capita performance. The models estimated are not "structural" in the sense of involving restrictions that allow

direct testing of alternative economic theories of investment and productivity. However, their specifications are linear approximations based on widely accepted theories of the phenomena at hand. Thus, the capital formation specification explicitly derives from a standard model of forward-looking investment behaviour with adjustment costs, the FDI specification is consistent with Markusen's "unified approach" to international investment and the MFP specification is grounded in conditional convergence models that attribute a large role to international technological transfer. All these models attribute an important potential role to policies, in particular those affecting private governance and competition.

36.   Accordingly, we focus on the effects of liberalisation and privatization policies, which have had a wide variability across countries, sectors and time. However, we control either explicitly or implicitly for institutions and policies in other areas (*e.g.,* the labour market), which often vary less in one or more of these dimensions. For instance, labour market policies are explicitly introduced in the models for domestic and foreign investment, while they are accounted for implicitly through fixed country and time dummies in the MFP model. Other potentially important policy areas, such as financial market regulation, are not covered due to lack of data. However, all the estimated models include a full set of fixed effects (for countries, sectors and time) that attempt to capture unobserved influences on investment and productivity.

37.   Most of the analysis is disaggregated at either the industry level (for domestic investment and MFP) or at the bilateral level (for FDI). This required a significant effort in data construction and verification (*e.g.* for obtaining sectoral MFP estimates or indicators of regulation). In this context, we took particular care at relating as much as possible the dependent variable to either industry-level or country-pair influences. For instance, sector or country-pair-specific series for human capital and regulatory policies were used as regressors in the estimations. It should be noted, however, that while this disaggregation has the advantage of bringing the analysis closer to the source of the phenomenon being studied, it may also be more prone to problems of heterogeneity and measurement error. For instance, measured productivity and investment in service sectors are generally less reliable than in manufacturing or, for that matter, the economy as a whole. For other variables, however, such as regulations, measurement is probably more accurate at the industry level, and this may create a mismatch between the accuracy of measurement in the dependent and explanatory variables.

38.   We tried to address the potential heterogeneity problems implicit in the panel estimation of average parameters in two ways. First, we restricted the analysis to a relatively homogenous subset of "core" OECD countries. Typically, these would include the EU members (before the recent enlargement), Switzerland, North American countries, Japan, Australia and New Zealand. In this subset, country-specific responses to liberalisation and privatization policies can be expected to be quite similar, although heterogeneity biases in coefficient estimates cannot be excluded. Second, we acknowledged potentially different reactions to such policies in different sectors by either restricting the analysis to a relatively homogeneous set of industries (such as network industries in the domestic investment estimates) or by testing differences in crucial coefficients across sectors (such as between the speed of catch up and the reaction to regulation in manufacturing and services in the MFP estimates).

39.   Finally, to verify the robustness of our estimates to potential measurement error and small sample problems, we systematically screened regressions for the presence of outliers. This was done in two ways. In all estimations we identified outliers using a combination of methods based on leverage values and studentised residuals.[21] We then estimated equations both including and excluding outliers. In some estimations, notably those for MFP, we checked the robustness of the value and significance of key coefficients to recursively dropping country/sector observations one at a time.

4. Empirical evidence on the effect of product market regulations on economic performance

40.   There is sufficient variability in approaches to market regulation across countries and over time to expect that some of the channels highlighted in previous sections could help explain differences in growth performances in the OECD area. To check this, we take a bottom up approach and look at the evidence concerning the effects of regulation on the main determinants of growth: capital formation and multifactor productivity. Since the purpose of this paper is to summarise this evidence, we report only the main features and results of the analyses, as well as (where possible) some quantitative inferences on the likely impact of regulation on macroeconomic aggregates. In interpreting these results, the reader should bear in mind the illustrative nature of any policy simulation based on aggregate regressions. For details on the empirical approaches characterising each study, the reader may refer to the annex or the original papers.

4.1 Regulation and investment

41.   There are very few studies looking at the effects of product market policies on aggregate investment. Yet, casual observation suggests that various measures of investment have recently been related to product market developments. For instance, countries with a more restrictive regulatory environment tend to invest less in ICT (Figure 7). Moreover, investment in crucial non-manufacturing industries appears to have been increasing in the "business-friendly" United States and United Kingdom at a faster rate than in "restrictive" large continental EU countries. The patterns of investment vary significantly between the two groups of countries: while in the United States and the United Kingdom investment as a share of the capital stock increased from 3.7% in 1975 to 8.2% in 1998, in the large continental European countries the investment rate decreased by 5 percentage points from 9.4% to 4.4%. Interestingly, the United States and the United Kingdom strongly liberalized product markets before the nineties, while reforms were almost absent before then in Italy, Germany and France. Moreover, changes in investment trends in each non-manufacturing industry are statistically associated with the timing of reforms.

[Figure 7. Regulation and investment in ICT]

42.   Here, we summarise two recent studies that look at investment in the non-manufacturing sector (Alesina *et al.,* 2005) and aggregate foreign direct investment (Nicoletti *et al.*, 2003), respectively. The focus on non-manufacturing industries is justified by the fact that they are major users of ICT and there are large differences across countries in the extent to which these industries contribute to aggregate productivity growth. Moreover, these differences appear to be closely related to the extent of regulation, with most restrictive countries failing to obtain productivity gains (see below). Looking at FDI is relevant because there is a strong presumption that FDI could significantly contribute to productivity growth. Casual observation suggests that countries and industries where regulations restrict access and make business difficult tend to receive less inward FDI (Figure 8).

[Figure 8. Regulation and FDI]

Investment in non-manufacturing

43.   Alesina *et al*., (2005) look at the effects of regulation on investment in the transport (airlines, road freight and railways), communication (telecommunications and postal services) and utilities (electricity and gas) sectors. They estimate a simple dynamic panel model of investment and regulation, controlling for sector/country fixed effects and common or sector-specific year effects (see Annex for more details). They measure regulation with the time-varying indicator described in the previous section, which captures entry barriers and the extent of public ownership, among other things. They find that regulatory

reforms have had a significant positive impact on capital accumulation in these industries. In particular, liberalisation of entry in potentially competitive markets has a sizeable effect on long-run investment rates.

44.   Their findings are consistent with the idea that a reduction in barriers to entry is likely to stimulate investment because it leads to a decrease of the markup and, therefore, of the shadow cost associated with capital and output expansion. This effect appears to outbalance potential downward pressures on investment that might have originated from changes in incentives due to the re-design of price regulation (*e.g.,* from rate of return to price caps or inappropriate access pricing regimes) or changes in industry structure (*e.g.,* vertical separation of networks from service provision). While in principle agency problems and political mandates affecting the behaviour of public managers may lead to over-accumulation of capital, Alesina *et al.,* also find that privatisation spurs investment. This suggests that the reduction of barriers to entry for private firms associated with the elimination of state control on business enterprises more than compensates the reduced importance of potential overinvestment problems due to managerial incentives. Interestingly, there is also evidence that the marginal effect of deregulation on investment is greater when the policy reform is large and when changes occur starting from relatively low levels of regulation. In other words, small changes in a heavy regulated environment are not likely to produce much of an effect. The implications of the analysis are clear: regulatory reforms that substantially lower entry barriers are likely to spur investment. The authors show that the empirical results are robust to several sensitivity checks and extensions.

45.   Using these results, it is possible to derive some (highly tentative) quantitative estimates of the potential effects of product market reforms on investment. For instance, a decrease of the indicator of regulation from its third quartile value to its first quartile value would generate according to the estimated model an increase in the investment rate of approximately two percentage points in the long run, which is quite large. Considering that the sectors analysed are highly capital intensive, the increase of investment as a percentage of gross output or value added would be even larger. Another way of gathering a sense of the magnitude of the changes is to make some experiments with actual values of the indices in different time periods in one country or across countries. For instance, the estimated model would predict that the regulatory reforms implemented in the United Kingdom in the transport and communications sector over the period 1984-1998 would raise the investment rate in the long-run by 2.5 percentage points over the same period. The actual increase was 3.0 percentage points. The estimated model would also predict that if Germany and France were to align regulation in non-manufacturing industries with US standards their investment rate would increase by 2.3 percentage points in the long-run. Taking the 1994-1998 period average as a benchmark, this would raise Germany's rate from 5.6% to 7.9% and France's rate from 5.9% to 8.2%, both much closer to the US average level of 9.0%. The same thought experiment would raise Italy's investment rate by 3.3 percentage points, from 6.8% to 10.1%.

