

# REGULATION OF FINANCIAL SYSTEMS AND ECONOMIC GROWTH IN OECD COUNTRIES: AN EMPIRICAL ANALYSIS

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## INTRODUCTION

The operation of the financial system can have a key impact on economic growth and the stability of the economy. It affects long-term economic growth through its effect on the efficiency of intermediation between the savers and final borrowers of funds; through the extent to which it allows for monitoring of the users of external funds, affecting thereby the productivity of capital employed; and through its implications for the volume of saving, which influences the future income-generating capacity of the economy. It affects the stability of the economy because of the high degree of leverage of its activities and its pivotal role in the settlement of all transactions in the economy, so that any failure in one segment risks undermining the stability of the whole system.

The impact of financial systems on growth has been well established empirically. Given the difficulties in directly measuring efficiency in the financial sector, a large number of empirical studies have relied on measures of size or structure to provide evidence of a link between financial system development and economic growth (Levine, 2005).<sup>1</sup> Indeed, nearly all studies based on macro- or sector-level data find that financial development, measured as the size of financial intermediation or of external finance relative to GDP, has a significant positive impact on growth, either directly via productivity, or indirectly via its effect on the build-up of physical and knowledge capital (Pelgrin *et al.*, 2002). And the finding is generally quite robust to variations in the sample. For instance, even though the majority of these studies cover a broad range of developed and developing countries, the results of financial development affecting growth have been found to hold also when the sample is limited to OECD countries (Leahy *et al.*, 2001).

Taken at face value, these results would suggest that in order to achieve faster growth, individual countries should vigorously pursue the development of domestic financial markets and institutions regardless of the size of their domestic economy. However, to the extent that markets for banking services and securities exchange are characterised by increasing returns to scale or network externalities, cross-border integration of financial markets may well be one of the major sources of efficiency gains. If all countries might benefit from reduction in costs arising from international market integration, only those with a comparative advantage in the provision of financial services would be expected to see an increase in the depth of their domestic financial sector. In this regard, beyond a certain threshold most likely to be reached in most developed countries, the size of a domestic

financial system as conventionally measured may not be an adequate indicator of efficiency in terms of accessibility to credit and financial services, intermediation costs, or productivity of capital employed (Guiso *et al.*, 2004).

Another limitation of empirical studies linking growth to measures of financial sector size is the difficulty of identifying unambiguously the direction of causality. In order to address this issue, several studies have focused more directly on the determinants of financial development and/or on the mechanisms through which the latter affect growth. For instance, Rajan and Zingales (1998) exploit industry-level data across a set of countries to test the theoretical argument that financial development reduces the cost of raising funds from external sources by contributing to overcome problems of moral hazard and adverse selection. They do so by examining whether industries that are typically more reliant on external financing grow faster in countries with better-developed financial systems. More recently, Barth, Caprio and Levine (2004) use a database they have assembled on the regulation and supervision of banks around the world to examine the relationship between banking regulation and the development of the banking sector.

This paper combines the two approaches and uses industry-level data from over 20 countries to examine whether industries that rely more heavily on external sources of funds grow more rapidly in countries where regulation allows for stronger competition in markets for banking services and financial instruments.<sup>2</sup> The construction of regulatory indicators relies essentially on surveys conducted by the World Bank on regulations in banking and securities markets for its member countries.<sup>3</sup> Individual elements from these surveys are aggregated into broader indices directly used in the regression analysis.

In the case of banking regulation, the areas covered are separated according to whether they constitute unwarranted barriers to competition or whether they achieve stability objectives, such as market integrity and stability, with more limited adverse effect on competitive pressures. Regulatory impediments to competition include barriers to entry (both foreign and domestic) and lines-of-business restrictions. The extent of government ownership is also treated as a barrier to competition, reflecting the potential impact of state control on the level playing field. As for markets for debt and equity instruments, the regulatory indicators cover the following four areas: Contract enforcement, access to credit, investor protection and bankruptcy procedures.

Using panel regression techniques, the paper examines whether regulation that facilitates competition in banking and that is more conducive to securities market development and efficiency has a significant positive impact on sectoral output growth, productivity growth and firms' entry rates. The reason for looking at firm's entry rates is two-fold. First, according to the Shumpeterian approach to growth, the possibility for new, more innovative and efficient firms to compete

with – and eventually to drive out – older less efficient firms is a key factor linking innovation to productivity gains. Second, using firm entry data is one way – albeit an indirect one – to examine the impact that financial system regulation may have on small firms, the ones most likely to face limited options in terms of access to external funding.

The output and productivity regressions are performed on a sample of around 25 countries and industries. The entry regression includes fewer countries (16) but a similar number of industries and also has a time-series dimension. Overall, the results indicate that financial system regulation has a statistically significant influence on output and productivity growth, in particular via the impact on industrial sectors relying more heavily on external sources of funding. The economic impact is also found to be non-negligible. The analysis suggests that reforms that would align regulations in banking in countries with the most restrictive stance to the OECD average could be associated with an increase in annual GDP growth by  $\frac{1}{4}$  to  $\frac{1}{2}$  of a percentage point for a significant period of time. The impact from strengthening investor protection would be somewhat weaker.

The rest of the paper is organised as follows: The next section provides a discussion of barriers to competition in financial systems and introduces the regulatory indicators used in the empirical analysis. Empirical methodology and results are then presented and compared with findings from earlier studies. This is followed by concluding remarks.

## **BARRIERS TO COMPETITION IN FINANCIAL MARKETS: THE ROLE OF REGULATION AND OTHER POLICIES**

This section discusses regulatory impediments to competition (both from domestic and foreign sources) in various segments of banking activities, as well as of the regulatory underpinnings of securities markets. Using essentially information from comprehensive regulatory databases compiled by the World Bank, the stance of regulation in banking and some aspects of securities markets is presented in the form of quantitative indicators. It is important to stress that the indicators presented in this section reflect for the most part the stance of domestic regulation in specific areas of banking and securities market. Financial sector development and efficiency can also be hampered by a number of less formal policy barriers to cross-border competition in securities and banking services. Such barriers, which include differences in national corporate tax systems as well as in legal, technical or accounting standards, are discussed in Box 1.

### ***Banking regulation***

Banking regulation has often been put in place with several – and sometimes conflicting – objectives in mind, such as promoting strong national financial

### Box 1. Less formal and/or non-legal barriers to competition

Apart from the formal barriers discussed above, a number of less formal or non-legal obstacles contribute to maintaining inefficiencies in financial markets. While some of these obstacles may be “natural” such as language, culture or preferences, others may result from policy settings, including unfinished agendas for facilitating international trade and market integration. Some of the most significant policy areas can be regrouped according to the type of market instrument they are most directly related to:

- In the case of *retail banking services*, including bank loans to individuals and small- and medium-sized enterprises, barriers to trade include the lack of harmonisation in consumer protection rules as well as in procedures for solving cross-border or cross-region disputes (Walkner and Raes, 2005). In addition, banks wishing to expand into neighbouring countries via foreign subsidiaries are generally subject to host country supervision rules, implying multiple reporting. Even within countries, banks operating nationwide must in some member countries deal with multiple layers of supervisory authorities, often with different reporting requirements (Dermine, 2006).
- In the case of *equity markets*, a number of factors contribute to limiting the consolidation of stock exchanges as well as to raising the cost of cross-border securities transactions. These include differences in national corporate tax systems as well as in reporting and accounting standards, and, in some cases, the vertical ownership structure of stock exchanges.\* In some member states, investors/traders wishing to transact in several regions or provinces face higher costs owing to the presence of different securities exchange commissions.
- The development of the *private equity or venture capital market* is hampered in several countries by legal restrictions on holding of high-risk instruments by pension and/or mutual funds (Thompson and Choi, 2002). In addition, high capital gains taxes have been found to adversely affect venture capital development (Gompers and Lerner, 2004). Barriers to consolidation of secondary stock markets may also play a role, given the importance of exit prospects in attracting venture capital investment (OECD, 2003a).
- In the case of the *bond market*, a number of barriers have slowed the development of asset-backed securities including, in several cases, provisions from bankruptcy legislation requiring borrowers to be individually notified that the loan they contracted via a financial intermediary is being securitised, which raises the cost of such operation. More generally, the development of an integrated asset-backed securities market is hampered by cross-country differences concerning reporting regulations, rules on withholding taxes, income tax treatment of issuing vehicles and treatment of capital gains.

\* This issue has been particularly well documented in the context of the European Union, with reports published by the Giovannini group (2003) as well as by the CEPS (2003).

institutions, offering consumer protection, assisting industrial and/or regional development and preserving financial stability, in particular the safeguarding of the payment and settlement system. This has led in the past to tight and widespread regulation, ranging from interest rate ceilings and branching restrictions to capital requirements and deposit insurance. While some of the most stringent rules such as interest rate controls and branching restrictions have by now been largely eliminated in OECD countries, the sector remains nevertheless one of the most intensely regulated across countries. Furthermore, the main objectives of regulation have generally become more narrowly focused, with the main emphasis put on market integrity (conduct rules) consumer/investor protection (disclosure rules) and crisis prevention, in particular on limiting systemic risks should one or more institutions get into trouble (prudential regulation). In parallel, in an effort to level the playing field internationally, efforts have been made to harmonise prudential regulation across countries via the Basel I and II processes.

