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ABSTRACT

Finance, Investment and Growth*

This paper evaluates relations between industrial activity and the structure of countries' financial ownership and legal systems. Using data on 27 industries in 14 OECD countries over the period 1970 to 1995, we evaluate whether the structure of countries' systems is associated with different types of economic activity. We do this by examining whether there is a link between industry activity and the interaction of country structures with industry characteristics. We find that there is a relation in terms of both industry growth rates and shares of output devoted to R&D. Investment in R&D rather than fixed capital formation appears to be the main route through which financial systems affect economic activity. Consistent with theories of financial development, relations between financial systems and economic activity are sensitive to countries' stages of economic development. For example, bank oriented systems are associated with higher growth of externally financed industries in low but not high income countries.

JEL Classification: E2, G3, O4
Keywords: financial systems, ownership, legal form, growth, investment

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NON-TECHNICAL SUMMARY

There has been much discussion over a long period of time about the relationship between financial systems and economic performance. The relative performance of bank and stock market oriented financial systems has been discussed for the best part of a century and the problems associated with corporations being widely held by a large number of dispersed shareholders has been debated since the 1930's. More recently, attention has turned to the role of different legal and regulatory structures in promoting economic growth.

Despite the length and intensity of the debates, we still know very little about the way in which financial, corporate and legal structures bear on economic performance. There have been several studies that have looked at and found strong relations between financial and economic development. But they are open to a number of criticisms. First, since they are concerned with growth at the national level, they suffer from small numbers of observations. Second, they can only provide limited control for the range of other factors, such as savings rates and non-financial endowments, which may influence economic performance. Third, they have been restricted to assessments of whether there is a link between financial and economic development. They do not therefore address the range of other questions that lie at the heart of debates about financial systems.

A central issue is whether stock markets or banks are more appropriate for promoting economic development and, more subtly, whether different types of financial systems promote different types of activity. For example, it has been suggested that stock markets might be better at supporting new, risky activities (in, for example, high technology industries) where individuals legitimately hold diverse views about future prospects and stock markets perform a valuable function in aggregating these views. On the other hand, the monitoring of more routine activities, for example, investment in plant and machinery may be better delegated to a financial institution which can reduce costs of monitoring. Similarly, hard budget constraints may be more effective in corporate sectors with dispersed rather than concentrated ownership. This is particularly important for investment in high risk, innovative activities such as R&D. More traditional investments in fixed capital formation may benefit from monitoring by a small number of investors.

While existing studies have focused on aggregate effects of financial development on economic performance, this paper examines the relationship of the structure of countries' financial systems, corporate sectors and legal systems to *types* of activity in different countries. We exploit the emergence of a new class of statistics that provides measures of the structure of financial,

corporate and legal systems in a large number of countries. These have opened up the possibility of, for the first time, undertaking serious analysis of the relation between finance, corporate and legal governance and economic performance.

We map these large data banks on country structures to the characteristics of a wide variety of manufacturing industries in an attempt to establish whether there is an inter-relation between the two. Specifically, we are interested in whether country structures (financial, corporate and legal forms) and characteristics of industries (dependence on external finance and investments in skills and training) are related to levels of activity (growth rates and levels of investment) of these industries in different countries. For example, do bank oriented financial systems promote the growth of bank dependent industries? Do ownership concentrations encourage investment in skill intensive industries? Are stock market oriented countries associated with investments in R&D?

We perform this analysis by collecting data on growth, fixed capital formation and expenditures on R&D in 27 manufacturing industries in 14 OECD countries over 25 years from 1970 to 1995. We collect data on country structures and industry characteristics. There are three types of country structure variables. The first is measures of the size of stock markets, banking systems and ownership concentration. The second is information disclosure (accounting standards), bank relations (as measured by bank ownership of corporate equity) and the nature of concentrated ownership (specifically pyramid structures). The third is indicators of legal form – creditor rights, anti-director rights and the origins of legal systems (civil versus common law systems).

The industry characteristics are the extent to which industries are dependent on bank finance, equity finance and investment in skills. This requires an assessment of the countries in which institutional arrangements are most conducive to their provision. We measure the reliance of different industries on bank finance in Japan, market finance in the US, and skills in Germany.

All the variables are demeaned relative to industry and/or country means. The equations therefore estimate the relation of three measures of activity (growth, share of fixed capital formation in value added, and share of R&D in value added) to the interaction of the country and industry variables controlling for both country and industry specific effects. We find that there is a strong relation of the country-industry inter-relations to two of three measures of activity (growth and R&D) but only a weak relation to the third (fixed capital formation). In addition, the relations of growth and R&D to the country-industry inter-actions are very similar. This suggests that (a) the financial and corporate structures of countries bear more directly on R&D activity than on

fixed capital formation and (b) their influence on growth comes via R&D rather than capital formation, at least in OECD countries.

There is evidence of a relationship between market features (in particular disclosure of information) and activities in market financed and skill dependent industries. In addition, there is a positive relation of concentration of ownership to growth or investment in industries with high external financing and skill requirements. However, there is no support for the view that activities in bank financed industries are positively related to the bank orientation of a country's financial system; indeed, if anything, the performance of these industries is more closely associated with information disclosure.

We perform several tests of robustness of these results. In addition, we are concerned with the endogeneity of the independent variables – the possibility that activities may cause, rather than be caused by, country structures and industry characteristics. It is, for example, frequently suggested that financial development is derivative in a Coasian sense – that financial institutions emerge to meet economic requirements rather than determine economic performance. For the most part, the results are quite robust to different specifications; however, there is one respect in which they are sensitive.