Foreign direct investment

46.   There is a large literature looking at the structural determinants of FDI flows from both the point of view of investor and host countries (see, for instance, Markusen and Maskus, 2001a). Surprisingly, however, less attention has been devoted to the role of policies. While the effects of corporate taxation have been extensively studied (see the survey in de Mooij and Ederveen, 2003), very few empirical studies have looked at the influence of other border and, especially, non-border policies. Interest in this issue has increased recently as a "unified approach" to the analysis of trade and the multinational enterprise has gained ground (Markusen and Maskus, 2001b).[22] For instance, Markusen (2002) used this approach to assess the effects of both trade and investment liberalisation on bilateral FDI flows.

47.   Nicoletti *et al.,* (2003) is, to our knowledge, the only study looking explicitly at the effects of a broad range of product market policies on FDI, including both investment barriers and domestic

regulations.[23] As argued in section II, this is one of the areas in which the impact of regulation is a priori ambiguous.

48.   Using some of the policy indicators described in the previous section, Nicoletti *et al.,* estimate two distinct FDI models: an empirical specification of the determinants of (aggregate) bilateral outward FDI stocks based on Markusen's "unified approach"; and a reduced form specification of the determinants of total inward FDI stocks (see Annex for more details). In both specifications, FDI stocks are determined by a set of structural factors - including gravitational ones (such as distance, transaction costs, total market size, *etc.*) and others reflecting comparative advantage and scale effects (relative factor endowments, relative market size) – and policies in the investor and host countries (participation in free trade areas, tariff and non-tariff barriers, FDI restrictions, labour market arrangements, infrastructure investment and product market regulations). These specifications are estimated on a panel of OECD countries over the past two decades, controlling for a range of unexplained effects (including host-specific, investor-specific, country-pair specific and time effects).

49.   FDI restrictions by the host country are estimated to have a significant negative impact on its bilateral FDI stock with specific partners and, consistently, are also found to significantly depress its total inward FDI position (relative to all its partner countries). Similarly, product-market regulations that curb competition at home are estimated to have a negative and significant effect on FDI, but what is relevant for bilateral FDI positions is the relative stringency of regulations in the host and investor countries. Put simply, the net effect of regulations that curb competition is to make the host country less attractive for international investors located in countries where regulations are less restrictive. This is confirmed by the significantly negative impact of anti-competitive regulations in the host country (relative to the OECD average) on its total FDI inward position.

50.   With the usual caveat, empirical estimates can be used to quantify the long-run impact on inward FDI positions of changes in policies that affect FDI restrictions and product-market regulation.[24] The estimates suggest that bringing FDI restrictions in all OECD countries down to the level of restrictions in the United Kingdom, the least restrictive country according to the indicator used in the empirical analysis, would have a sizeable impact on global integration. The effects of such reforms on FDI inward positions depend on how restrictive each country was before the policy move. Relatively restrictive countries could increase their total FDI inward position (which is typically low in terms of GDP) by between 40% and 80%, but even in countries that are estimated to be already relatively liberal the gains could amount to around 20% of their initial inward position. Overall, such policy reforms could increase OECD-wide inward positions by almost 20%, significantly raising economic integration in the area.

51.   Reducing anti-competitive product-market regulations is also likely to increase significantly FDI inward positions. If all OECD countries were to reduce the level of their product-market regulations to that of the United Kingdom (again the least restrictive country according to the indicator used in the analysis), OECD-wide inward positions would increase by over 10% relative to the initial inward position. Since bilateral FDI outward positions are estimated to depend on the relative stringency of regulation in the home and host countries, relatively restrictive host countries -- such as Greece, Italy and France -- that host FDI from relatively liberal countries could increase their FDI inward positions by as much as 60% to 80% through regulatory reform. Conversely, countries that are relatively liberal would see the relative attractiveness of their product markets either unchanged (such as in the United States, New Zealand and Sweden) or even reduced (such as in the United Kingdom and Australia).

4.2 Regulation and multifactor productivity

52.   Improvements in MFP play a crucial role in the process of economic growth, and in OECD countries they accounted for between one third and one half of the average business sector GDP growth

observed over the past two decades (OECD, 2002). Cross-country evidence suggests that countries that have extensively reformed their product markets (as measured by our indicators of regulation) have also experienced an acceleration of MFP over the 1990s, while the productivity slowdown (or stagnation) has continued in other countries (Figure 9).

[Figure 9. Multifactor productivity acceleration and product market regulation]

53. In Nicoletti and Scarpetta (2003), we move from this aggregate bivariate evidence to a multivariate regression analysis of the driving forces of industry-level MFP growth. We estimate a multifactor productivity equation derived from a production function in which technological progress is a function of country/industry specific factors, as well as a catch-up term that measures the distance from the technological frontier in each industry (see Annex).[25] This framework allows testing for the direct effect of institutions and regulations on estimated productivity, as well as for the indirect influences of these factors *via* the process of technology transfer.[26]

54. We find that various measures of anticompetitive product market regulation (both economy-wide and industry-specific) significantly curb productivity performance at the industry level.[27] In particular, the long-run costs of anticompetitive regulation, in terms of foregone productivity improvements, are higher in countries that are further away from the technological frontier. This negative effect on productivity catch up may result, for instance, from lower incentives for organisational and technological change in markets where competition is weak due to state interference (*e.g.,* entry barriers or price controls), and, in addition, a narrower scope for knowledge spillovers in markets where entry is restricted. The empirical results also suggest that, by increasing competitive pressures, regulatory reform will promote productivity in each individual industry, regardless of its position with respect to the technology frontier. Our findings are consistent with a growing empirical literature that has looked at the links between competition and productivity at the aggregate and especially at the industry and micro levels.[28]

55. Our empirical results can be used to illustrate the potential productivity gains that would be induced by regulatory reforms. Bearing in mind the limits of such simulations, a product market reform that would align industry-specific regulations with those of the most liberal OECD country is estimated to reduce the MFP gap *vis-à-vis* the leading country by around 10%, in the long run, in high-gap countries such as Greece, and by around 4 to 6 percentage points in several other continental European countries and Japan. Put differently, aligning the overall regulatory stance with that of the most liberal OECD country could increase the annual rate of MFP growth in continental EU countries by between 0.4% and 1.1% over a period of ten years (Table 1).

[Table 1. Change in annual percentage growth of MFP in EU countries implied by the alignment of regulation on OECD best practice over 10 years]

56. The effect of entry regulations is likely to be particularly important for productivity performance in industries in which technology is rapidly evolving, such as ICT-producing and ICT-using industries. In these industries new entrants play an important role in introducing new vintages of technology (see Scarpetta *et al.,* 2002). Therefore, product market regulations that minimise the prospective costs faced by new entrants are likely to create favourable conditions for increasing the contribution of ICT to productivity growth. As shown by Gust and Marquez (2002) regulatory burdens are likely to have slowed down the adoption of ICT in restrictive countries. While the relationship between regulation and ICT adoption awaits further empirical research, Figure 10 suggests that in countries which underwent extensive product market reforms it was easier to translate such investment into productivity improvements in crucial ICT-using sectors, thereby increasing their contribution to aggregate productivity growth.

[Figure 10. Regulation and the contribution of ICT-using services to aggregate productivity growth]

5. Conclusions

57.   In this paper, we looked at the possible links between product market regulation and growth in the OECD area over the past two decades. The paper documents that differences in labour utilisation, investment in new technologies and MFP growth underpin the observed cross-country divergences in growth. These factors contributed to accelerate growth in the United States, the United Kingdom, Canada and a few smaller OECD economies, while they held back growth in large continental EU countries and Japan. We cast the cross-country dispersion in growth patterns against product market reforms made over the past two decades showing that, despite efforts in virtually all OECD countries to make regulations more market friendly, the cross-country dispersion in product market approaches has also increased due to differences in the pace and depth of reforms. In particular, European countries, despite market integration, EC competition policies and the European monetary Union, have been characterized by diverging regulatory reform patterns. And new data covering the most recent years suggest that this divergent process of reform has continued in Europe.

58.   Can these diverging patterns of reform contribute to explain the puzzling disparities in growth outcomes? The results described in this paper suggest that there are several links between product market policies and growth performance. In particular, lower barriers to trade and competition in less regulated countries seem to have increased the level and rate of growth of productivity by stimulating business investment and promoting innovation and technological catch up. These policies can explain part of the growth advantage experienced by the United States and other English-speaking and small EU countries over the past two decades. Thus, regulatory reforms in product markets seem to be an essential element of any "agenda for growth". Looking forward, this would appear to apply especially to large continental European countries and Japan, which experienced a persistent productivity slowdown and widening GDP-per-capita gaps *vis à vis* the United States over the past decade.