Against this background, the policy challenge is to strike the right balance between preserving the overall soundness of the banking system and fostering its efficiency. To a certain extent, rules aimed at consumer protection may contribute to re-enforce competition, for instance by helping consumers to make better informed choices, raising thereby their willingness to switch between institutions. Also, a minimum level of regulation is needed to ensure that financial institutions behave prudently, and this can raise efficiency even if it increases the cost of entry. In many cases, however, regulation aimed at stability or consumer protection is implemented at the expense of competition with the balance being unnecessarily tilted against efficient outcomes. Indeed, as long as measures such as capital requirements, disclosure rules and risk-based deposit insurance are in place to ensure banks' prudent behaviour, further reductions in direct barriers to competition need not weaken the key regulatory objectives.<sup>4</sup>

#### *Construction of regulatory indicators*

In order to compare the stance of banking regulations across countries, the analysis relies essentially on the World Bank's *Bank, Regulation and Supervision Database*. It compiles the results from a detailed survey of banking regulation conducted in 2000 and again in 2002-03 in a large number of countries (see de Serres *et al.*, 2006 for details regarding the questionnaire and the construction of quantitative indices). As such, it provides a measure of the stance of banking regulation in the countries covered, with some indications of the enforcement powers by supervisors. The survey consists of approximately 250 questions which, for the purpose of this exercise, have been categorised under two broad headings: Stability and barriers to competition (Figure 1).

Each category is in turn divided in sub-groups according to the specific aspects of regulation covered. The sub-groups for the competition-barriers category include regulatory barriers on domestic and foreign entry, restrictions on banking activities and the extent of government ownership. The sub-groups for stability category consist of ten diverse regulatory areas. Even though the *Bank, Regulation and Supervision Database* contains some information about foreign entry and government ownership, the indicators used in the empirical work are based on alternative sources which were viewed as more comprehensive. More specifically, the index of restrictions on foreign entry in banking is based on earlier OECD

Figure 1. **The system of regulatory indicators for the banking system**  
 Panel A. Regulatory barriers to competition

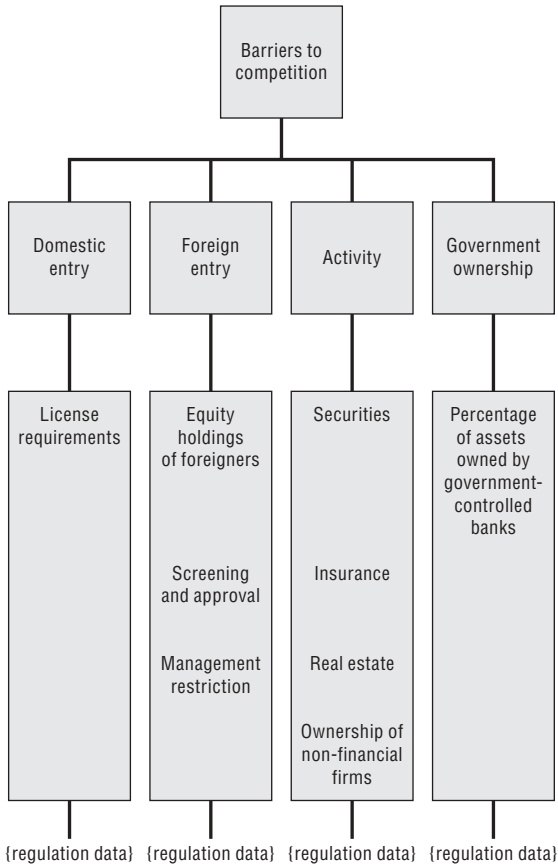
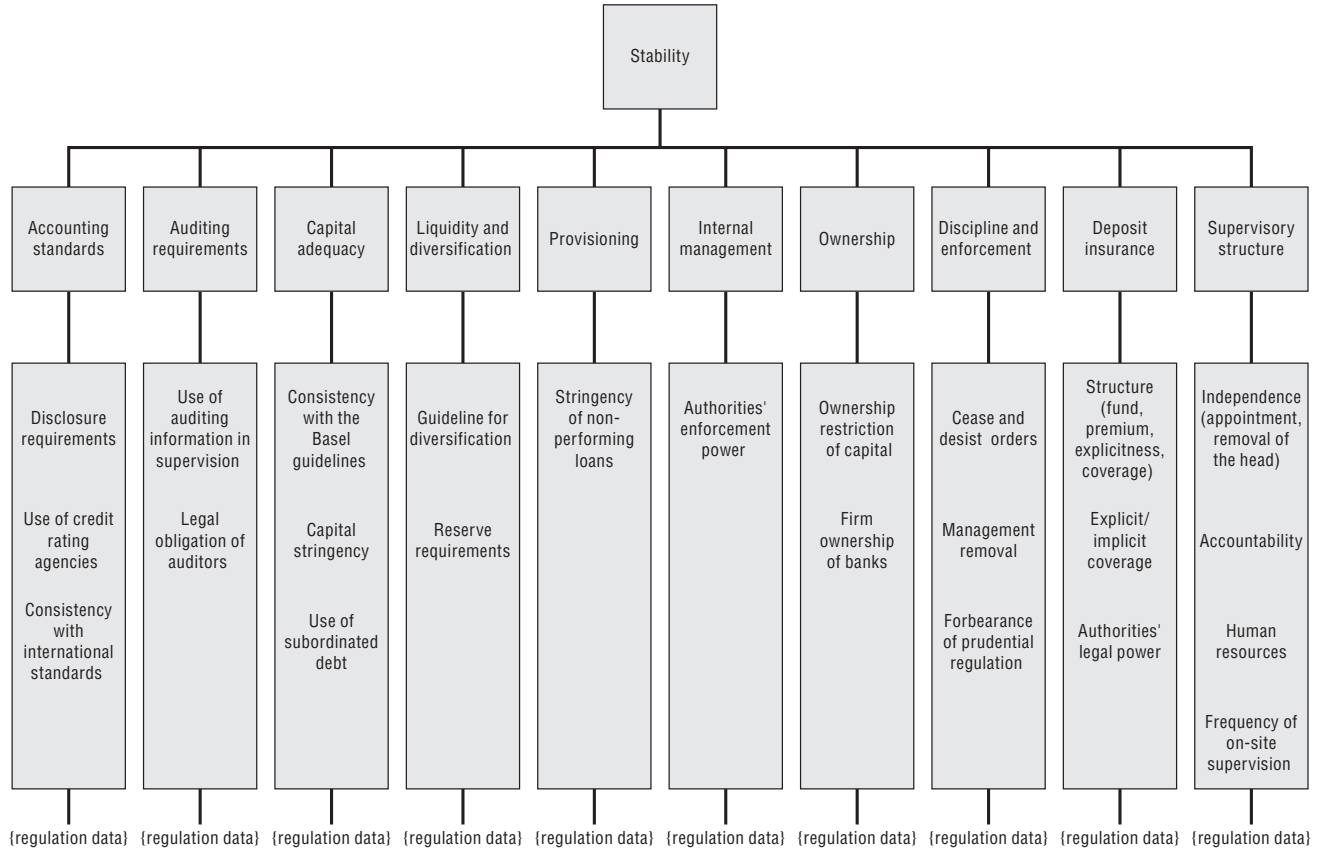


Figure 1. **The system of regulatory indicators for the banking system** (cont.)  
 Panel B. Regulations aimed at stability





work on FDI restrictions (Golub, 2003). As for the measure of government ownership of banks, it is taken from La Porta *et al.* (2002).<sup>5</sup>

As is common practice with regulatory indicators, qualitative answers (mostly in the form of “yes” or “no”) to a questionnaire have been converted into quantitative indices by attributing a score that increases according to the restrictiveness of regulation. The scores attributed to individual questions (on a scale going from 0 to 1) have first been aggregated into sub-indices, corresponding to the groupings shown in Figure 1, and then into the two broad categories, barriers to competition and stability. Converting qualitative information into quantitative indicators is not, however, without problems. A key issue is to what extent the same weight should be given to all indicators or if some indicators should have a bigger weight, which obviously is crucial to the value of the indicator. One way to address this is to assign random weights to individual or groupings of questions and provide a range of possible values for the index as a function of changing weights, as has been done in the following.<sup>6</sup>

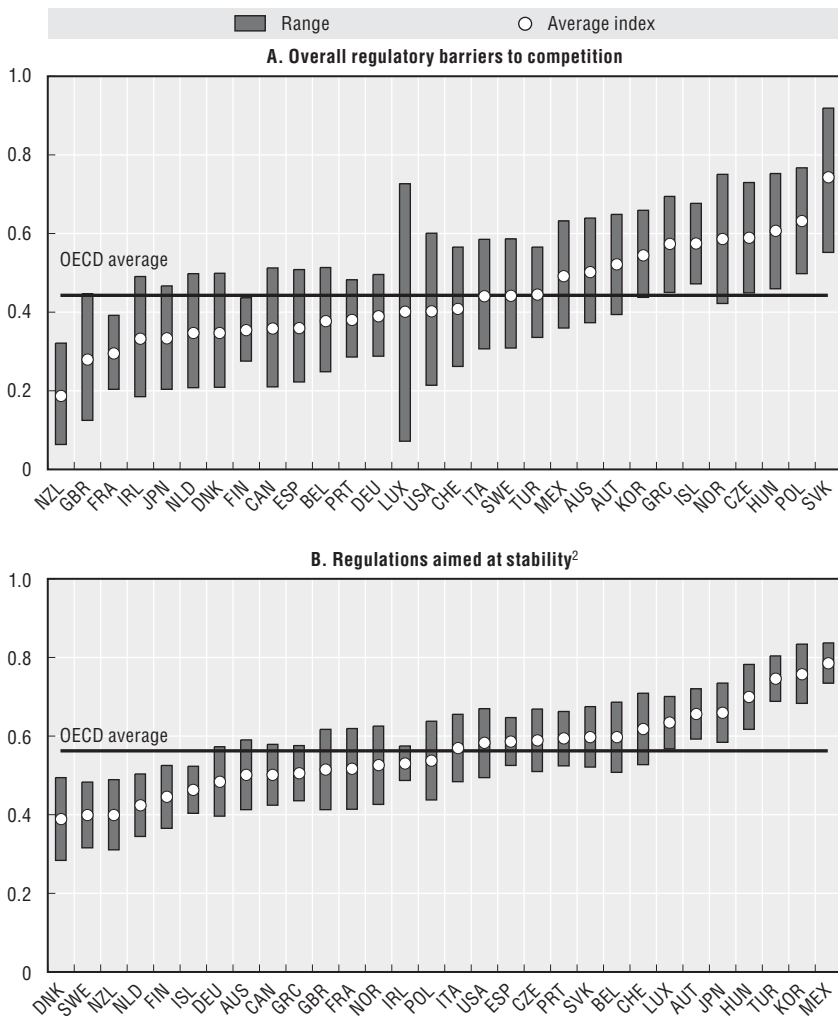
## Results

Figure 2 shows the constructed regulatory indicators for the broad competition and stability categories. The mid-point (*i.e.* the white circle) shows the average index and the ranges shown in shaded areas are calculated using the random weights technique (using 90% confidence intervals). On the basis of this technique, less than ten OECD countries differed at the time from the OECD average with respect to regulatory barriers to competition. Looking at regulations aimed at stability suggests narrower confidence intervals and hence greater dispersion with a number of countries being clearly below or clearly above the OECD average.