We collected data on four additional OECD countries with markedly lower GDP per capita than the other countries at the start of the period in 1970. We did this to examine (a) the Gerschenkron thesis that banks play a particularly important role in the early stages of development of a country and (b) the view that the agency problems associated with high concentration of ownership are particularly acute in less developed economic systems.

We find support for both these views. Whereas there is no clear association of banking structures with economic activity in high GDP countries, there is in the low GDP countries. In particular, there is a positive relation in the less developed countries between activity in bank financed industries and the bank orientation of the countries. In addition, contrary to the results for developed countries, there is a *negative* relation between concentration of ownership and activity in high skill and externally financed industries.

The conclusion of the article is that financial, corporate and legal structures do bear an important relation to industrial characteristics, that their effects on activity come primarily through R&D rather than fixed capital formation and that the relations are sensitive to different stages of economic development.

If these observations are correct, they imply that countries' policies towards the structure of financial and corporate systems should be sensitive to their industrial composition and stages of economic development. While liberalisation, through, for example, greater information disclosure

requirements may be appropriate in developed countries, policies in less developed countries may be better directed towards the development of banking systems and the control of abuses associated with concentrations of ownership.

1 Introduction

There is a large literature on differences in the organization of financial markets and corporate sectors across countries. These differences relate to the structure of financial systems and the role of banks, the ownership and control of corporations, and financial regulation and corporate law. There are close relations between banks and industries in some but not all countries (for example, Cameron (1961 and 1967)), high levels of concentration of ownership in Europe and the Far East but not in the UK and the US (for example, Franks and Mayer (1994) and La Porta et al (1999)), and both common and civil law systems (La Porta et al (1998)).

A number of studies have attempted to establish the significance of these differences for economic performance. One set uses detailed data to evaluate how cross-sectional variations within countries or across a small number of countries affect company performance. The picture that emerges is unclear. While some analyses of Japan, for example, find advantages in close bank-firm relations (see, for example, Hoshi, Kashyap and Scharfstein (1990, 1991)), others (for example, Kang and Stulz (1997) and Weinstein and Yafeh (1998)) do not. Similarly in Germany, Edwards and Fischer (1994) and Edwards and Ogilvie (1996) note that German banks have provided less finance for industry than British banks, and Franks and Mayer (1999) fail to find a relation between concentration of ownership of German firms and active disciplining of bad management.

A second approach has been to use data from a large number of countries to establish the relevance of financial and legal systems for economic growth. The work has its origins in Goldsmith (1969) who correlated the relation between the size of financial systems, as measured by the ratio of the value of intermediary assets to GNP, and economic growth in 35 countries over the period 1860 to 1963. Subsequent work (see, for example, King and Levine (1993a, b and c), Levine and Zervos (1998), and Demirguc-Kunt and Maksimovic (1998a and b)) has controlled for other influences on growth, such as education and government expenditure, and included additional measures of financial development, such as the size of stock markets. These studies almost invariably report a significant relation between development of financial systems and subsequent economic growth.

Recently a theoretical literature has emerged that provides an explanation for these observations. It suggests that the structure of financial systems and ownership of companies may be related to *types* of economic activity rather than overall levels. For example, stock markets may be appropriate for high-risk, innovative investments where the imposition of tight budget constraints is important. Bank finance may be better suited to lower risk, more traditional investments where the provision of long-term finance is required. It may also be more relevant to early than late stages of

economic development, as suggested by Gerschenkron (1962).

This paper provides a first examination of the relation between the structure of financial systems, corporate ownership, legal forms and types of economic activity. Rajan and Zingales (1998) report an interrelation between industry growth rates and the product of a measure of dependence on external finance of different industries (measured in the US) and the development of different countries' financial systems (in particular, as measured by the number of accounting standards). Industries dependent on external finance (in the US) grow faster in countries that have highly developed financial systems as measured by accounting standards. This is a route through which financial development can affect economic growth: financial development relaxes constraints on the expansion of industries dependent on external finance and raises aggregate economic growth.

We extend Rajan and Zingales' analysis in four directions. Firstly, we examine the relation between different types of financial systems (e.g. banks versus stock markets) and examine whether they are associated with different types of economic activity. Secondly, we evaluate the route through which financial systems affect growth. The theories referred to above suggest that stock markets may be associated with high-risk (for example, R&D as against fixed capital formation) investments. Thirdly, we examine the influence of the structure of corporate ownership and legal forms as well as financial systems on economic activity. Finally, we contrast countries in their early and later stages of development. We take as our base sample a set of 14 OECD countries for which we have data on growth, fixed investment and R&D expenditure from the early 1970s to the mid 1990s. We then introduce four countries that have lower per capita GDP in 1970 and test whether similar relationships apply to low as to high income countries.

Section 2 surveys the theoretical literature on the relation between financial systems, ownership structures and economic activity, and derives a set of testable hypotheses. Section 3 describes the methodology and data employed. Section 4 reports the results of the regression analyses for the determinants of growth, capital expenditure and R&D. Section 5 summarizes the implications of the results for the hypotheses described in section 2 and section 6 concludes the article.

2 Theory and hypotheses

Three strands of the theoretical literature suggest that different types of financial systems and corporate ownership may be associated with different types of economic activity: incomplete information, control through hard budget constraints, and commitment.