59.   How reliable and general are these inferences? While overall the regulation-growth linkage seems robust to different model specifications and sample coverage within the OECD area, several caveat should be pointed out. First, more analysis needs to be done to extend these results to non-OECD countries, where the impact of competition-oriented policies on some of the determinants of growth could be different. Second, several missing links remain. For instance, we have produced only indirect evidence of the effects of product market reforms on innovation. More specific analysis of the link between regulation (including intellectual property rights) and aggregate innovative activity is needed. Moreover, there is still very little evidence on the relationship between economic growth and financial market policies, an important aspect of product market reform that has been left out in our discussion. Lastly, it should be recognised that the channels going from product market policies to performance identified in this paper cannot be considered in isolation, because investment and productivity outcomes are closely related. Integrating these channels would perhaps provide a more nuanced view of the effects of reform on overall economic growth.

Annex: Some empirical analyses of regulation and performance

Regulation and domestic investment (Alesina et al., 2005)

The empirical investigation of the links between regulations and domestic investment was based on estimation of various versions of an unrestricted dynamic model of investment of the form:

$$(I/K)_{ijt} = \sum_{s=1}^{2} \alpha_s (I/K)_{ijt-s} + \sum_{s=0}^{2} \beta_s REG_{ijt-s} + \gamma_{ij} + \zeta_t + (or\ \zeta_{jt}) + \varepsilon_{ijt}$$

where t represents years, i denotes countries and j sectors; I denotes investment, K the capital stock; REG is the product market regulation index; and the remaining terms capture country/sector specific fixed effects, and common (or sector specific) year dummies. The analysis controlled for endogeneity of regulation (by instrumenting it with lags and with some of its structural determinants according to recent political economy literature) and technology changes (through the sector-specific year dummies). The empirical analysis covered three broad non-manufacturing sectors in 12 OECD countries over the 1975-1998 period. The model was estimated with both dynamic fixed effects and generalised method of moments (Arellano and Bond, 1991) techniques. Results are robust to changes in estimation approaches and to a number of other extensions, such as allowing for short-run heterogeneity in responses of investment to regulation, controlling for additional country-specific variables (notably labour market regulation) and country/industry specific variables (e.g. factor prices).

Product Market Policies and FDI (Nicoletti et al., 2003)

The bilateral estimations covered 28 OECD countries and partners over the 1980-2000 period and were based on equations relating FDI outward stocks to non-policy-related factors, and the relative costs of trading and investing implied by policies in the home or partner countries (Markusen and Maskus, 2001b, and Egger, 2001). The building blocks are *i)* standard variables expressing gravity forces, factor proportions or other economic variables likely to affect FDI (*e.g.,* R&D intensity and exchange rates); *ii)* indicators of openness (multilateral and bilateral tariffs; multilateral indicators of non-tariff barriers; dummies for free-trade agreements; and FDI restrictions), domestic product-market regulations and labour-market flexibility; and *iii)* indicators of infrastructure supply. Thus, the basic bilateral model was:

$$Y_{ijt} = \sum_{x} \beta_x X_{ijt} + \sum_{c} \beta_c C_{it} + \sum_{p} \beta_p P_{jt} + \alpha_i + \alpha_j + \alpha_t + \alpha_{it} + \alpha_{ij} + \alpha_{jt} + u_{ijt}$$

where Y_{ijt} stands for the logarithm of bilateral FDI outward stocks from country i to partner j at time t (with $i=1,2,…,I$; $j=1,2,…,J$; and $t=1,2,…,T$); X_{ijt} are policy and non-policy related variables that are specific to a given country-partner pair; C_{it} are country-specific variables; and P_{jt} are partner-specific variables. The α-type variables stand for specific effects that control for all combinations of bilateral, country or partner-specific and time varying or time invariant unobserved factors. Since estimating dummies for all these factors is not viable, due to an excessive loss of degrees of freedom and high potential multicollinearity, we transformed variables according to Erkel-Rousse and Mirza (2002), decomposing the estimation in two equations in which all variables are expressed as deviations from the mean investor or, alternatively, the mean host. This reduced the number of unobserved components to be estimated parametrically while at the same time preserving the desirable properties of the relevant coefficient estimates. All estimates controlled for outliers and heteroskedasticity.

The model for total inward FDI positions accounted for the possibility that the adjustment of actual to desired stocks of FDI is costly and takes time. Therefore, equations for total FDI inward position were of the dynamic partial adjustment kind, with the total FDI inward position in each period also depending on the realised inward position in the previous period (see Cheng and Kwan, 2000). The estimated dynamic panel specification for total FDI inward positions was:

$$\ln Y_{it} = \gamma \ln Y_{it-1} + \sum_{x} \delta_x X_{it} + \sum_{z} \lambda_z Z_{it} + \nu_i + \varepsilon_{it}$$

where the X_{it} are non-policy related variables, the Z_{it} are policy variables, δ_x and λ_z are parameters to be estimated, ν_i are unobserved country-specific time-invariant effects and ε_{it} is a random disturbance. Estimation was carried out using generalised method of moments (Arellano and Bond, 1991).

Product market regulations and multifactor productivity (Nicoletti and Scarpetta, 2003)

The empirical analysis of MFP growth is centred on a catch-up specification of productivity, whereby, within each industry, the production possibility set is influenced by technological and organisational transfers from the technology-frontier country (indexed L) to other countries. We further extend the conventional model by assuming that, in each period t, MFP growth in industry k and country i depends on country and industry characteristics (human capital, hc_{ikt}, regulation, pmr_{ikt}, and other unobserved effects) as well as the state of knowledge in the technology-leader country (country with the highest level of MFP). In particular, an MFP advance in the frontier country is assumed to produce faster MFP growth in follower countries with the size of this impact increasing with each country's distance from the technological leader (see Scarpetta and Tressel, 2002 for more details). Thus the MFP equation is:

$$\Delta \ln MFP_{ikt} = \alpha_k \cdot \Delta \ln MFP_{Lkt} + \beta_k \cdot RMFP_{ikt-1} + \gamma_k \cdot pmr_{ikt} \cdot RMFP_{ikt} +$$

$$\delta\, hc_{ikt} + \lambda_k pmr_{ikt} + f_i + g_k + d_t + \eta_{ikt}$$

where η is the usual error term, and the equation includes dummies that control for unexplained country-specific (f), industry specific (g) and time-specific (d) factors. In the equation, pmr is the synthetic indicator of product market regulations, which varies over countries, time and/or industries, depending on the specification, and $RMFP$ is the ratio of MFP to the level found in the leader country. Note that α indicates the standard pace of technological transfer from the leader, β quantifies the importance of the technological transfer that depends on the size of the technology gap, and δ shows how the level of human capital affects the pace of technical progress in each country and industry. Moreover, λ shows the direct impact of regulation on productivity growth and γ gauges whether regulation hinders technology transfers from the technological leader. Most coefficients are sector-specific to account for potential heterogeneity bias. The empirical analysis covers 23 industries in manufacturing and business services in 18 OECD countries over the period 1984-1998. The model was estimated using a standard panel data fixed effects approach controlling for outliers and heteroskedasticity. In those specifications that use country-wide indicators of regulations instead of industry-specific indicators, we also adjusted standard errors and variance-covariance matrixes of the estimators for cluster level effects on country-industry using the procedure suggested by Moulton (1996). Moreover, a detailed sensitivity analysis was performed to test the robustness of results: it showed that the results were robust to recursively dropping country/industry observations and to different measures of MFP and human capital. In particular, alternative measures of MFP were considered that control for quality changes in labour input and for the presence of price mark-ups over marginal costs (see Scarpetta and Tressel, 2002).

NOTES

1   OECD and World Bank. This paper is forthcoming in T. Eicher and C. García-Peñalosa (eds.) <u>Institutions and Growth</u>, MIT Press. We thank Alain Desdoigts, Cecilia García-Peñalosa, participants in the CESIFO Venice Summer Institute 2004 on "Institutions and Growth" and three anonymous referees for their useful comments on a previous version of the paper. The opinions expressed are the authors' own and cannot be attributed to the organisations to which they are affiliated.

2   The European Union income gap worsened even discounting the effect of unification in Germany.

3   Within Europe, there were starkly contrasting developments: productivity continued to grow fast in Ireland, some Nordic countries and Portugal, while its growth remained disappointing in the Netherlands, Spain and, especially, Switzerland.

4   For studies that have looked at the macroeconomic effects of labour market reforms see *e.g.,* Nickell, 1997; Nickell and Layard, 1998; Elmeskov *et al.,* 1998; Blanchard, 2000.

5   In an early attempt to relate reforms to growth, Koedijk and Kremers (1996) noted that policy changes in European product markets have sometimes been deeper than reforms in labour markets.