At the time the survey was conducted (2002-03), the indicator for regulations affecting competition shows that Korea and central and eastern European countries tended to have generally stricter regulation. By contrast, regulations in this area were particularly permissive in New Zealand. Most other countries were found to lie within a fairly narrow range around an intermediate position with respect to competition-restraining regulations in banking.

The overall indicator of barriers to competition can be further decomposed into its main sub-indices (Figure 3). Most OECD countries tend to have relatively stringent requirements to set up banking institutions and regulations tend to be comparatively homogenous across countries. Thus, basically all countries require extensive information about financial projections for new banks and their business plan, the sources of equity and the financial status of the main potential shareholders, the planned organisation of the bank and the background of future directors and managers.

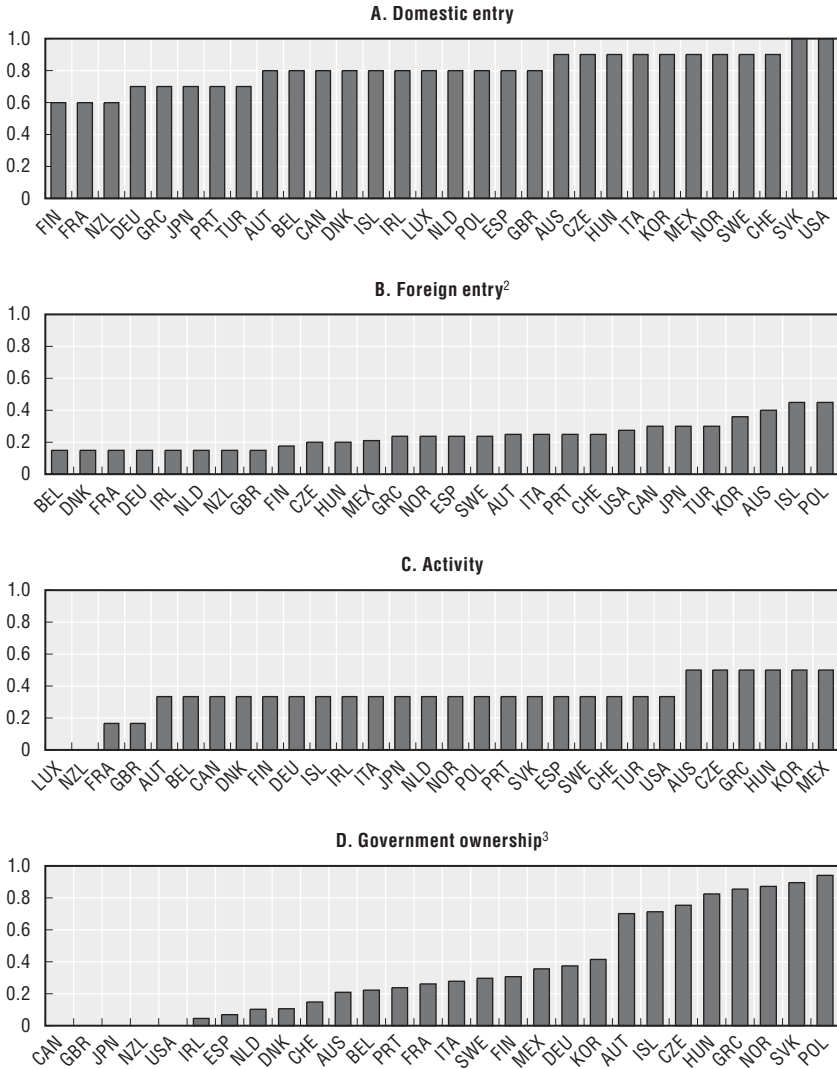
Figure 2. **Banking regulation indices, 2003<sup>1</sup>**



1. The scale of the indicator is 0-1 from least to most restrictive. A higher value indicates more competition-restraining regulation.  
 2. Covers different measures related to prudential regulation of the banking sector.  
 Source: OECD; World Bank, Bank Regulation and Supervision Database.

Somewhat more variations are observed with respect to activity control and restrictions to foreign entry into banking (at least as they were prevailing in the late 1990s). Controls on the types of activity that bank can engage into are particularly

Figure 3. Barriers to competition in banking<sup>1</sup>



1. The scale of the indicator is 0-1 from least to most restrictive. A higher value indicates more competition-restraining regulation.
2. Restrictions to foreign entry are taken from Golub, S. (2003). This index reflects the stance of regulation prevailing in the period 1998-2000.
3. Measures the amount of assets held by banks (among the 10 largest) where government ownership is at least 20 per cent as a ratio of total assets (of the 10 largest banks). The measure is taken from La Porta *et. al* (2002) and applies to 1995.

Source: OECD; World Bank, Bank Regulation and Supervision Database and La Porta *et al.* (2002).

low in many European countries. Government ownership of banks was most extensive in Korea and European member countries in the mid-1990s, while the banking system was fully in private hands in many countries, including the United States, Canada, Japan, New Zealand and the United Kingdom at that time. Overall, there is little correlation between the four sub-components, which reflect a fair degree of heterogeneity in the regulatory stance within countries across the different areas explains the relatively large confidence band (top Panel of Figure 2).

Regulations related to prudential conduct in the banking sector are comparatively strict in a few low-income member countries and relatively light in some Nordic countries, New Zealand and the Netherlands. As reflected in the comparatively narrow confidence intervals for the stability-oriented regulation index depicted in Figure 2 (lower Panel), policies tend to be applied more consistently in the ten different areas making up the index. For example, countries with tight accounting standards and auditing requirements also tend to give regulators relatively strong powers to intervene in the internal management of banks.

#### *Correlations of banking regulations and financial development*

Simple correlation analysis shows that across countries the variables measuring aspects of regulation in the banking industry appear to be related to financial development and with an effect that is in conformity with priors (Table 1). More specifically, stricter anti-competitive regulation is associated with lower bank assets relative to GDP though not with private credit by banks relative to GDP. At a lower level, these indicators of banking sector development are negatively (albeit, weakly) associated with regulations on foreign entry and activities. To some extent, these results corroborate those found in an earlier study based on the same regulatory data set (albeit from an earlier vintage, see Barth, Caprio and Levine, 2001).<sup>7</sup> With respect to stability-oriented regulations, the correlations reported in Table 1 suggest that they tend to be negatively associated with financial development, though the correlation is not statistically significant for most of the more specific regulatory areas.

#### **Securities market regulation**

In contrast to banking regulation, tensions between different regulatory objectives have been less of an issue in the case of securities markets. This owes much to the fact that a core objective of market regulation – investor protection defined in a broad sense – is also viewed as contributing positively to financial system efficiency. Even so, striking the right balance between protecting the rights of various stakeholders (shareholders, creditors, entrepreneurs/managers and employees) on the one hand, while allowing firms and markets to function efficiently on the other, does involve complex policy trade-offs, cutting through a wide range of regulatory areas

Table 1. Correlation between banking regulations and financial development

Structural indicator	Bank assets as a share of GDP					Private credit by banks as a share of GDP				
	I	II	III	IV	V	VI	VII	VIII	IX	X
Barriers to competition	-2.15**					-1.69				
Domestic entry	(0.04)	-0.91				(0.16)	-0.03			
Foreign entry		(0.19)	-1.90*				(0.97)	-1.10		
Activity			(0.05)	-1.10*				(0.31)	-1.16*	
Government Ownership				(0.06)	-0.11				(0.08)	-0.32
Number of observations					(0.86)					(0.65)
R <sup>2</sup>	0.15	0.06	0.14	0.12	0.00	0.07	0.00	0.04	0.11	0.01
	Bank assets as a share of GDP									
Structural indicator	I	II	III	IV	V	VI	VII	VIII	IX	X
Stability in banking regulation	-1.43**									
Accounting standards	(0.04)	-0.06								
Auditing requirements		(0.92)	-0.03							
Capital adequacy			(0.96)	-0.13						
Liquidity and diversification				(0.79)	-0.32					
Provisioning					(0.31)	-0.68***				
Internal management						(0.00)	0.08			
Ownership							(0.65)	-0.85**		
Discipline and enforcement								(0.03)	-0.76*	
Deposit insurance									(0.07)	
Supervisory structure										-0.51
Number of observations										(0.22)
R <sup>2</sup>	0.15	0.00	0.00	0.00	0.04	0.34	0.01	0.16	0.12	0.06
										0.29