Incomplete information

Economic theory attributes a particular function to banks in monitoring corporate activities: economies of scale in monitoring make banks more efficient monitors than individual market participants. They are efficient where good investment decisions require the costly accumulation of available information on, for example, the quality and performance of borrowers. On the other hand, as Allen (1993) has noted, securities markets have the advantage of aggregating diverse views of a large number of market participants. Securities markets are therefore superior at promoting investment where there are legitimate grounds for differences in views. They would therefore be expected to be associated with speculative investments in, for example, high-tech industries, pharmaceuticals and oil exploration, and banks with more traditional plant and machinery investment in manufacturing. In contrast, Bhattacharya and Chiesa (1995) argue that firms engaged in R&D are damaged by disclosure of proprietary information to competitors. They argue that firms may prefer bilateral relations with single banks that respect confidentiality to multilateral lending which involves the disclosure of information to competitors.

Control

In Dewatripont and Maskin (1995) decentralized financial systems with many small banks impose tighter budget constraints than centralized systems with a small number of banks. The reason is that banks in decentralized systems do not have adequate resources to refinance failing companies; instead, new banks have to be drawn in which dilute the returns that initial lenders receive and discourage them from lending in the first place. Multibank systems are superior in imposing tough budget constraints on inefficient projects but are too short-termist in failing to sustain efficient long-term projects. The Dewatripont-Maskin model therefore suggests that financial systems with many small banks foster industries with short-term projects whereas industries with longer term investment projects fare better in systems with a few large banks.

Huang and Xu (1998b) describe a model in which the degree of uncertainty rather than the gestation period of projects differ. Again multi-bank systems impose tighter budget constraints than single bank systems, in this case because the information sharing that is required to make correct refinancing decisions does not occur because of conflicts of interest between banks. Where there is considerable uncertainty about returns from projects (i.e. there is a high proportion of bad projects) then the commitment to terminate projects is valuable and multi-bank systems invest more than do those with single lenders. Where uncertainty is low then single banks have more information with which to make investment decisions *ex ante* and they

invest more.

Huang and Xu (1998a) demonstrate that similar considerations apply to concentration of ownership as well as to the structure of financial systems. Systems with a large number of dispersed owners impose tighter budget constraints than concentrated owners. Multiple investors are required to finance high-risk projects where there is considerable uncertainty about quality and a significant fraction of projects may need to be terminated. Where risks are small then single investors offer lower cost sources of finance. Multi-bank and dispersed ownership systems are therefore associated with R&D intensive industries, particularly when companies are young and uncertainty is high, and single bank systems with concentrated ownership with lower uncertainty, imitative investments. Huang and Xu's models also predict that financial and ownership systems will be associated with different stages of economic development. Single bank, single investor financing will be observed during catch-up stages of development when investment primarily takes the form of imitation but multi-bank, dispersed ownership finance will dominate in economies at advanced stages of development that are undertaking higher risk R&D.

Commitment

In the above models, financial and ownership systems are associated with different commitments to terminate poor projects. They may also affect commitments to other parties. Unlike dispersed shareholders, large block-holders cannot anonymously withdraw from past commitments (see Franks and Mayer (1994)). Activities that require a high level of irreversible investment by other stakeholders, in, for example, human skill formation and knowledge about customer markets, benefit from having large committed rather than dispersed anonymous shareholders. But past commitments inhibit future flexibility. Anonymous, dispersed shareholders can avoid the special pleading and side payments to which large shareholders are prone. Bebchuk (1999), for example, describes how the control benefits of concentrated ownership and violations of one share-one vote systems can lead to the selection of inefficient activities that preserve private at the expense of social benefits. Concentrated ownership will therefore be associated with activities that require investments by other stakeholders in, for example, dedicated plant and skills training. Dispersed ownership will be associated with activities where change (for example, the adoption of new technologies) has to be imposed on other stakeholders to raise public at the expense of private benefits.

In all of the above models, financial and ownership systems are associated with different *types* of corporate activities and investments. In Allen (1993), new technologies, where there are legitimate grounds for diverse expectations, benefit from

securities markets; more traditional investments, which are prone to asymmetries of information between borrower and lender benefit from the economies of monitoring that banks can provide. In Bhattacharya and Chiesa (1995), R&D is financed through bilateral bank-firm relations that can protect commercial confidentiality. In Dewatripont and Maskin (1995), fragmented banking systems are associated with short-term investments and single bank systems with long-term investments. In Huang and Xu (1998a and b), multi-bank and dispersed ownership systems promote high-risk R&D investments and single bank, concentrated ownership systems lower risk, imitative investments. In Franks and Mayer (1994), concentrated ownership is associated with activities that involve investments by other stakeholders and dispersed ownership with the adoption of new technologies that would be resisted by other stakeholders.

On the basis of the above, we test the following hypotheses in the following sections:

H1. Different financial and ownership structures are associated with different types of activity. In particular, bank oriented financial systems are associated with activities that require active screening and monitoring, securities markets with high-risk activities.

H2. Bank finance and concentrated ownership are associated with fixed capital formation, and securities markets and dispersed ownership with R&D investment. Dispersed ownership is associated with activities where change has to be imposed on stakeholders.

H3. Concentrated ownership is associated with activities that involve investments by other stakeholders, in particular in skills formation.

H4. Bank finance and concentrated ownership are associated with countries in their early stages of development, and securities markets and dispersed ownership with countries in their later stages of development.

H1 draws on information theories, H2 and H4 on control theories and H3 on commitment theories.

3 Methodology and data

3.1 Methodology

We are interested in establishing the way in which the structure of countries' financial and ownership systems interact with the characteristics of industries in affecting their activity in different countries.