6   While the primary (short and long-run) effects of anticompetitive product market regulation are to be expected on investment and productivity, regulatory hindrances to competition may also have consequences for employment, both at the firm level and in the aggregate. See Blanchard and Giavazzi (2003), Ebell and Haefke (2003), and Nicoletti *et al.,* (2001).

7   MFP estimates involve a number of difficult measurement problems. For instance, it is hard to make adjustment for quality and compositional changes in the labour input and, especially, the capital stock. Other potential sources of measurement error are economies of scale and mark-up pricing (see Morrison, 1999)

8   The workforce throughout the OECD has gradually become better educated, as entering young cohorts have higher educational attainment than the exiting older cohorts.

9   The odd position of Finland, which invested enormously in ICT goods relative to other countries, can be partly explained by its specialisation in ICT related industries.

10   See Sappington and Sidak (2003).

11   Cost-increasing regulations in the investor country may also stimulate outward FDI by favouring the delocalisation of production plants in countries with less costly regulations. On the other hand, the costs implied by these regulations may cripple the ability of investor-country firms to internationalise production to the desired level. For instance, there is evidence that certain product market regulations can hinder firm growth and curb R&D spending (Nicoletti *et al.,* 2001; Bassanini and Ernst, 2002). Both factors can constitute a handicap for internationalisation.

12   For instance, the effects on growth trajectories of reforms that improve the efficiency in the use of inputs have been recently stressed by Bergoeing *et al.,* (2002).

13   See Winston (1993) for a review.

14   These channels are highlighted by Lazear and Rosen (1981), Nalebuff and Stiglitz (1983) and Aghion and Howitt (1998).

15   This literature has been recently surveyed by Keller (2004). See also Görg and Greenaway (2002).

16   Cross-country evidence on the effects of regulation on R&D spending is provided by Bassanini and Ernst (2002).

17   The role of intersectoral input-output linkages in transmitting and amplifying the effects of product market reform has been recently stressed by Faini *et al.,* (2004).

18   Another important element of product market reform was liberalisation of international capital flows. However, the empirical analysis surveyed in this paper does not cover the effects of liberalisation in financial markets.

19   The construction of such indicators is an intricate business that is explained in detail in Nicoletti et al., (1999), Nicoletti and Scarpetta (2003), Alesina *et al.,* (2005), Golub (2003) and Conway *et al.,* (2005). Many of these indicators have recently been updated to reflect developments over the 1998-2003 period. In this paper, we only report indicator values for the period covered in the empirical analyses discussed below.

20   As noted by Kox *et al.,* (2004), this liberalisation is partly formal, because barriers related to the heterogeneity of regulations and administrative requirements across countries remain significant, even within free trade areas such as the European Union.

21   In the different specifications, the outliers have been identified using the DFITS statistics and the COVRATIO statistics, which, in turn, are based on the studentised residuals and the leverage values. The outliers are those annual observations for a given country that significantly increase the standard error of the regression or affect the estimated coefficients.

22   This approach merges early analyses, largely replicating gravitational models of trade, with models of the multinational enterprise that stress the joint determination of trade and FDI, economy-wide and firm-level economies of scale and the policy influences upon them.

23   The study also considers the effects of trade barriers on FDI, related to the so-called "tariff-jumping" rationale for horizontal FDI, as well as the effects of infrastructure policies. Here, we focus only on results concerning FDI restrictions and domestic regulations.

24   It is important to notice that, given the specification of some of the policy variables (which entail a comparison between policies of the investor country and the host country), the quantitative effects highlighted in these thought experiments cannot take into account diversion effects (*i.e.,* FDI re-directed from one country to another). To the extent that these are important, the simulation results may overestimate the effects of policy changes on the variables of interest.

25   Griffith *et al.,* (2004) have, amongst others, used a similar approach. However, their study does not include regulatory variables, nor does it consider industry differences in important covariates (*e.g.,* human capital). A number of other studies have looked at productivity convergence using industry/country data.

26   For example, if the adoption of new technologies relies partly on new firms, high entry barriers may reduce the pace of adoption (see *e.g.,* Boone, 2000b).

27   For additional evidence of the productivity effects of entry liberalisation at the industry level, see the papers in OECD (2001).

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28   For a review of the available studies using industry-level data see Scarpetta and Tressel (2002). For cross-country studies that explore the role of competition on productivity using mark-ups and concentration indexes, see Cheung and Garcia Pascual (2001). For studies using firms' market shares, see Nickell (1996), Nickell *et al.,* (1997) and Disney *et al.,* (2000).

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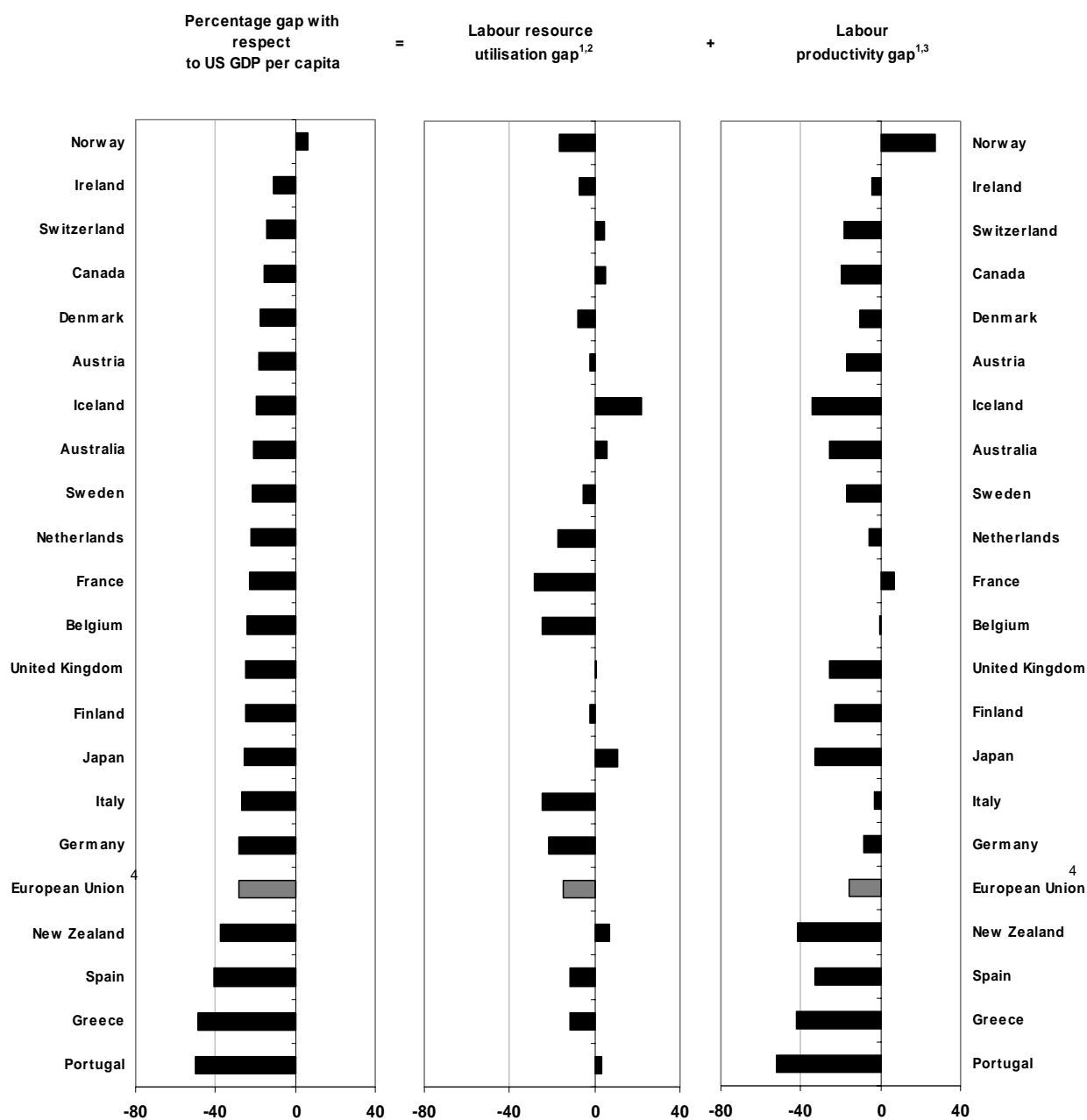
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Table 1. Change in the annual percentage growth of MFP in EU countries implied by the alignment of policies to OECD best practices over ten years

	Contributions of:		Total effect
	Overall regulatory reform	Industry-specific reforms	
Austria	0.10	0.32	0.42
Belgium	0.15	0.45	0.60
Denmark	0.10	0.27	0.37
Finland	0.04	0.55	0.59
France	0.19	0.43	0.62
Germany	0.08	0.62	0.70
Greece	0.29	0.83	1.12
Italy	0.22	0.48	0.70
Netherlands	0.11	0.34	0.44
Norway	0.02	0.36	0.38
Portugal	0.23	0.42	0.65
Spain	0.12	0.28	0.41
Sweden	0.01	0.50	0.51
United Kingdom	0.00	0.11	0.11

The simulations are based on the results of a panel regression on 23 industries
 in 18 OECD countries over the 1984-1998 period.