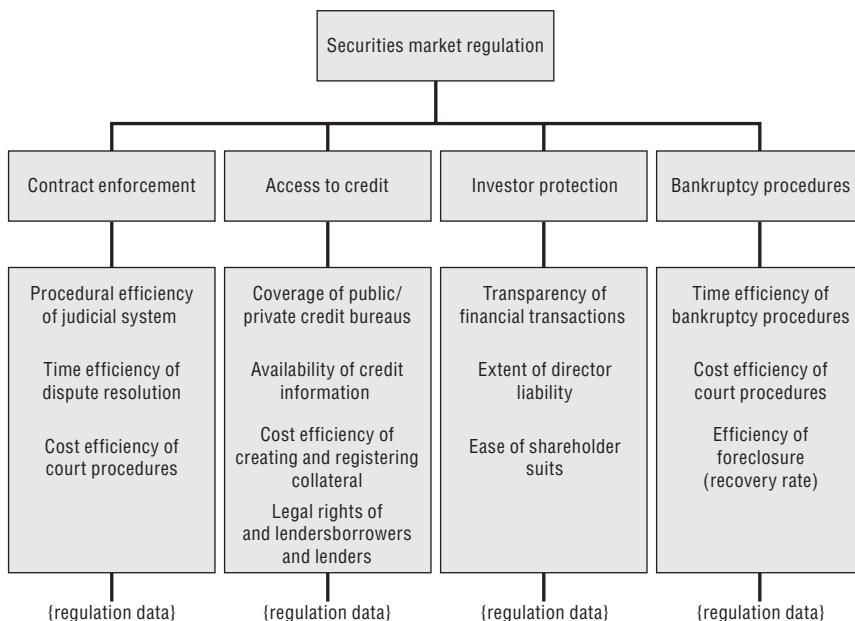
1. Each column in barriers to competition and stability in banking regulation is a separate regression. Dependent variables for barriers to competition are bank assets as a share of GDP and private credit by banks as a share of GDP (average between 2000 and 2003). Dependent variable for stability is bank assets as a share of GDP. P-values are reported under the estimated coefficients. \*, \*\*, \*\*\* indicate significance at the 10, 5 and 1% level respectively.

such as securities exchange rules, company law and bankruptcy law. Accordingly, providing a comprehensive quantification of the stance of regulation in these areas with a view to identifying best practice remains a challenge.

*Construction of indicators*

To assess the stance of securities market regulation in member countries, quantitative indicators have been derived using the *Doing Business Database* (2005) of the World Bank.<sup>8</sup> Four broad indices of securities market regulation have been used:<sup>9</sup> Contract enforcement, access to credit, investor protection and bankruptcy procedures. Each category is constructed from sub-indices which essentially reflect aspects of transparency (information disclosure) and efficiency of legal procedures (Figure 4).<sup>10</sup> For instance, the access to credit index combines information about the coverage of public registries and private bureaus with estimates of cost to create collateral and with information on the legal rights of lenders and borrowers. As was the case with banking regulation, all individual items have been converted into a quantitative index ranging from 0 to 1. In contrast to banking regulation, however, and given the emphasis put on investor/creditor protection and information standards, the indices have been constructed in such a way that a higher value is interpreted as being good for financial development and overall economic performance.

Figure 4. The system of regulatory indicators for securities markets



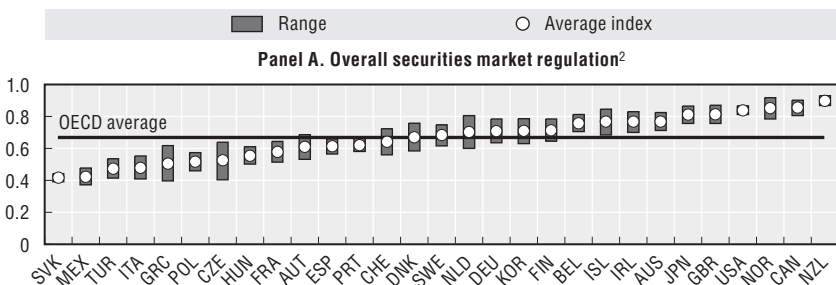
Results

The value of the overall index of securities market regulation is shown in Figure 5, Panel A. As is the case in banking regulation, the mid-point (*i.e.* the white circle) shows the average index and the ranges shown in the shaded areas are calculated using the random weights technique. Compared with the results obtained in banking regulations, a larger set of countries (English-speaking countries as well as Norway, Japan, Iceland, Belgium and Finland) have significantly more demanding regulations (*i.e.* favourable to the development of securities markets) than the OECD average. By contrast, the indicator shows that central and eastern European countries, and other countries with relatively low values, had, in around 2005, a regulatory stance less conducive to the development of securities markets.

The overall indicator of securities market regulation can be further decomposed into four broad sub-indices:

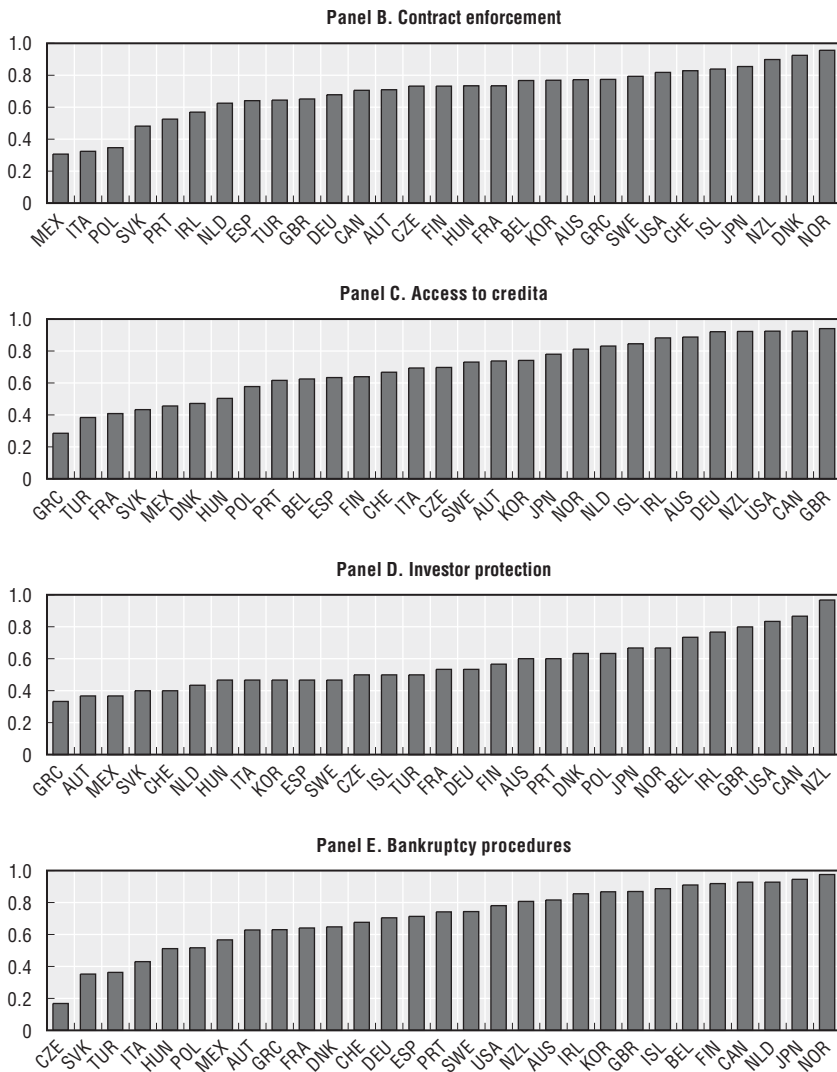
- *Contract enforcement.* Captures essentially the efficiency of commercial contract enforcement based on the number of procedures, the number of calendar days for dispute resolution and the official cost of court procedures.
- *Access to credit.* Captures two broad elements in assessing the ease of access to credit: The amount of credit information available through public registries or private bureaus; the strength of legal underpinnings in arranging collateral in protecting secured lenders.
- *Investor protection.* Captures the strength of minority shareholder protection against directors' misuse of corporate asset for personal gain from three perspectives: transparency of transactions, liability for self-dealing and shareholders' ability to sue directors for misconduct.

Figure 5. Securities markets regulation indices<sup>1</sup>



1. The scale of the indicator is 0-1 from least to most restrictive. A higher value indicates more competition-restraining regulation.  
 2. Covers contract enforcement, access to credit, investor protection and bankruptcy procedures.  
 Source: OECD; World Bank, Bank Regulation and Supervision Database.

Figure 5. Securities markets regulation indices<sup>1</sup> (cont.)



1. The scale of the indicator is 0-1 from least to most restrictive. A higher value indicates more competition-restraining regulation.  
 2. Covers contract enforcement, access to credit, investor protection and bankruptcy procedures.  
 Source: OECD; World Bank, Bank Regulation and Supervision Database.



- *Bankruptcy procedures.* Captures the efficiency of bankruptcy laws and its proceedings with respect to the time required to go through the bankruptcy procedure, the overall cost of procedures and the recovery rate.

Overall, the stance of securities market regulations in different areas tends to be correlated in each country. Some G7 countries (*e.g.* Canada, the United States and the United Kingdom) are relatively demanding in all areas, whereas central and eastern European countries tend to be fairly unrestrictive across the board (Figure 5, Panels B-E).

*Correlations of securities market regulations and financial developments*

Correlation analysis underlines that across OECD countries the indicators of securities market regulation appear to be related to financial development (Table 2). To be more specific, stricter regulation is associated with higher stock market and private bond market capitalisation relative to GDP. At a lower level, significant influences of contract enforcement and bankruptcy procedures are found.