We define:

Y = k×i matrix of activity in i industries in k countries

X = s×k matrix of s country structural features in k countries

Z = c×i matrix of c industry characteristics in i industries.

We estimate **B**, the s×c matrix that relates country structural characteristics and industry characteristics to industry activity in particular countries in the equation

$$\mathbf{Y} = \mathbf{X}'\mathbf{B}\mathbf{Z} + \varepsilon \qquad \textbf{(1)}$$

where ε is the error term in the regression.

Specifically, we use three different variables for the *activity measure*, **Y**. These are the growth rate of output, the average fixed capital formation share (GDFCF/ value added) and the average R&D share (R&D expenditure/ value added). In our core sample, there are 14 OECD countries (k = 14) and 27 3-digit SIC industries (i = 27).

The *industry characteristics*, **Z**, are measured in relation to the dependence of industries on external financing and skilled labour. In their analysis of finance and growth, Rajan and Zingales (1998) link financial markets with external finance dependence of different industries. We want to extend this in two directions. Firstly, we allow for the possibility that different industries may be dependent on different types of finance. The theories of section 2 suggest that bank finance will be more prevalent in industries requiring active screening and monitoring and securities market finance in high-risk industries. We therefore split external finance into bank and securities market dependence to distinguish between industries that are prone to information asymmetries and to risk. Secondly, we want to allow for the possibility that different financial systems may be suited to investment by other stakeholders, most notably in labour force training. We therefore include a third industry characteristic, namely skills dependence.

To test empirically for the presence of an impact on industry growth of the interaction between industry characteristics and the financial, corporate and legal structures of countries, we need to identify the underlying industry characteristics (which are assumed to be constant across countries) separately from the countries in which industries are located. Establishing the significance of these inputs to the activities of different industries is complicated by the constraints under which firms in these industries may be operating. There may be legal, regulatory, institutional and cultural considerations that limit their availability or raise their price.

The approach we have taken develops that in Rajan and Zingales (1998) who argue that, since the US has one of the most highly developed and liberal financial markets in the world, US firms are likely to face the least constraints in raising equity finance. New equity funding levels of US industries will therefore most closely approximate the underlying requirements of firms operating in those industries. We constructed our three industry variables by using the countries in which conventional wisdom suggests that access to these 'inputs' is likely to be least constrained and in which industry reliance on equity, bank loans or skills therefore most closely reflects the underlying industry characteristics. Stylized descriptions treat the US as the archetypal market based financial system, Japan as a bank-based system and Germany as a country in which investments in skills and training is promoted. We therefore measured cross-industry variations in external market based sources of finance in the US, bank finance in Japan and investment in skills in Germany.

The *country structural features,* **X**, are measured in three ways. Firstly, we use data on the size of securities markets (ratios of market capitalization to GDP), size of banking systems (bank credit to GDP ratios) and concentration of ownership. Second, we look at features of financial systems and corporate sectors that have been identified in the literature as possible influences on firm behaviour, namely information disclosure as measured by accounting standards, bank-firm relations as measured by bank ownership of corporate equity and the wedge between cash-flow and voting rights in corporate structures as measured by pyramid ownership. Finally, we look at various legal factors, namely anti-director rights, creditor rights and the origins of legal systems.

In order to focus on the relationship between growth and the interaction of industry and country structure characteristics, we control for industry and country fixed effects by demeaning the dependent and independent variables. For example, in the growth rate equation, the dependent variable is growth in industry i in country k controlling for the average growth of industry i in the sample as a whole and the average growth of all industries in country k. Similarly, we demean the components of the interaction terms – in the case of industry characteristics relative to their all-industry average and in the case of country characteristics relative the OECD average.

We therefore define y_{ik} as the dependent variable in industry i in country k, y_{i-} as its average across countries, y_{-k} as its average across industries and y_{--} as its average across countries and industries. In turn, we define x_k as the country variable in country k, z_i as the industry variable in industry i, x_- as the averages of the country variables across all countries, z_- as the averages of the industry variables across all industries and a and b as parameters.

Specifically, if

$$y_{ik} = a_i + a_k + b_i z_i + b_k x_k + b_{sc} x_k z_i + \varepsilon_{ik} \quad (2)$$

we can use the definitions of y_{i-}, y_{-k}, y_{--}, z_{-}, and x_{-} to rewrite this expression in terms of the demeaned dependent and independent variables as:

$$y_{ik} - y_{-k} - y_{i-} + y_{--} = b_{sc}(x_k - x_{-})(z_i - z_{-}) + \varepsilon_{ik.} \quad (3)$$

In separate equations for each dependent variable, we regress the relative growth, fixed capital formation and R&D shares of industries in particular countries on the set of interaction terms of country structures relative to their worldwide average with industry characteristics relative to their averages across all industries.

The advantage of the demeaning approach is that it allows attention to be focused on the relationship between growth (or investment) and the interaction of country structure and industry characteristics. While problems of omitted variables can never be eliminated entirely, by demeaning data relative to country and industry averages we are able to provide a control for other factors that may affect growth and investment.

However, it is important to appreciate what this study does and does not do. It provides an evaluation of whether the interaction of country structures and industry characteristics are associated with performance in particular industries and in particular countries relative to average performance in those countries and industries. It does not address the larger question of whether there are financial or ownership factors that are associated with the overall performance of countries. To take one example, this methodology can establish whether high levels of bank ownership of corporate equity are related to the growth of industries in which there are high levels of bank finance. It does not determine whether high levels of bank ownership are related to high levels of growth in all industries in such countries. The reason why we do not even to attempt to perform the second test is that the problems of providing adequate controls for all the other factors that may influence growth of a country are formidable. In addition, insufficient countries are available to provide reliable estimates of these effects.