Source : Nicoletti and Scarpetta (2003).

Figure 1. The sources of real income differences, 2002

(2000 Purchasing Power Parities)

| Percentage gap with respect to US GDP per capita | = | Labour resource utilisation gap[1,2] | + | Labour productivity gap[1,3] |

1. Percentage gap with respect to the United States level.
2. Labour resource utilisation is measured as trend total number of hours worked divided by population.
   Information on hours worked for Austria, Luxembourg, Poland and Turkey is not available.
3. Labour productivity is measured as trend GDP per hour worked.
4. European Union except Austria and Luxembourg.

Source: OECD Productivity Database.

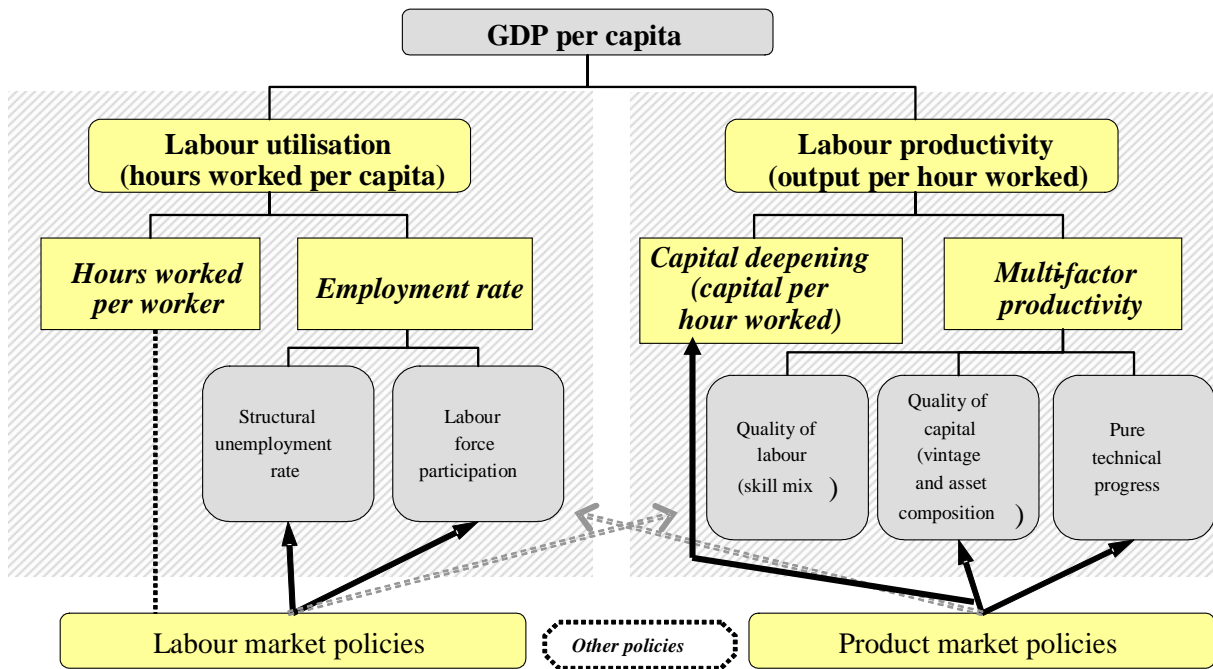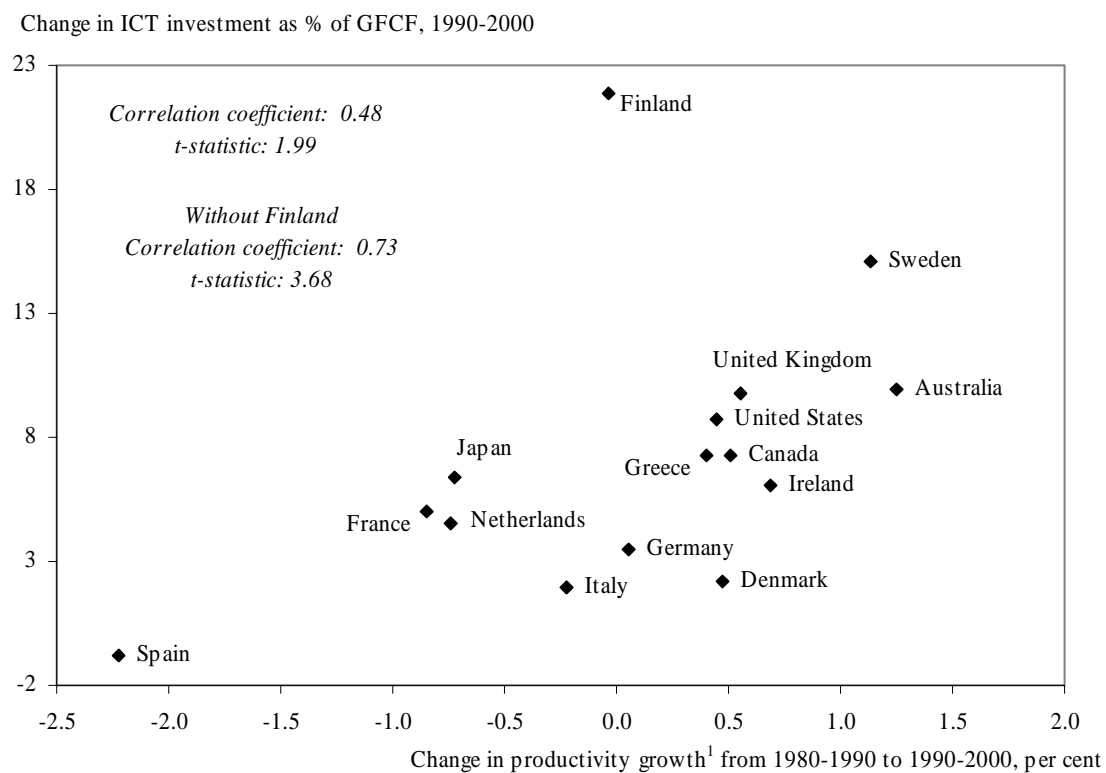Figure 2. The proximate determinants of GDP per capita

**Figure 3. Pick-up in hourly labour productivity growth and increase in
information and communication technology investment**

Change in ICT investment as % of GFCF, 1990-2000

Correlation coefficient: 0.48
t-statistic: 1.99

Without Finland
Correlation coefficient: 0.73
t-statistic: 3.68

Finland

Sweden

United Kingdom

Australia

United States

Japan

Greece

Canada

Ireland

France

Netherlands

Germany

Italy

Denmark

Spain

Change in productivity growth[1] from 1980-1990 to 1990-2000, per cent

1. Labour productivity is defined as output per hour worked
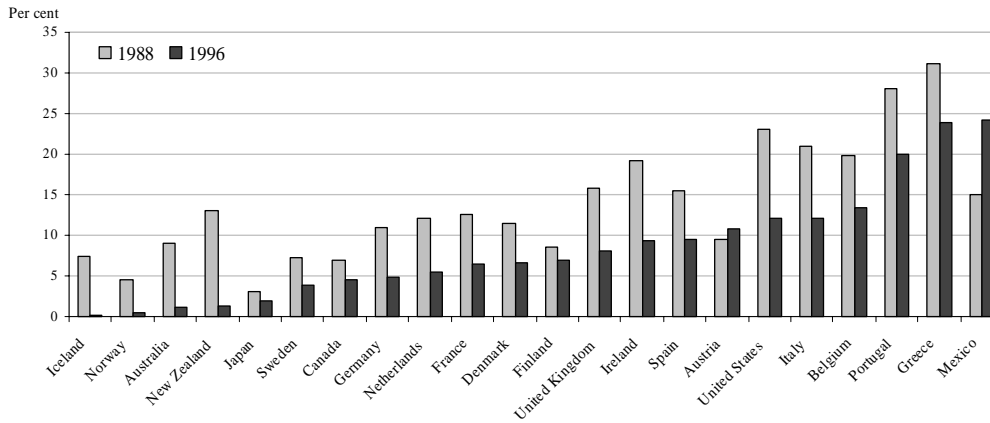
Source: OECD Productivity Database.