**Table 2. Correlation between securities market regulations and financial development**

Structural Indicator	Stock market and private bond market capitalisation as a share of GDP				
	I	II	III	IV	V
Securities market regulation	2.41*** (0.01)				
Contract enforcement		1.69** (0.03)			
Access to credit			1.33* (0.06)		
Investor protection				0.66 (0.43)	
Bankruptcy procedures					1.71*** (0.01)
Number of observations	29	29	29	29	29
R <sup>2</sup>	0.22	0.16	0.13	0.02	0.24

Note: Each column is a separate regression. Dependent variable is the sum of stock market and private bond market capitalisation as a share of GDP (average between 2000 and 2003). P-values are reported under the estimated coefficients. \*, \*\*, \*\*\* indicate significance at the 10, 5 and 1% level, respectively.

**THE IMPACT OF FINANCIAL SYSTEMS' DEVELOPMENT AND POLICIES ON ECONOMIC PERFORMANCE: EMPIRICAL EVIDENCE AT THE INDUSTRY LEVEL**

This section reports on the results from panel regression analysis linking a number of indicators of regulatory policy in the areas of banking competition and securities markets reviewed in the previous section, as well as measures of financial development and costs to broad measures of economic performance. As men-

tioned earlier, a large number of empirical studies have shown the importance of financial systems' development for growth at the aggregate level, but fewer have gone beyond standard measures of financial development and examined directly the impact of policy variables on performance at the sectoral level. The approach taken follows Rajan and Zingales (1998) and the basic argument is that insofar as financial markets and institutions do reduce the cost of raising external funds, industries that depend more heavily on external sources should benefit disproportionately from a regulatory environment that is more conducive to financial systems' development and efficiency.

To the extent that important differences prevail across industries with respect to the use of external finance, using disaggregated data also allows cross-section regression analysis to be performed over a larger and richer dataset.<sup>11</sup> Accordingly, the empirical investigation presented in this section is conducted on the basis of industry-level data, which are used to examine the effect of various policy indicators and measures of financial development on real value-added growth and labour productivity growth. In addition, given the importance of experimentation in the development of new products and services, and the role that financial systems can play in this process, the impact of financial development and policy on industry entry rates is also examined.<sup>12</sup>

### ***Methodology and specification***

The approach used to test whether regulations and the development of financial systems have a significant influence on economic growth is based on the idea that firms' dependence on external sources of finance varies across industries according to differences in technology and characteristics such as the degree of capital intensity. For example, highly capital- and R&D-intensive industries may be more dependent on external funding due to large investment costs and longer periods before the profits can be harvested. Insofar as these differences across industries in the desired degree of external dependence are broadly similar across countries, this opens the possibility to test whether industries that depend more heavily on external funds grow faster in countries that have better-developed financial systems.

Concretely, this is done by interacting an industry-specific measure of external financial dependence with a country-specific indicator of financial development or regulatory policy such as those discussed in the previous section.<sup>13</sup> However, the *desired* amount of external financing in each industry is not observed and can only be inferred from the *actual* amount of funds raised externally. The latter is likely to be a good proxy for the former only where financial markets are sufficiently developed to provide firms with a largely unconstrained access to external financing. Again, following Rajan and Zingales (1998), the assumption

made is that US financial markets come closest to provide such access and accordingly, data on US listed firms are used to identify industries' need of external finance. More specifically, a firm's dependence on external finance is defined as its capital expenditure minus internal funds (cash flow from operations) divided by capital expenditure (see Annex for more details).<sup>14</sup>

Each interaction term is then introduced as a potential determinant in separate regressions. In principle, it would have been desirable to include all the regulatory variables in a single regression allowing for statistical discrimination, but this was not feasible due to strong multicollinearity induced by the interaction with the measure of external financial dependence.<sup>15</sup>

This methodology is applied to examine the impact of financial systems' regulation and development on valued-added growth, labour productivity growth and firms' entry rates. In the first two cases, the analysis is conducted on a panel dataset with country and industry dimensions, using average growth rates over the 1994 to 2003 period. A time-series dimension is included in addition in the case of firm entry rates. The latter are defined as the number of entering firms divided by the total number of firms in a specific industry and are calculated on an annual basis over the period 1990-2001. The empirical analysis is based on the estimation of the following respective equations:

a) Industry growth:

$$GROWTH_{c,i} = \alpha + \beta_1 INITSH_{c,i} + \beta_2 (X_c * EXDEP_i) + \sum_c \gamma_{1c} Dcountry_c + \sum_i \gamma_{2i} Dindustry_i + \varepsilon_{c,i} \quad [1]$$

b) Industry entry dynamics:

$$ENTRY_{c,i,t} = \alpha + \beta_1 GAP_{c,t} + \beta_2 (X_c * EXDEP_i) + \sum_c \gamma_{1c} Dcountry_c + \sum_i \gamma_{2i} Dindustry_i + \sum_t \gamma_{3t} Dyear_t + \varepsilon_{c,i,t} \quad [2]$$

where  $GROWTH_{c,i}$  and  $ENTRY_{c,i,t}$  are the dependent variables and refer to growth of value added or labour productivity and entry rates in industry  $i$  and country  $c$ , respectively.  $X_c$  stands for indicators of financial development and regulatory stances and the variable  $EXDEP_i$  captures the measure of industries' dependence on external finance.<sup>16</sup> The model for firm entry includes also the time dimension with sub-index  $t$ . Dummy variables for each country, industry and year are introduced to correct for country, industry and time specific effects. An industry's initial share of the total value added,  $INITSH_{c,i}$ , is used to control for potential convergence effects.<sup>17</sup> Finally, a measure of the output gap,  $GAP_{c,t}$ , is used to control for business fluctuations affecting firm entry.

The financial development and performance variables include an overall measure of size (sum of private credit and securities market capitalisation), venture capital and overhead costs in the banking sector. As for policy indicators, they cover the two broad indices of securities market regulation and barriers to competition in

banking, as well as some of their main sub-indices as defined in the previous section. While stability-oriented regulations have been excluded from the analysis reported, preliminary results indicated no robust evidence of a significant impact of such regulation on long-term performance. All the details concerning data sources, variable definitions and country and industry coverage are exposed in the annex.

## **Results**

### *Base case results*

Overall, the results for value-added growth and labour productivity growth provide further support to the view that financial systems matter for economic performance (Tables 3 and 4). Both the broad measures of financial depth, venture capital and overhead costs have a significant influence on the two growth measures, with the impact going in the expected direction. As for policy indicators, both the overall indices of barriers to banking competition and securities market regulation are found to impact significantly on value-added and productivity growth. Taken at face value, this would suggest that policies improving contract enforcement, access to credit, the efficiency of bankruptcy procedures, or reducing barriers to entry and government control in the banking sector will foster labour productivity and value-added growth, in sectors most dependent on external finance.

Turning to the impact on firms' entry rates, the results are broadly in line with those for value-added and labour productivity growth, although the degree of significance is generally somewhat weaker (Table 5). One difference is that venture capital is no longer significant. Another difference is that the impact of barriers to banking competition relative to that of securities market appears to be larger than in the case of productivity and value-added growth. This finding is consistent with the view that new and small firms tend to rely more heavily on bank financing and thus regulation on this sector may have a stronger effect on such firms. Perhaps more importantly, the negative impact of barriers to competition in banking on firm entry contradicts the view according to which greater market power in banking may facilitate entry by providing easier access to credit for young and unknown firms (Peterson and Rajan, 1995).

Even if the statistical analysis supports the importance of the financial development and regulatory variables, they explain only a small fraction of the variance in sectoral value-added and productivity growth, as well as of entry rates. Indeed, these variables account for one to two per cent of the total variance, the country, industry and (in the case of entry rates) time fixed effects accounting for almost all of the multiple correlation coefficients ( $R^2$ ) of the regressions. Nonetheless, since the variation is quite large, the financial development and regulatory indicators are of significant quantitative importance. For instance, based on the empirical estimates reported above, a one standard-deviation increase in financial development would lead on average to an increase in the growth rate of value-added or

Table 3. Value-added growth, financial development and regulations: Empirical analysis

	Panel regressions with country and industry dimensions: average over 1994-2003										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Initial share	-0.19** (0.07)	-0.20** (0.08)	-0.18** (0.07)	-0.21*** (0.07)	-0.20*** (0.07)	-0.18** (0.07)	-0.19** (0.08)	-0.20*** (0.07)	-0.22*** (0.08)	-0.20*** (0.08)	-0.21*** (0.07)
Financial development *EXDEP	0.38*** (0.13)										
Venture capital *EXDEP		1.63*** (0.58)									
Overhead costs in banking *EXDEP			-21.99** (9.75)								
Securities market regulation *EXDEP				2.20*** (0.65)							
Contract enforcement *EXDEP					1.52*** (0.55)						
Access to credit *EXDEP						0.99** (0.49)					
Investor protection *EXDEP							0.99** (0.49)				
Bankruptcy procedures *EXDEP								1.33** (0.54)			
Barriers to banking competition *EXDEP									-3.03*** (0.86)		
Regulation on entry and activity *EXDEP										-3.10** (1.30)	
Government ownership *EXDEP											-1.08*** (0.33)
Number of observations	435	444	466	466	466	466	466	466	466	466	466
R <sup>2</sup>	0.45	0.41	0.42	0.43	0.42	0.42	0.42	0.43	0.43	0.42	0.43

Note: EXDEP variable in the interaction terms refers to industries' dependence on external finance. Financial development is measured as the sum of private credit, stock market and private (0.33) bond market capitalisation to GDP. All regressions include country and industry dummies. Robust standard errors are reported in parentheses; \*, \*\*, and \*\*\* indicate significance at the 10, 5 and 1% level, respectively.