There are a number of issues that this estimation raises. We have already mentioned the problem of omitted variables. We attempt to overcome this by examining the relationship with performance of a range of variables in addition to those referred to above. However, there are obvious limitations to such an exercise.

Secondly, it is questionable whether the country structure and industry characteristic variables can be really treated as exogenous. The structure of countries and the characteristics of industries may be a product of rather than a cause of the performance of different industries and countries. For example, whether a country has high levels of concentration of ownership may reflect rather than cause the growth rates of its industries.

There are two senses in which this may be troublesome. Firstly, in interpreting the results there is a strong temptation to impute causation to, in particular, the country structures, by, for example, stating that growth in industry i in country k was above average because of a high level of bank ownership or information disclosure. However, it is highly debatable whether a structural feature caused or was caused by activity in an industry in a country. The hypothesis that we are testing is the more basic one that there is an interrelation between country structures, industry characteristics and activity in industries in particular countries.

This interpretation does not avoid the econometric problems that endogeneity creates. We use a number of techniques to address this. Firstly, it has been argued by La Porta et. al. (1997) that legal factors (such as creditor and shareholder rights and the origins of legal systems) are more fundamental than some of the country structural variables described above. We exploit this assertion in two ways: firstly by replacing some of the country characteristics with legal factors and, second, by instrumenting our country structure variables with legal factors. In particular, the claim of exogeneity seems to be most convincing in the case of the origin of legal systems, which is used as an instrument for the country structural variables.

Second, as discussed above, data from three countries (Germany, Japan and the US) are used to identify the three variables that proxy industry characteristics. Problems of endogeneity are likely to be most acute in relation to these three countries in so far as feedback from performance to structure is most likely to come from performance in those countries. We therefore report below the results of omitting these three countries from the analysis.

We can describe the four hypotheses (H1 to H4) of section 2 in relation to matrix **B**. H1 is based on information theories and states that "different financial and ownership structures are associated with different types of activity; in particular, bank oriented financial systems are associated with activities that require active screening and monitoring, securities markets with high-risk activities". This implies that at least some of the coefficients of matrix **B** in the growth equation are non-zero and in particular the top two diagonal coefficients shown in Figure 1 are positive.

H3 is derived from commitment theories and states that "concentrated ownership is associated with activities that involve investments by other stakeholders, in particular in skills formation". This implies that the bottom diagonal coefficient in the growth equation is positive and possibly the other two coefficients in the final column of matrix **B** are positive if concentrated ownership encourages greater participation by outside investors. In contrast where control is required "to impose change on other stakeholders" according to H2 then the coefficients in the final column of matrix **B** are expected to be negative.

H2 also states that "bank finance and concentrated ownership are associated with fixed capital formation, and securities markets and dispersed ownership with R&D investment". This implies that coefficients b_{22} and b_{13}, b_{23} and b_{33} will be positive in the fixed capital formation equation and b_{11} will be positive and b_{13}, b_{23} and b_{33} will be negative in the R&D equation, as shown in Figure 2.

Figure 1 – Signs of Coefficients in Matrix B for Growth Predicted by Hypotheses 1, 2 and 3

	Country (k)			
		1 (securities markets)	2 (banks)	3 (ownership concentration)
Industry (i)	1 (equity finance)	> 0 (H1)		> 0 (H3) < 0 (H2)
	2 (bank finance)		> 0 (H1)	> 0 (H3) < 0 (H2)
	3 (skills)			> 0 (H3) < 0 (H2)

Figure 2 – Signs of Coefficients in Matrix B for Fixed Capital Formation and R&D Predicted by Hypothesis 2

	Country (k)			
		1 (securities markets)	2 (banks)	3 (ownership concentration)
Industry (i)	1 (equity finance)	> 0 (R&D)		> 0 (GDFCF) < 0 (R&D)
	2 (bank finance)		>0 (GDFCF)	> 0 (GDFCF) < 0 (R&D)
	3 (skills)			> 0 (GDFCF) < 0 (R&D)

H4 reflects control theories applied to different levels of development: "bank finance and concentrated ownership are associated with countries in their early stages of development, and securities markets and dispersed ownership with countries in their later stages of development". This implies that b_{11} is positive in developed countries, b_{22} is positive in developing countries, column 3 is positive in developing countries and negative in developed countries, as shown in Figure 3.

Figure 3 – Signs of Coefficients in Matrix B for Growth Predicted by Hypothesis 4

	Country (k)			
		1 (securities markets)	2 (banks)	3 (ownership concentration)
Industry (i)	1 (equity finance)	> 0 (DC)		> 0 (LDC) < 0(DC)
	2 (bank finance)		> 0 (LDC)	> 0 (LDC) < 0(DC)
	3 (skills)			> 0 (LDC) < 0(DC)

3.2 Data

Output and growth

Data were collected on growth in constant price value added in 27, predominantly 3-digit SIC, manufacturing industries in 18 countries over the period 1970 to 1995. The base sample of countries used for this paper is the 14 OECD countries for which growth, fixed investment and standardized R&D data are available on a consistent cross-country basis from the OECD's STAN data base (1997)[1]. A preliminary analysis of the fourth hypothesis is undertaken using the growth data that are available from the same OECD source for an additional four low GDP per capita countries (Portugal, Greece, South Korea and Mexico). Unless otherwise stated, all of the descriptive and econometric analysis relates to the base sample of 14 countries.