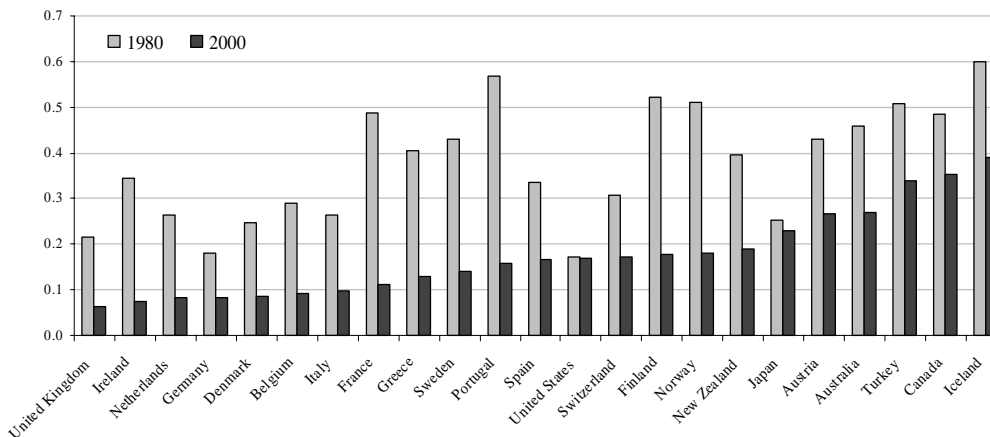**Figure 4. Openness to trade and foreign direct investment**

Tariffs in 1996 and 2001[1]
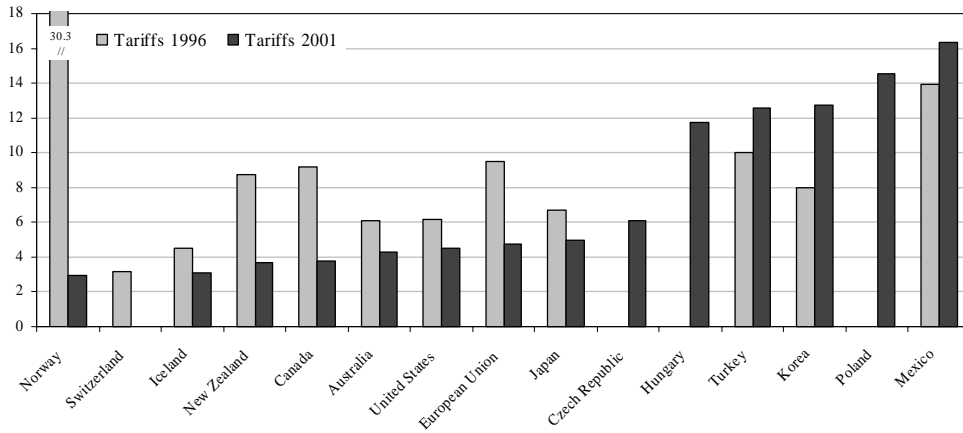
Import coverage of non-tariff barriers[2]
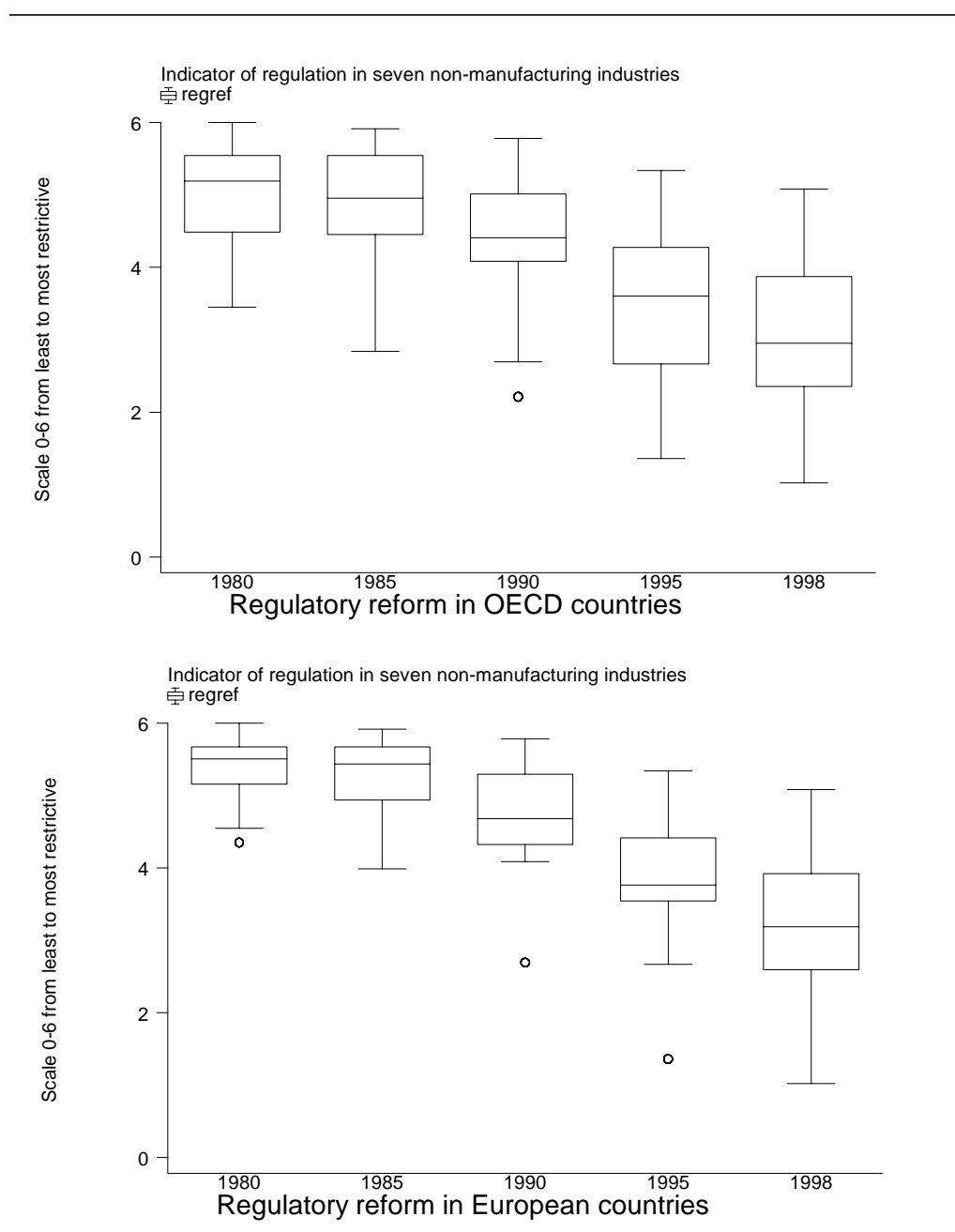

FDI restrictions over time, 1980-2000[3]

1. Simple average of applied MFN tariff rates.
2. OECD calculations based on UNCTAD data. Aggregation from 2-digit level tariffs to national level using sectoral value-added weights.
3. The indicator ranges from 0 (least restrictive) to 1 (most restrictive). The most recent year for which data are available varies across countries between 1998 and 2000.

Source: WTO online database; UNCTAD TRAINS Database; Golub (2003)

Figure 5. Regulatory reform in non-manufacturing[1,2]

Indicator of regulation in seven non-manufacturing industries
⊟ regref

Regulatory reform in OECD countries

Indicator of regulation in seven non-manufacturing industries
⊟ regref

Regulatory reform in European countries

1. The box plot shows, in each year, the median OECD value of the regulatory indicator (the horizontal line in the box), the third and second quartiles of the cross-country distribution (the edges of each box) and the extreme values (the two whiskers extending from the box). Dots identify outlier observations. For consistency, European countries include only EU members since 1980.