Table 4. **Productivity growth, financial development and regulations: Empirical analysis**

Panel regressions with country and industry dimensions: Average over 1994-2003

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Initial share	-0.15 (0.09)	-0.15* (0.08)	-0.14* (0.08)	-0.17** (0.08)	-0.16** (0.08)	-0.15* (0.08)	-0.16* (0.08)	-0.16** (0.08)	-0.19** (0.08)	-0.17** (0.08)	-0.18** (0.08)
Financial development *EXDEP	0.36*** (0.10)										
Venture capital *EXDEP		0.93** (0.47)									
Overhead costs in banking *EXDEP			-20.50** (9.82)								
Securities market regulation *EXDEP				1.96*** (0.56)							
Contract enforcement *EXDEP					1.32*** (0.50)						
Access to credit *EXDEP						0.81** (0.41)					
Investor protection *EXDEP							1.16*** (0.43)				
Bankruptcy procedures *EXDEP								1.13*** (0.36)			
Barriers to banking competition *EXDEP									-2.90*** (0.58)		
Regulation on entry and activity *EXDEP										-3.43*** (1.15)	
Government ownership *EXDEP											-0.96*** (0.22)
Number of observations	394	423	423	423	423	423	423	423	423	423	423
R <sup>2</sup>	0.45	0.42	0.42	0.43	0.42	0.42	0.42	0.42	0.43	0.43	0.43

Notes: EXDEP variable in the interaction terms refers to industries' dependence on external finance. Financial development is measured as the sum of private credit, stock market and private bond market capitalisation to GDP. All regressions include average country and industry dummies. Robust standard errors are reported in parentheses; \*, \*\*, and \*\*\* indicate significance at the 10, 5 and 1% level, respectively.

Table 5. **Entry rates, financial development and regulations: Empirical analysis**

	Panel regressions with country, industry and time (1990-2001) dimensions										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Financial development *EXDEP	0.58*** (0.21)										
Venture capital *EXDEP		-0.28 (0.81)									
Overhead costs in banking *EXDEP			-33.21** (13.73)								
Securities market regulation *EXDEP				2.15* (1.22)							
Contract enforcement *EXDEP					1.55* (0.91)						
Access to credit *EXDEP						1.24 (0.80)					
Investor protection *EXDEP							0.73 (0.83)				
Bankruptcy procedures *EXDEP								1.73** (0.87)			
Barriers to banking competition									-3.39*** (1.22)		
Regulation on entry and activity *EXDEP										-4.73*** (1.77)	
Government ownership *EXDEP											-0.91** (0.41)
Number of observations	1 995	1 950	2 170	2 170	2 170	2 170	2 170	2 170	2 170	2 170	2 170
R <sup>2</sup>	0.63	0.65	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63

Notes: EXDEP variable in the interaction terms refers to industries' dependence on external finance. Financial development is measured as the sum of private credit, stock market and private bond market capitalisation to GDP. All regressions include country, industry, and year dummies and output gap to control for business cycles in each country. Cluster corrected standard errors are reported in parentheses; \*, \*\*, and \*\*\* indicate significance at the 10, 5 and 1% level, respectively.

productivity in the business sector of a magnitude varying roughly from 0.2 to 0.5 percentage points (depending on the averaging method), while the impact on entry rates would range between 0.4 and 0.7 percentage points (Table 6). Improvements in the stance of banking regulations equivalent to one standard deviation would be associated with increases in growth and entry rates of similar magnitudes, whereas the impact of securities market regulation is somewhat lower.

The findings reported in this section are broadly in line with the few empirical papers looking at the growth and finance nexus from a sector-level perspective. For instance, the results on industry growth confirm the findings of Rajan and Zingales (1998) and the more recent study by Guiso *et al.* (2004) that analyses growth in the EU countries.<sup>18</sup> The research at the industry level has mostly focused on value-added growth and the finding that productivity growth is also positively affected by financial development provides further evidence on the relationship between finance and growth. A couple of studies examine the effects of financial development on firm entry

Table 6. **Effect of a one standard-deviation change in the indicators of financial development and regulation**

<b>Panel A. Value-added growth</b>		
	Simple average effect	Weighted average effect
Financial development	0.27	0.48
Venture capital	0.18	0.31
Overhead costs in banking (decrease)	0.20	0.34
Securities market regulation	0.24	0.42
Barriers to banking competition (decrease)	0.29	0.52
<b>Panel B. Labour productivity growth</b>		
	Simple average effect	Weighted average effect
Financial development	0.25	0.45
Venture capital	0.10	0.18
Overhead costs in banking (decrease)	0.18	0.32
Securities market regulation	0.21	0.37
Barriers to banking competition (decrease)	0.28	0.49
<b>Panel C. Firm entry</b>		
	Simple average effect	Weighted average effect
Financial development	0.41	0.66
Overhead costs in banking (decrease)	0.30	0.48
Securities market regulation	0.24	0.38
Barriers to banking competition (decrease)	0.34	0.53

1. Calculated as a simple average of the effect on each industry.

2. Calculated as a weighted average of the estimated effect on each industry, with the weights being based on the average share across countries of respective industries in total business sector value-added.



(Klapper, Laeven and Rajan, 2004; Vartia, 2006) and their results are consistent with those reported in this study. Beck, Demirguc-Kunt, Laeven and Levine (2004) also find that small firms are particularly affected by financial development, in line with the above results on entry since entering firms generally tend to be small.

### *Robustness tests*

In order to test the robustness of the findings on value-added and productivity growth and firm entry reported above, a number of sensitivity tests were carried out. In particular, the sensitivity to important omitted variables from the baseline regressions is tested. In the analysis of industry growth three additional variables are introduced to the baseline regressions (Tables 3 and 4 specifications IV and IX). These are: *i*) the rate of change of the industry-specific regulation-impact indicator;<sup>19</sup> *ii*) industry investment growth, and *iii*) industry R&D intensity.

The results on the effects of financial regulation seem to be relatively robust to the inclusion of these variables (see Table 7). The estimated coefficients of investment growth, R&D intensity and change in the regulation impact indicator have the expected signs. However, only the regulation indicator and investment growth have statistically significant effects on value-added and productivity growth. Including the measure of regulation impact also reduces to some extent the statistical significance of the effect of banking competition regulation on labour productivity growth.

In the case of firm entry the robustness analysis was carried out using industry value-added growth and R&D intensity as control variables (not shown in the Table). Of these, only R&D intensity was statistically significant and in neither case were the basic results affected. On the other hand, the significance of the basic results turned out to be sensitive to the inclusion of the industry-specific regulation impact indicator, but in this case the sensitivity of results was due to the exclusion of Hungary and Mexico for which no data on the regulation impact were available. One reason for this sensitivity is that firm entry regressions are performed over a smaller set of countries than value-added and productivity growth regressions. In such a case, the exclusion of Hungary and Mexico reduces considerably the cross-country variations in the banking and securities market regulation indicators. In contrast, the results from value-added and productivity growth regressions are not sensitive to the exclusion of these countries.

Given the important role played by the ratio of external dependence in the analysis, the sensitivity of the results to this variable was also examined. In particular, a potential concern is that the results presented above could be essentially driven by the extreme values for the degree of external dependence observed in two industries, namely real estate and business activities and chemicals and chemical products, where the ratios are 3.3 and 6.2, respectively (see Table A.3 in

Table 7. Effects of financial regulation on growth: Sensitivity to the inclusion of additional variables

	Panel A. Effects of securities market regulation					
	Value-added growth			Labour productivity growth		
	I	II	III	IV	V	VI
Initial share	-0.03 (0.05)	-0.19** (0.09)	-0.20*** (0.08)	-0.07 (0.07)	-0.18** (0.08)	-0.16** (0.08)
Securities market regulation*EXDEP	1.23** (0.58)	1.88** (0.76)	1.98*** (0.69)	1.32** (0.54)	1.85*** (0.56)	1.64*** (0.55)
Relative change in industry regulation (1994-2003)	-15.48* (9.33)			-29.49*** (11.43)		
Investment growth		4.09*** (1.28)			1.74 (1.44)	
R&D intensity			1.82 (5.23)			6.15 (4.20)
Number of observations	369	382	437	357	372	398
R <sup>2</sup>	0.56	0.44	0.42	0.50	0.48	0.42
	Panel B. Effects of banking competition regulation					
	Value-added growth			Labour productivity growth		
	I	II	III	IV	V	VI
Initial share	-0.03 (0.06)	-0.20** (0.09)	-0.22*** (0.08)	-0.07 (0.07)	-0.19** (0.08)	-0.18** (0.08)
Barriers to banking competition*EXDEP	-1.74** (0.77)	-2.02** (0.91)	-2.95*** (0.90)	-1.56* (0.85)	-2.27*** (0.64)	-2.50*** (0.62)
Relative change in industry regulation (1994-2003)	-14.63 (9.32)			-28.42** (11.43)		
Investment growth		4.10*** (1.28)			1.70 (1.45)	
R&D intensity			1.38 (5.08)			5.70 (4.14)
Number of observations	369	382	437	357	372	398
R <sup>2</sup>	0.56	0.44	0.43	0.50	0.48	0.42

Notes: EXDEP variable in the interaction terms refers to industries' dependence on external finance. All regressions include country and industry dummies. Robust standard errors are reported in parentheses; \*, \*\*, and \*\*\* indicate significance at 10, 5 and 1% level, respectively.

Source: Authors' calculations.

the Annex). One factor potentially explaining the high degree of dependence on external funding in these industries is that they account for a large share of total business R&D spending, which in the national account convention, is treated as an operating expense than capital formation.

To examine this issue, the equations were re-estimated with ratio of external dependence for these two industries calculated on the basis of the whole sample of firms as opposed to a sample that excludes large firms (over a thousand employees).