Table 1 records the annual average growth rates of manufacturing industry in the 14 countries over the period 1970 to 1995. Italy, Japan and Finland have the highest growth rates and Germany, Norway and the UK, the lowest. Since the focus of the paper is on interrelationships between country and industry characteristics, an initial question was the extent to which relative growth rates of countries are attributable to initial industrial allocations as against comparative industry growth rates. We attempt to answer this by decomposing deviations of country growth rates from world averages into three components. The first is a "share effect", the contribution of deviations of initial shares in different industries from world averages in 1980, assuming that industries grow at the world average over the period. The second is a "growth effect", the contribution of deviations of growth rates of an industry in a particular country from world average growth rates for that industry assuming initial shares are equal to world averages. The third is an "interactive effect", the interaction of deviations of initial shares and industry growth rates from world averages.

The table records that the country variation is nearly entirely attributable to the growth effect. This is confirmed by an analysis of variance: -9.9% of country growth variation is attributable to the share effect, 118.3% to the growth effect and -8.4% to the interactive effect. The last of these implies that there is regression to the mean – high share industries have below average growth rates. The small share effect means that countries did not do particularly well or badly by virtue of their initial allocations

[1] See the data appendix. An alternative source of data is the Industrial Statistics Yearbook of the United Nations Statistical Division. The country coverage of the UN data is greater than that of the OECD. However, the control problems of the regressions are exacerbated by the inclusion of developing as well as developed countries and a comparison of the two sources suggested that there were fewer statistical problems with the OECD data. In particular, there is no constant price value added series in the UN data.

- country growth performance appears to have been largely independent of initial industrial allocations. These observations justify (i) concentration in the subsequent analysis on cross-country variations in industry growth rates rather than initial shares and (ii) inclusion of initial shares of industries in the growth regressions to account for regression to the mean.

Fixed capital formation and R&D

Data were collected on gross fixed capital formation for 27 manufacturing industries over the period 1970 to 1990 and on R&D expenditure for 15 manufacturing industries over the period 1973 to 1994.[2] Table 2 reports the average ratio of fixed capital formation to value added and R&D to value added for the fourteen countries. The rankings of the two are markedly different. While Spain has the lowest ratio of both, the UK and USA have some of the highest R&D but the lowest fixed capital formation ratios.

Table 3 presents disaggregated data for the industries with the highest growth, fixed capital formation and R&D to value added ratios for the sample as a whole and separately for Germany, Japan, UK and US. A comparison of the rankings of industries in terms of growth, fixed capital formation and R&D across the sample as a whole and within individual countries reveals some interesting features. Electrical machinery ranks as one of the top three growth and R&D industries in the OECD and in each of the four countries but it is not in the top three industries for fixed investment in either the OECD or any of the four countries. This reflects a general pattern, namely that there is more overlap between high growth and high R&D industries than between high growth and high investment industries. We will find confirmation for this in the regressions reported below.

There is considerable cross-country variation in relative industry performance. The fastest growing industry in Japan (electrical machinery) grew at nearly twice the rate of the fastest growing industry in the US (plastic products) which in turn grew considerably faster than the fastest growing industries in Germany and the UK. The fixed capital formation share of the highest capital expenditure industry in Japan (petrol and coal products) was more than twice that of the highest capital expenditure industry in any of Germany, the UK and US. On the other hand, the R&D share of the highest R&D industry in the US was much greater than that of the highest R&D industry in Germany and Japan. This suggests not only that rankings of growth, fixed capital formation and R&D rankings vary across countries but also that these are at least in part attributable to specific industries. This provides further support for the

[2] The time periods and industries were dictated by data availability from the OECD. In addition, petrol

disaggregated industry approach of this study.

Industry characteristics

As discussed above, we characterize industries by the extent to which they are reliant on external finance and skilled labour and we distinguish industries that are dependent on the monitoring and screening skills of banks from those that benefit from the risk assessments of securities markets. To establish 'unconstrained' demands of industries for these inputs, we measure dependence on equity finance in the US, bank loans in Japan and skills in Germany.

Using data from Rajan and Zingales (1998), equity financing was measured as the ratio of the net amount of equity issues to capital expenditures by US firms during the 1980s. Although we usually use the equity financing measure, we also refer to external financing - the fraction of US capital expenditure that was not financed with cash flow from operations. Industry data on bank finance in Japan was obtained from the Japanese Ministry of Finance. Bank financing ratios were constructed as the ratio of bank loans to gross external financing (total investment including investment in financial assets minus retentions) and as the ratio of bank loans to physical investment (net of depreciation) averaged over the period 1981 to 1990. Most of the results reported below refer to the latter definition. Oulton (1996) reports skill levels of the German workforce in 1987. The proportion of the workforce with high, upper intermediate, lower intermediate and no vocational qualifications is reported for 30 manufacturing sectors.[3]

Table 4 shows three of the industry variables: equity financing, bank financing and skill levels. Electrical machinery has a high level of equity financing in the US and is skill-intensive in Germany but has only a modest level of bank financing in Japan. Clothing has one of the highest levels of bank financing in Japan but raised no equity in the US and was not skill-intensive in Germany. Textiles showed a similar pattern. Skill levels are high in ship-building, an industry which raises little equity in the US and ran down outstanding stocks of bank debt in Japan during the 1980s. In professional goods, levels of equity finance, bank finance and skills are all above their means. The correlation between equity and bank finance is 0.073, between skills and bank financing is –0.455 and between skills and equity financing is 0.172.