2. The indicator summarizes regulation (including barriers to entry, vertical separation, price control and public ownership) in air, rail and road transport; post and telecommunications; and energy (electricity and gas)

Source: Nicoletti and Scarpetta (2003)

Figure 6. Overall regulatory approaches across countries[1]

Economic and administrative regulation[2]

Administrative regulations

Correlation coefficient 0.48
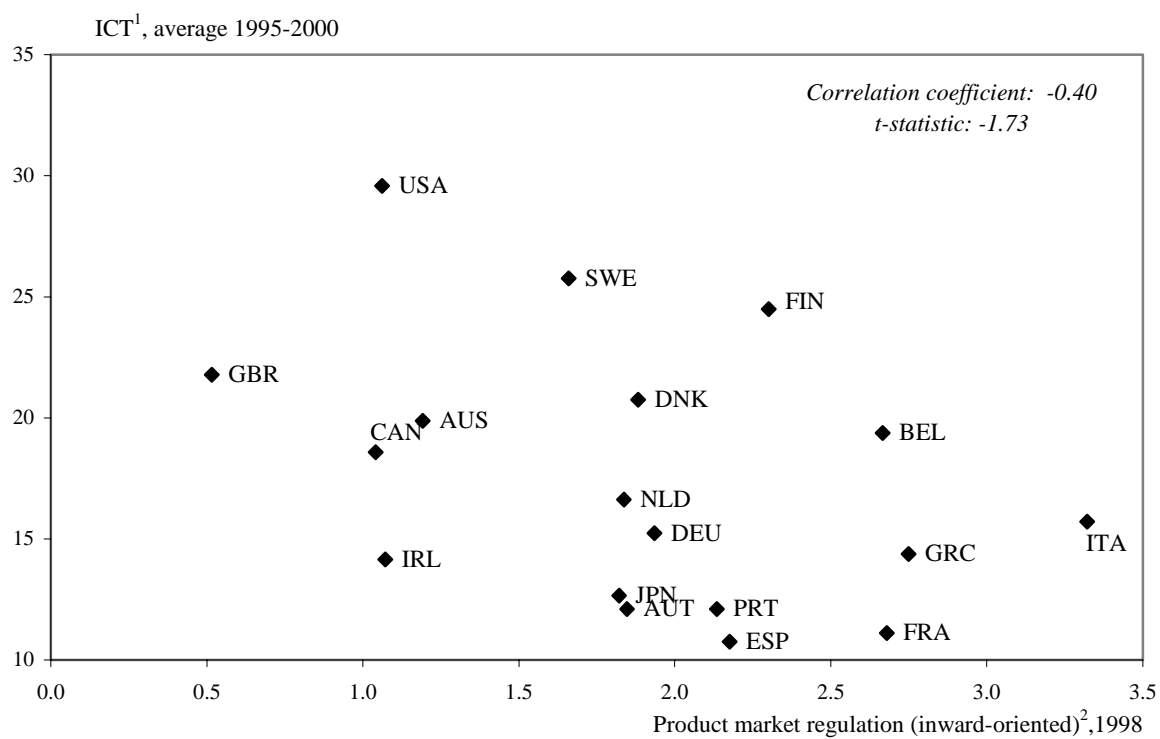*t-statistic 2.42*

Economic regulations
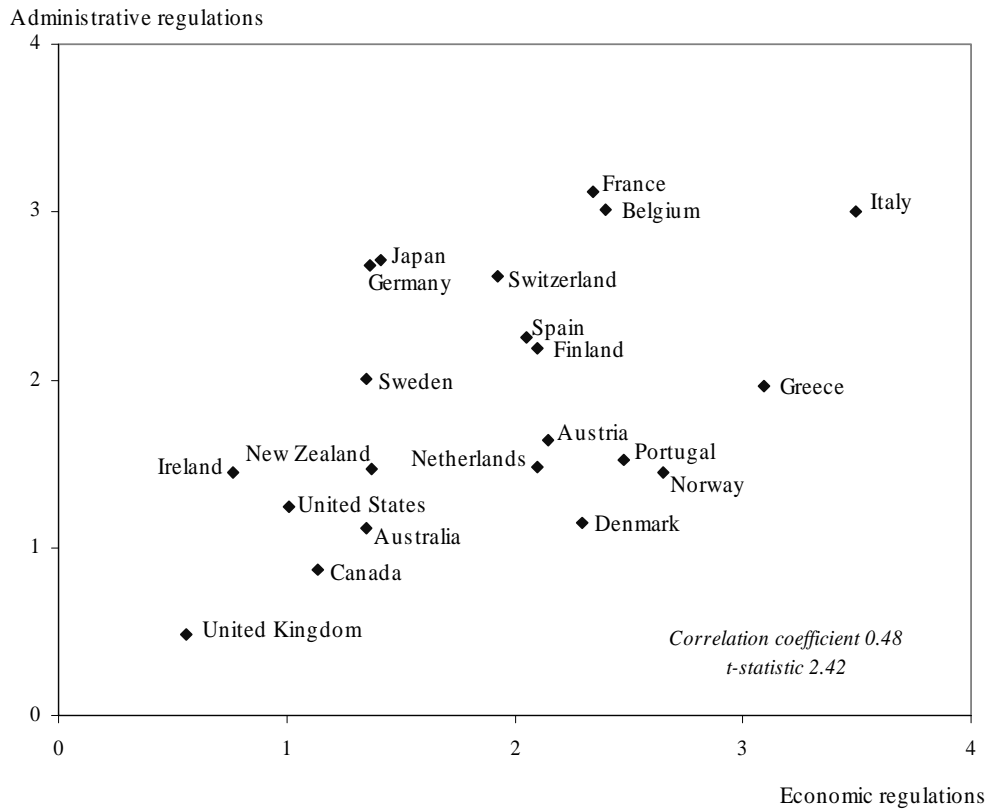
1. The scale of indicators is 0-6 from least to most restrictive.
2. Administrative regulation includes reporting, information and application procedures and burdens on business start-ups, implied by both economy-wide and sector-specific requirements; economic regulation includes all other domestic regulatory provisions affecting private governance and product-market competition (such as state control and legal barriers to entry in competitive markets).
Source : Nicoletti *et al.* (1999).

Figure 7. Regulation and investment in information and communication technology

ICT[1], average 1995-2000

Correlation coefficient: -0.40
t-statistic: -1.73

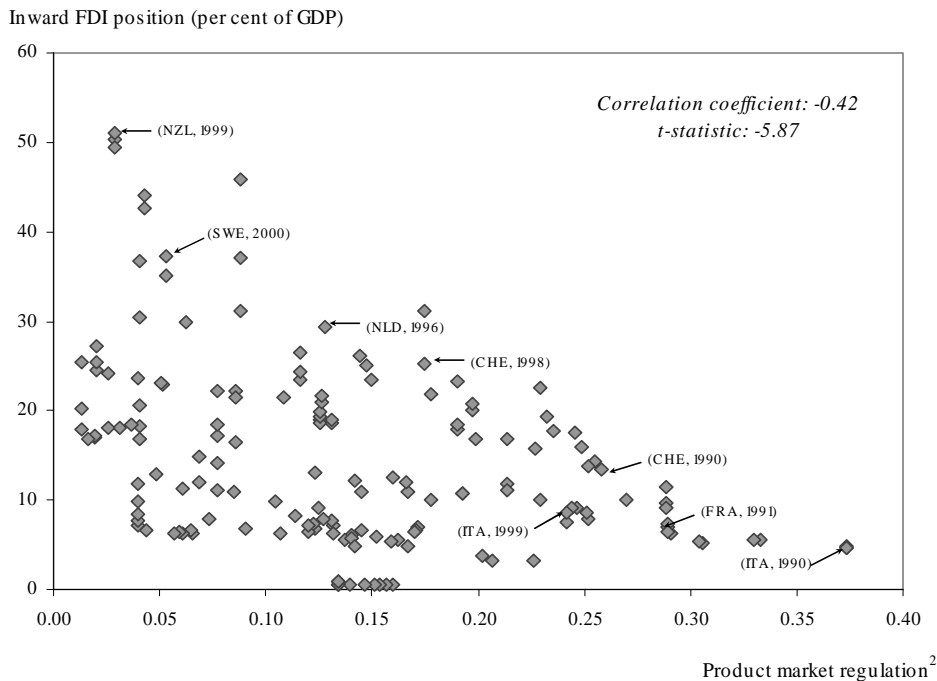Product market regulation (inward-oriented)[2],1998

1. ICT investment as a percentage of non-residential gross fixed capital formation.
2. Indicator of economy-wide regulation excluding barriers to international trade and investment.
   The indicator ranges from 0 to 6, from least to most restrictive.
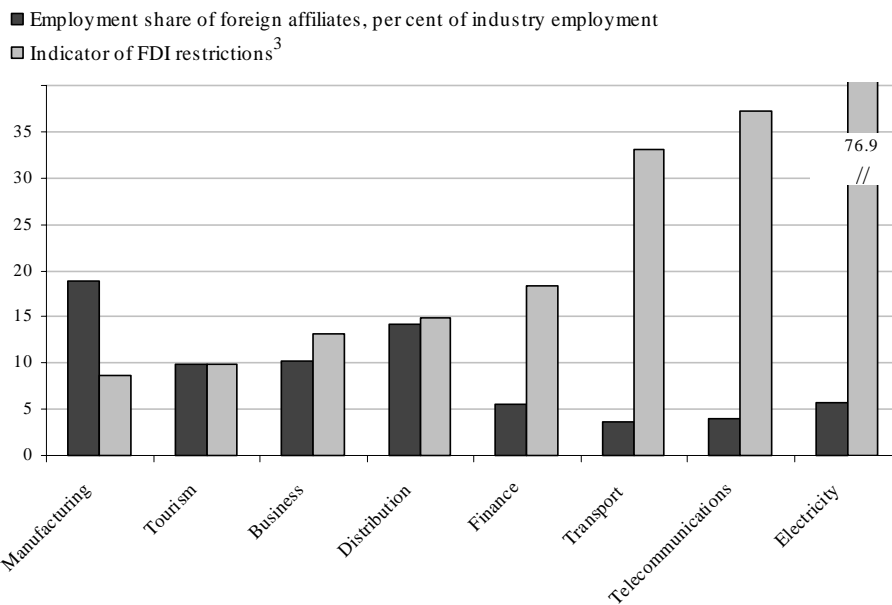
Source: OECD Productivity Database and Nicoletti et al. (1999).