Including large firms reduces the ratios for these industries to 1.8 (from 3.3) and 1.4 (from 6.2), respectively, which leaves these industries at the upper end of the range of dependence ratios, but with values that are more in line with those found for other industries. The impact of this change on the estimated coefficients of the main variables of interest is shown in Table 8. For reasons of parsimony, Table 8 reports only the estimated coefficient on the main variable of interest in each regression, *i.e.* the interaction term between external dependence and the proxies for financial development and regulation. As in the base case, each measure of financial development and regulation are entered individually in separate regressions, along with the same additional control variables as reported in Tables 3 to 5.

Perhaps not surprisingly, the reduced variance in external dependence across industries resulting from using significantly lower values for two sectors with extremely high values is compensated for by substantially higher parameter estimates. In the value-added and productivity growth specifications, the results are largely robust to the change in external dependence, the exception being venture capital in the case of

**Table 8. Sensitivity of results to lower values of external dependence for two industries**

	Value added growth		Productivity growth		Firm entry	
	Base case	Lower ratio	Base case	Lower ratio	Base case	Lower ratio
Financial development*EXDEP	0.38*** (0.13)	0.83*** (0.26)	0.36*** (0.10)	0.93*** (0.31)	0.58*** (0.21)	1.21** (0.52)
Venture capital*EXDEP	1.63*** (0.58)	3.05** (1.34)	0.93** (0.47)	0.99 (1.53)	-0.28 (0.81)	-2.16 (2.13)
Overhead costs in banking*EXDEP	-21.99** (9.75)	-45.67** (18.43)	-20.50** (9.82)	-56.73** (27.06)	-33.21** (13.73)	-84.95** (36.93)
Market regulation*EXDEP	2.20*** (0.65)	4.24*** (1.48)	1.96*** (0.56)	4.41*** (1.67)	2.15* (1.22)	4.19 (3.19)
Contract enforcement*EXDEP	1.52*** (0.55)	2.65** (1.04)	1.32*** (0.50)	3.21** (1.37)	1.55* (0.91)	2.86 (2.53)
Access to credit*EXDEP	0.99** (0.49)	1.93** (0.97)	0.81** (0.41)	1.93* (1.03)	1.24 (0.80)	2.62 (1.99)
Investor protection*EXDEP	0.99** (0.49)	1.97* (1.09)	1.16*** (0.43)	2.31* (1.28)	0.73 (0.83)	1.63 (2.01)
Bankruptcy procedures*EXDEP	1.33** (0.54)	2.95** (1.31)	1.13*** (0.36)	2.77** (1.12)	1.73** (0.87)	3.04 (2.13)
Barriers to banking competition *EXDEP	-3.03*** (0.86)	-5.90*** (2.02)	-2.90*** (0.58)	-6.55*** (2.01)	-3.39*** (1.22)	-7.27** (2.92)
Regulation on entry and activity*EXDEP	-3.10** (1.30)	-6.16** (2.61)	-3.43*** (1.15)	-7.61** (3.10)	-4.73*** (1.77)	-10.01** (4.30)
Government ownership*EXDEP	-1.08*** (0.33)	-2.01*** (0.73)	-0.96*** (0.22)	-2.02*** (0.68)	-0.91** (0.41)	-2.09** (0.97)

Note: In the analysis of value added and labour productivity growth, the new value for external dependence in *Chemicals and chemical products* (ISCI 24) and *Real estate renting and business activities including computer and R&D services* (ISIC 70-74) are 1.55 and 1.95, respectively. In the analysis of entry rates, the new value for external dependence in *Chemicals and chemical products* (ISCI 24) is 1.43 and in *Real estate renting and business activities including computer and R&D services* (ISIC 70-74) it is 1.82.

productivity growth. The results are somewhat less robust in the case of firm entry. This concerns in particular the two indicators of market regulation (contract enforcement and bankruptcy procedures) which are no longer significant.

## CONCLUSIONS

This paper has used industry-level data from over 20 OECD countries to examine whether industries that rely more heavily on external sources of funds grow more rapidly in countries where regulation allows for stronger competition in markets for banking services and financial instruments. In the case of banking, regulatory impediments to competition focus essentially on barriers to entry (both foreign and domestic), on lines-of-business restrictions and on the scope of government ownership. As for markets for debt and equity instruments, the regulatory indicators cover the following four areas: contract enforcement, access to credit, investor protection and bankruptcy procedures.

Using panel regression techniques, the results indicate that financial system regulation has a statistically significant influence on output and productivity growth as well as on firm entry, via the impact on industrial sectors relying more heavily on external sources of funding. The economic impact is also found to be substantial enough to matter, yet sufficiently small to remain credible.

Regulatory indicators show that member countries have at least in the past adopted different approaches to regulate banking and securities, with less significant differences found in the former case, where most countries were found to lie within a fairly narrow range around an intermediate position with respect to competition-restraining regulations. As regards the market for debt and equity, more variations were observed in the extent to which regulation is either more friendly to investors/lenders or significantly less so, as compared with the OECD average.

Despite moves to liberalise financial markets in the past, there is some indication that the degree of competition in banking has been kept weak in several member countries. The OECD countries that are characterised by strong competition in banking activities have not been subject to instability in recent decades. Weak competition in other countries cannot therefore be justified on the basis that this has fostered greater stability. One reason why stronger competition may not risk greater instability is that the authorities have developed tools to foster prudent behaviour without adverse impact on competition.

## Notes

1. For an on-going effort in assessing the performance of financial systems using a broad range of indicators, see Hartmann *et al.* (2006).
2. One motivation for combining the two approaches is that the issue of causality may still prevail even when using policy indicators given that policies are often adjusted in reaction to performance.
3. The two World Bank data sources exploited in this study are the *Bank Regulation and Supervision Database* ([www.worldbank.org/research/projects/bank\\_regulation.htm](http://www.worldbank.org/research/projects/bank_regulation.htm)) and the *Doing Business Database* ([www.doingbusiness.org](http://www.doingbusiness.org)).
4. Such a view is supported by recent empirical evidence suggesting that restrictions on bank competition has in the past brought significant real economic costs that are not offset by the alleged benefits such as wider access to credit by small and risky firms or lower frequency of bad loans (see Guiso, Sapienza and Zingales, 2003 in the case of Italy). Using data on the US banking markets, Cetorelli and Strahan (2006) find that stronger bank competition in local markets (lower state-level restrictions on bank entry) is generally associated with a higher share of smaller establishments as well as with a rise in the number of establishments, while larger firms which benefit from easier access to securities markets are less affected.
5. Compared with the *Bank Regulation and Supervision Database*, these two indicators are based on information that is much earlier, *i.e.* 1998-2000 in the case of restrictions on foreign entry and 1995 in the case of government ownership. As such, they are obviously not necessarily a good indication of current policies, but they are still relevant for empirical analysis over a sample period that covers most of the 1990s.
6. In this application, the random-weights selection has been applied at the first sub-level of indicators, *i.e.* at the level of the four sub-component in the case of barriers to competition and ten sub-components in the case of stability. See Freudenberg (2003) for a discussion of the application of the random weights technique to the construction of indicators.
7. Based on the 1999 Survey of banking regulation, the authors also looked at the impact of various regulatory variables on a measure of bank development in a set of OECD and non-OECD countries. Even though their regulatory indicators were defined and constructed somewhat differently, they also found restrictions on bank activities and foreign entry as well as government ownership to have a significant negative impact on the amount of bank credit to the private sector as a share of GDP, while restrictions on domestic entry did not.
8. Some of the indicators used from this publication are not strictly exogenous policy indicators but rather reflect the stance of policy to an important extent.
9. For more details see the working paper version of this article (de Serres *et al.*, 2006).

10. All the sub-indices are based on the version of *Doing Business* published in 2005 except the cost to create collateral which is based on the 2004 publication. Although these indicators are associated with securities markets they cover aspects of regulation for debt instruments in general, including bank loans.
11. It also allows controlling for the possibility that important sectoral shifts in the industrial structure may bias the results from macro data analysis.
12. See OECD (2003b). Even though studies have shown that existing firms contribute more importantly to productivity gains than new firms, high entry rates may contribute indirectly via competitive pressures on incumbent firms.
13. From an econometric perspective, the interaction allows for testing the influence of determinants – regulation or financial development – that only have a country dimension on a dependent variable that has both the country and sectoral dimensions.
14. The computed ratios differ from those used by Rajan and Zingales (1998) in three important ways: *i*) They are derived from Worldscope instead of Compustat; *ii*) the industry classification is different and covers several service industries; and *iii*) they are calculated over a more recent period (1994-2003). Given that this period corresponded to a significant rise in (non-financial) corporate savings, the ratios for the majority industries turned out negative (*i.e.* on firms have been hoarding enough cash on average over the period to cover more than capital expenditures). To avoid this problem, the ratios have been re-calculated after excluding large firms (over a thousand employees).
15. One way to partly circumvent this limitation would be to construct broad regulatory indicators using principal component analysis.
16. In a standard difference-in-differences specification, the interaction term is included in addition to the two components separately. In this specification the separate components have been excluded as they are already captured by country and industry fixed-effects.
17. Even though there is little reason *a priori* to expect a convergence phenomenon in industrial structure, relatively high growth rates may be observed more frequently in the case of smaller industries. To the extent that this is the case, such effect needs to be controlled for.
18. These studies focus on manufacturing whereas the current study includes also services sectors. In addition, this study uses the indicator of industries' dependence of external finance that is computed using data from 1990-2003 whereas the previous studies have used the data from the 1980s.
19. See Conway *et al.* (2006). This variable is calculated using indicators of regulatory conditions in major network industries and estimates of the importance of these industries as intermediate inputs in the production process. Note also that the external dependence measure used in the firm entry and growth regressions have been calculated over a somewhat different period (1990-2001 for entry and 1994-2003 for growth).