Country structures

We focus on five country structural features: concentration of ownership, information

refineries were excluded throughout because of price index number problems.

[3] The four definitions are 'high' = Hochschulabschluss; Fachhochschulabschluss, 'upper intermediate' = Meister/Techniker gleichwertig Fachschulabschluss, 'lower intermediate' = Lehr-/Anlernausbildung

disclosure rules, relations between banks and industry, the size of stock markets and the size of banking systems. In two papers, La Porta et al report data on ownership concentration in a large number of countries. La Porta et al (1997) report data on the median ownership of the three largest shareholders in the 10 largest non-financial privately owned domestic firms. La Porta et al (1998, table 3b) report the mean percentage of the 20 largest firms which were widely held in the sense of having no shareholder with control of more than 10% of votes. La Porta et al (1998, table 4) report a third measure of ownership structure: the mean percentage of the 20 largest firms which were not widely held and had control exercised through a pyramid of at least one publicly traded company. Most of the results relate to the second measure of ownership concentration.

Financial disclosure is commonly associated with accounting standards. The Center for International Financial Analysis and Research creates an index of accounting disclosure on a scale from 0 to 90 based on the annual reports of at least three firms in each country. The first comprehensive survey was undertaken in 1990 and the results, which are reported in Rajan and Zingales (1998) and La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997), have been used in this study.

There is no single source of information on bank ownership of corporate equity. Data on the market value of equity held by banks as a proportion of the market value of equity held by the domestic private sector averaged over the period 1980 to 1990 were collected from individual central banks; where this was not available then OECD Financial Statistics were used to construct this variable.

The size of stock markets was measured by the average ratio of market capitalization to GDP over the period 1982 to 1991 as reported by the IFC Emerging Stock Market Factbook. The size of banking systems was measured by the average ratio of bank credit to GDP over the period 1980 to 1990 as reported by IMF International Financial Statistics.

Table 5 records that concentration of ownership is much lower in the UK and US than elsewhere. Australia, Canada and Japan have intermediate levels of concentration and Continental Europe has high levels of concentration. Finland, Germany and Japan have particularly high levels of bank ownership of corporate equity and also have large banking systems. France has a large banking system but little bank ownership of corporate equity. Sweden and the UK have very low bank ownership of corporate equity and small banking systems. There is little bank ownership in the US but an above average amount of bank lending. Italy and Spain have small stock markets and low accounting disclosure. The UK has high accounting

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gleichwertig Berufs-Fachschulabschluss; berufliches Praktikum, and ‘no qualifications’.

disclosures and a large stock market but Sweden has high accounting standards with only a modest sized stock market.

As predicted by the two models of Huang and Xu (1998a and b), size of stock markets is negatively correlated with ownership concentration (-0.755) but there is no evidence of a positive correlation between the size of banking systems and ownership concentration (-0.042). Bank ownership of corporate equity is associated with more bank credit (0.685) and, consistent with Bhattacharya and Chiesa (1995) which suggests that banks can protect firms' proprietary information, there are negative correlations between accounting information and the size of banking systems (-0.464) and bank equity (-0.367). On the other hand, there is a positive correlation between accounting standards and the size of stock markets (0.290).

La Porta et al (1997) (table 2) also report a number of legal characteristics of countries which have been used in this study, in particular creditor rights, anti-director rights and the origin of legal systems. The last variable has been used as an instrument for the other country characteristics in the regressions reported below.

4 Regression results

4.1 Growth

Table 6 reports the results of a regression of value added growth across 27 mainly 3-digit SIC industries in the base sample of 14 OECD countries over the period 1970 to 1995. The independent variables are the initial shares of industries at the start of the period, nine interactive terms constructed from the three industry characteristics variables (bank finance, equity finance and skills), and three country structural variables (accounting standards, bank credit to GDP ratios and concentration of ownership). All variables have been demeaned as described above. A dummy variable (which has not been reported) was also included to account for observations where bank finance in Japan was not available. The standard errors are all Huber-corrected.

Six variables are significant at better than the 10% level in the growth regression. Initial shares are strongly negative implying regression to the mean in the sense that industries with high initial shares of total output in particular countries have below average growth (relative to the country in question and the world average for that industry). The size of the effect is large. A 1% higher initial share of an industry in a country is associated with a 0.267% lower annual average growth rate of that industry.

Two of the three variables which interact with accounting standards are significant. Greater disclosure is associated with faster growth in skill intensive and equity financed industries but with lower growth in industries that make little use of

skilled labour and little equity financing. Again the economic significance of these variables is quite appreciable. The interactive term between accounting standards and skills (acc*allskill) has a range of 0.035 from Spain (the country with the lowest accounting standards) to Sweden (the country with the highest accounting standards) in non-electrical machinery (the industry with the second highest skill level in Germany). Shifting from the country with the lowest to the highest accounting standards is therefore associated with an increase in annual growth in non-electrical machinery of $0.439 \times 0.035 = 1.5$ percent. Conversely skill levels in Germany are at their lowest in leather products and footwear. The range of the interactive variable in these industries is 0.038. An increase in accounting standards from Spain to Sweden is therefore associated with a *decline* in the growth rate in these industries of $0.439 \times 0.037 = 1.7$ percent. The range of the interactive variable is much lower in industries close to mean skill levels in Germany, e.g. iron and steel where this variable therefore has little relation to growth rates. This variable illustrates the nature of the interactive relation between country structures and industry characteristics on growth rates in different industries; a similar effect applies to all the variables.