Figure 8. Regulation and foreign direct investment

Inward FDI position and regulation (OECD countries over 1980-1998 period)[1]

Inward FDI position (per cent of GDP)

Correlation coefficient: -0.42
t-statistic: -5.87

(NZL, 1999)
(SWE, 2000)
(NLD, 1996)
(CHE, 1998)
(CHE, 1990)
(FRA, 1991)
(ITA, 1999)
(ITA, 1990)

Product market regulation[2]

Industry share of foreign affiliates and FDI restrictions (OECD averages in 2000)

■ Employment share of foreign affiliates, per cent of industry employment
☐ Indicator of FDI restrictions[3]

76.9
//

Manufacturing
Tourism
Business
Distribution
Finance
Transport
Telecommunications
Electricity

1. Each point shows the combination of regulation and FDI in a given country and period. Some of these country/period contributions are shown for illustrative purposes.
2. Product of the indicator of economy-wide regulation in 1998 and the indicator of barriers to entry in seven non-manufacturing industries over the 1980-1998 period. 0-1 scale from least to most restrictive of competition.
3. The indicator ranges from 0 (least restrictive) to 100 (most restrictive).
   Summary indicator of restrictions on inward foreign direct investment in nine sectors.
Source: Nicoletti *et al.* (2003)

Figure 9. Multifactor productivity acceleration and product market regulation

Difference in average MFP growth rate between 1990-2000 and 1980-1990[1]
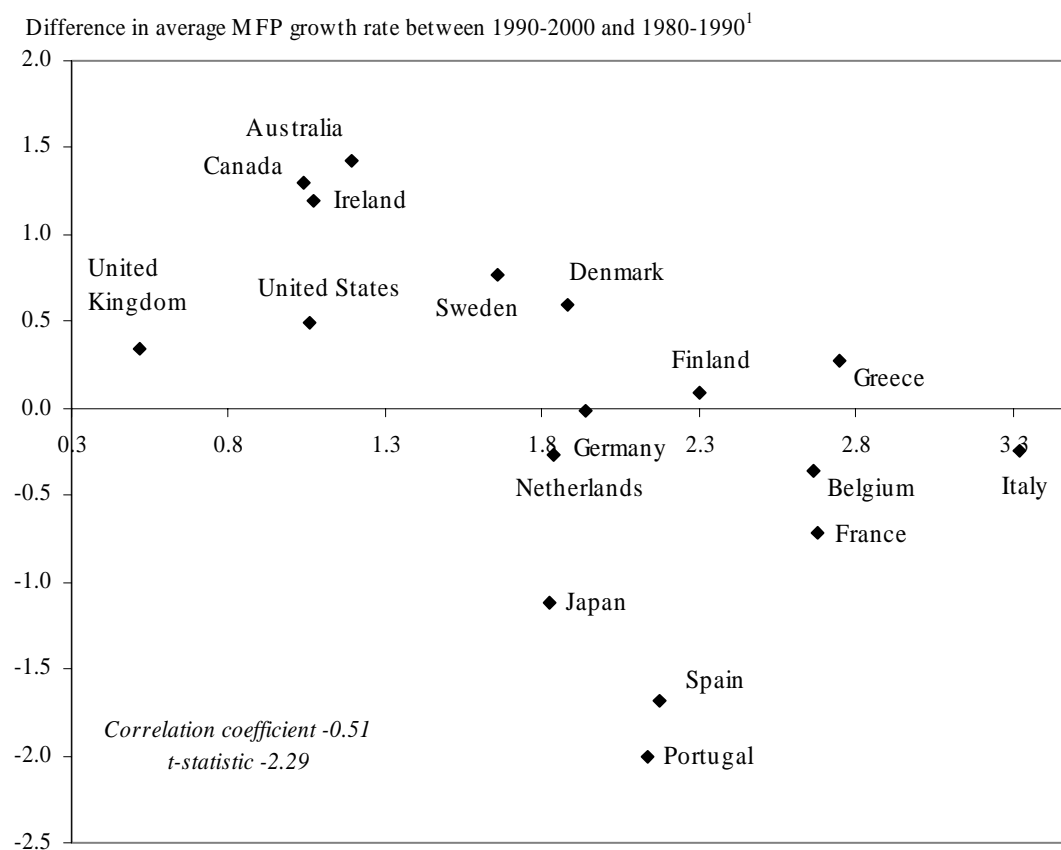
Product market regulation, inward oriented[2], 1998

1. Adjusted for hours worked.
2. Indicator of economy-wide regulation excluding barriers to international trade and investment.
   The indicator ranges from 0 to 6, from least to most restrictive. See Nicoletti et al. (1999).

Source : OECD Productivity Database.

Figure 10. Regulation and the contribution of ICT-using services to aggregate productivity growth

ICT using services[1], 1996-2001

Product market regulation (inward-oriented)[2], 1998
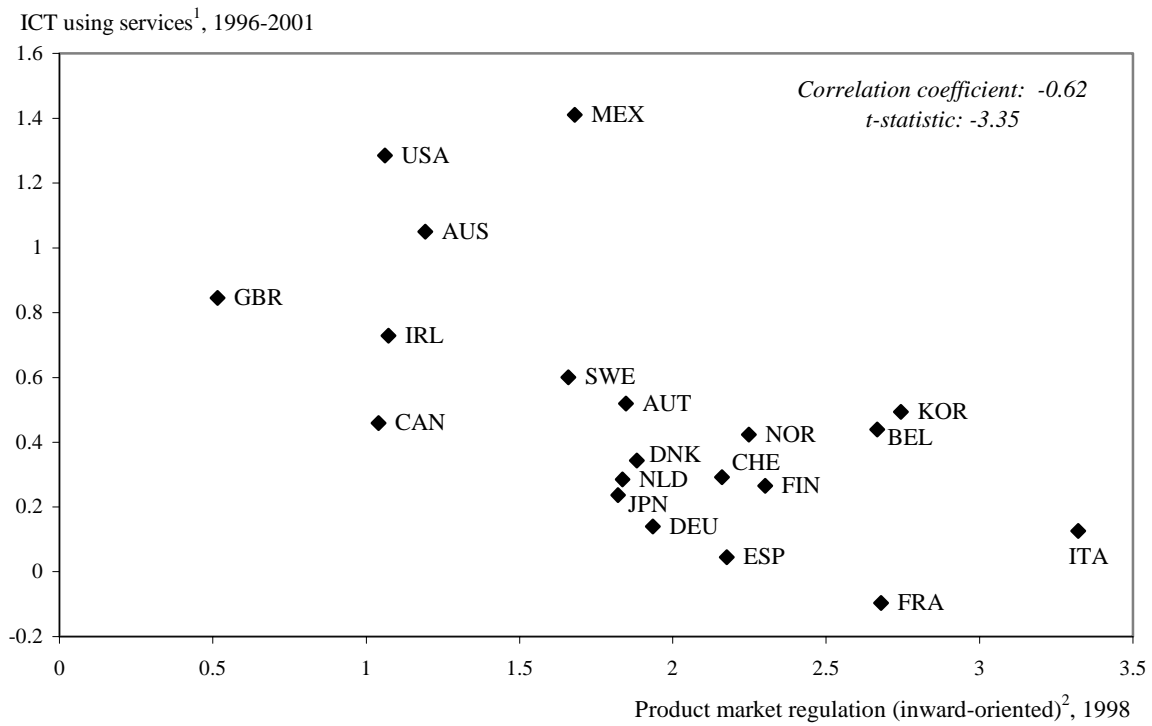
1. Contribution to aggregate labour productivity growth.
2. Indicator of economy-wide regulation excluding barriers to international trade and investment.
   The indicator ranges from 0 to 6, from least to most restrictive.

Source: OECD Productivity Database and Nicoletti *et al. (1999)* .

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