## Annex

## Data Coverage, Sources and Definitions

This Annex describes the different datasets and definitions used in the econometric analysis. (See Box 2 for data description.) In addition, it provides descriptive statistics on the main variables used in the analysis and on the measure of industries' dependence on external finance.

The empirical analysis examines the effects of financial systems' development and regulation on economic growth and firm demographics at the industry level. The endogenous variables at the industry level are the growth rates of real value-added and labour productivity, defined as real value-added divided by the number of employees in a given industry, as well as firm entry and turnover. Table A.1 reports the summary statistics of these variables.

Table A.1. Summary statistics of the dependent variables

	Number of observations	Mean	Median	Standard deviation	Minimum	Maximum
Real value-added growth	466	2.65	2.46	3.35	-13.83	13.35
Labour productivity growth	423	2.37	2.12	3.25	-15.80	13.51
Entry rate	2 170	12.75	11.20	8.09	0.00	60.16
Turnover rate <sup>1</sup>	2 011	23.43	21.55	12.29	0.00	106.16

1. The turnover rate may be larger than 100 if there are several firms that both enter and exit in the same year relative to the total number of firms in a certain industry.

The country coverage of the analysis varies depending on the availability of data (Table A.2). Industries are identified using International Standard of Industrial Classification (ISIC Rev. 3) at the two-digit level. The industries covered in the analysis of value-added and productivity growth rates are reported in Table A.3.<sup>1</sup>

The data on firm entry and turnover are obtained from two main data sources: *i*) The OECD firm-level database;<sup>2</sup> and *ii*) Eurostat Structural Business Statistics database.<sup>3</sup> In addition, data provided by the World Bank and Statistics New Zealand are used. The data from these different sources are merged to obtain a dataset with comparable data on firm entry and turnover for as many OECD countries as possible. The different data sources on firm dynamics include information on the total number of entering and exiting firms. In addition, for most countries data are also available according to the size of firms. The size classification differs in the OECD and Eurostat databases. In order to have a consistent size classification

## Box 2. Data source and construction: Summary

### 1) Value-added and labour productivity growth: Industry level

Period of analysis: 1994-2003.

Dimensions:

- 26 countries (value-added growth) and 24 countries (labour productivity growth);
- 22 industries.

**Endogenous variables:** Average real value-added and labour productivity growth rates.

Construction method: Industry growth rates are computed as geometric averages over the period.

Source: OECD STAN database.

#### **Measure of dependence on external finance**

Construction method: A firm's dependence on external finance is defined as its capital expenditure minus internal funds (cash flow from operations) divided by capital expenditure. To obtain the industry-wide measure, the firm-level ratios of external dependence are averaged first over time and then aggregated across firms in each industry.

Source: Thomson Financial Worldscope database.

**Control variables (industry level):** Initial share (year 1994) of each industry in business sector value added, average rate of change in the indicator of regulation impact, investment growth and R&D intensity.

Construction method: Control variables are computed as simple annual averages over the period.

Source: OECD STAN database and Conway *et al.*, 2006.

### 2) Firm demographics: Industry level

Period of analysis: 1990-2001.

Dimensions:

- 16 countries;
- 25 industries;
- varying time spans within the 1990-2001 sample depending on each country.

**Endogenous variables:** Firm entry and turnover rates.

Source: OECD firm-level database, Eurostat Structural Business Statistics database, World Bank and Statistics New Zealand.

Construction method: Entry rate is defined as the number of entering firms as a percentage of the total number of firms and firm turnover rate is defined as the sum of entering and exiting firms as a percentage of the total number of firms.

**Control variables:** Output gap, indicator of regulation impact, industry R&D intensity and value-added growth.

Source: OECD Analytical database, OECD STAN database, OECD ANBERD database and Conway *et al.*, 2006.



Table A.2. Country coverage

Variable	Value-added growth	Productivity growth	Firm demographics
Country:			
Australia	X	x	
Austria	X	x	
Belgium	X	x	x
Canada	X	x	
Czech Republic	X	x	
Denmark	X	x	x
Finland	X	x	x
France	X	x	x
Germany	X	x	x
Greece	X	x	
Hungary	X	x	x
Italy	X	x	x
Japan	X	x	
Korea	X	x	
Mexico	X		x
Netherlands	X	x	x
New Zealand	X	x	x
Norway	X	x	x
Poland	X	x	
Portugal	X	x	x
Slovak Republic	X	x	
Spain	X	x	x
Sweden	X	x	x
Switzerland	X		
UK	X	x	x
USA	X	x	x

in the merged dataset, firms are classified into two size groups that exist in all data sources: i) Firms with less than 20 employees; and ii) firms with 20 or more employees. The focus of the analysis is on small firms, *i.e.* on the former group, since the entrants in this size group are likely to represent the “true entrants” and not the outcome of mergers and acquisitions or some other organisational arrangements of firms.<sup>4</sup>

The OECD and Eurostat databases differ in the way they define entry and exit. The OECD database defines entry as those firms in year  $t$  that did not exist in the database in year  $t-1$  but exist in year  $t+1$ . Similarly, exit in year  $t$  is defined as those firms that existed in the database in  $t-1$  but disappeared in year  $t+1$ . This enables identification of firms that appear in the database for only one year. In the Eurostat database, “one year” firms are not identified separately. To be consistent, these firms are included in both datasets.

The variable measuring industries’ dependence on external finance is computed from the firm-level information contained in the Thomson Financial Worldscope database. As in Rajan and Zingales (1998), the dependence of a given industry is computed using data on US listed firms. A firm’s dependence on external finance is defined as its capital expenditure minus internal funds (cash flow from operations) divided by capital expenditure. Given that large firms tend to have more internal funds available to finance investment, external dependence was calculated excluding such firms (> 1 000 employees) so as to have more industries with positive dependence ratios. However, the relative ranking of industries according to

Table A.3. **Industries' dependence on external finance**

Industry	Dependence on external finance
Wood and products of wood and cork (ISIC 20)	-0.45
Fabricated metal products except machinery and equipment (ISIC 28)	-0.25
Construction (ISIC 45)	-0.19
Other non-metallic mineral products (ISIC 26)	0.00
Pulp paper, paper products, printing and publishing (ISIC 21-22)	0.09
Electricity gas and water supply (ISIC 40-41)	0.12
Manufacturing n.e.c.; recycling (ISIC 36-37)	0.17
Machinery and equipment n.e.c. (ISIC 29)	0.19
Textiles, textile products, leather and footwear (ISIC 17-19)	0.19
Other transport equipment (ISIC 35)	0.19
Motor vehicles, trailers and semi-trailers (ISIC 34)	0.20
Transport and storage (ISIC 60-63)	0.43
Basic metals (ISIC 27)	0.44
Food products, beverages and tobacco (ISIC 15-16)	0.53
Rubber and plastics products (ISIC 25)	0.56
Hotels and restaurants (ISIC 55)	0.64
Wholesale and retail trade; repairs (ISIC 50-52)	0.75
Coke refined petroleum products and nuclear fuel (ISIC 23)	0.78
Electrical and optical equipment (ISIC 30-33)	1.62
Post and telecommunications (ISIC 64)	1.67
Real estate renting and business activities including computer and R&D services (ISIC 70-74)	3.35
Chemicals and chemical products (ISIC 24)	6.20

*Source:* Authors' calculations based on Thomson Financial Worldscope database.

their dependence on external finance only changes marginally and the overall empirical results are robust to the use of the whole sample of US listed firms.

In order to obtain the industry-level measure of dependence on external finance, the external dependence of firms is averaged first over time and then aggregated across firms in each industry. Following Rajan and Zingales (1998), the time-averaging is done by summing individual firm's external finance (difference between its capital expenditure and cash flow) over the period of interest and then by dividing the result by the sum of each firm's capital expenditure over the same period. The industry-level measure of external dependence is then defined as the median of this ratio across firms in each industry. Table A.3 displays the external dependence by industry, and shows that industries related to ICT services and manufacturing as well pharmaceuticals are most heavily dependent on external finance.

## Notes

1. The industry coverage differs slightly in the analysis of firm demographics where the industry *Electrical and optical equipment* (ISIC 30-33) is analysed at a more disaggregated level. Given the focus on financial development as one of the key determinants, the *Financial intermediation* sector (ISIC 65-67) has been left out from the analysis.
2. Details on the OECD firm-level database are available on line at [www.oecd.org/document/4/0,2340,en\\_2649\\_37451\\_1962948\\_1\\_1\\_1\\_37451,00.html](http://www.oecd.org/document/4/0,2340,en_2649_37451_1962948_1_1_1_37451,00.html). See Scarpetta *et al.* (2002) and Bartelsman, Scarpetta and Schivardi (2003) for a detailed description and discussion of the database.
3. See Brandt (2004) for discussion on the Eurostat data and comparison between OECD and Eurostat databases.
4. Firms with zero employees are excluded since the OECD database does not include information on these firms for all countries.

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*The common indicator to assess fiscal power of sub-central governments is the share of sub-central to total tax revenue. But this indicator says nothing about the true discretion sub-central jurisdictions have over tax rates and the tax base, and it skips revenue from intergovernmental grants entirely. The main purpose of this paper is to develop and analyse a set of more refined indicators that assess the true autonomy sub-central governments have over fiscal resources. In sum, fiscal autonomy is considerably lower than the simple ratio suggests. About 60% only of own tax revenue is under full or partial control of sub-central governments, and again 60% only of transfer revenue is unconditional. Moreover, contrary to the allegations of fiscal federalism theory, much sub-central tax revenue comes from mobile income taxes and is prone to tax erosion. The new database can help assess how fiscal autonomy affects policy outcomes such as public sector efficiency, equity in access to public services or the long-term fiscal stance.*