There is a positive relation between growth and the interaction of ownership concentration with both equity finance and skill levels. There is also a positive relation between growth and the interaction of the size of banking systems with equity financing of industries. Separate regressions on the three sub-periods, 1970 to 1980, 1980 to 1990 and 1990 to 1995, reveal that the interactive effects of accounting and ownership concentration with skills are strongest in the early periods and with equity finance in the later periods.

4.2 R&D and fixed capital formation

Table 6 also reports results of regressions with the same set of independent variables but with R&D and fixed capital formation (both as ratios of value added) as dependent variables. Table 6 reveals similar results for R&D to those reported above for growth. In particular, there is a positive relation between accounting standards and R&D in skill intensive and equity financed industries. These results are particularly strongly observed in the last sub-period between 1990 and 1994. Again the magnitude of the effects is large: shifting from the lowest to the highest accounting standards country is associated with a $0.470 \times 0.090 = 4.2$ percent increase in the ratio of R&D to value added in electrical machinery (the industry with a high equity dependence) through the equity finance interaction term. On the other hand, the same variation in accounting standards is associated with a $0.470 \times 0.043 = 2.0$ percent decline in the ratio of R&D to value added in food (an industry which raised no external equity finance in the US) through the same term. In addition to a negative relation between the size of banking

systems and R&D in bank financed industries, there is also a significant negative relation of accounting standards with R&D in bank financed industries.

While there are similarities between the 'determinants' of growth and R&D, the 'determinants' of fixed capital formation are quite different. Accounting standards and concentration of ownership are associated with large ratios of fixed capital formation to value added in *low* equity industries. Accounting standards do not therefore appear to be related to growth through fixed capital formation but rather through R&D. In addition, while the interactive terms explain a substantial fraction of R&D to value added and value added growth (R^2 of 17.4% and 16.0% respectively), they explain very little of the cross industry/country variations in fixed capital formation (R^2 of 1.8%).

We examined the relationship between growth, R&D and fixed investment further by regressing growth on the predicted values from the fixed capital formation and R&D equations. The predicted values from the fixed capital formation equation were completely insignificant whilst those from the R&D regression were highly significant (see table 7). Nearly 50% of the variation in growth accounted for by the nine interactive terms in the growth regression is accounted for by the predicted values of R&D from the R&D regression. The coefficient restrictions in the R&D equation are therefore more relevant to the determination of growth than those in the fixed capital formation equation.

4.3 Alternative variable definitions

We have examined the sensitivity of the results to several different definitions of both country and industry variables.

4.3.1 Country structure variables

As noted above, La Porta et al. record a number of different measures of ownership concentration. The signs of the coefficients on the interactive term between pyramiding and the industry variables in the growth regression are summarized in table 8. Neither the earlier La Porta et al (1997) measure of concentration nor the pyramiding measures were more significant in the growth, fixed capital formation or R&D equations than the one reported above. However, pyramiding is associated with the growth of bank-financed industries rather than equity financed and of skilled based industries as reported above for the concentration variable. This may reflect the magnified control that pyramids allow banks to exert.

The significance of bank firm relations was assessed by replacing the size of banking systems (bank credit to GDP ratios) with bank ownership of corporate equity. The signs of the coefficients on the interactive terms with bank ownership are the

same as those with the size of banking systems but, in the case of bank ownership of equity, there is a significantly *negative* relation with the growth of bank financed industries (table 8). There is no significant bank ownership variable in the fixed capital formation or R&D regressions. Growth of bank financed industries is therefore associated with pyramid ownership structures rather than with the size of banking systems or bank ownership of corporate equity.

Replacing accounting standards with the size of stock markets (as measured by the ratio of market capitalization to GDP ratios), the fixed capital formation equation is similar to that in table 6 with a significant negative term in the interaction of market capitalization and new equity finance.[4] However, although the signs on the interactive terms in market capitalization are the same as those in accounting standards in the growth and R&D regressions, none are significant in the growth regression and only an interactive term with skills is positively significant at the 10% level in the R&D regression. Information disclosure is a more important determinant of growth and R&D in OECD countries than the size of markets, suggesting that information is a more relevant theory of growth and investment than control through hard budget constraints.

4.3.2 Industry characteristic variables

Results are little affected by the precise definition of market finance. Replacing new equity by external finance in the US, we still find positive interactions with accounting standards in the growth equation (table 8) and in the R&D equation. However, the relationships are in general weaker suggesting that the interaction of the financial and ownership structures with growth and R&D primarily comes through new equity finance.

The definition of skills used above is the proportion of the work force with any skills (i.e. one minus the proportion with no skills). Replacing this with the proportion of the workforce with lower and upper intermediate skill levels, the positive interactions between accounting and skills and between ownership concentration and skills in the growth regressions are still observed. However, the interaction with accounting standards is only significant in the R&D regressions when skills in the higher levels are included. In fact, there is a striking increase in the significance of the term in the R&D regression as the skill variable is raised from lower to higher levels. R&D shares are therefore closely associated with the interaction of accounting

[4] We also experimented with two other country measures of equity market development: the number of initial public offerings (IPOs) and a measure of stock market turnover (the value of shares traded divided by market capitalization). Substituting interactive terms in these variables into the growth, R&D and investment regressions, only in the R&D equation were the coefficients on the terms interacting IPOs with skills and equity positive and significant.

standards with highly qualified labour forces.

To date, bank finance in Japan has been measured as the ratio of bank finance to net physical investment. Since retained earnings are the dominant source of finance in most industries, it might be thought more appropriate to measure bank finance in relation to external rather than total finance. Results in the growth equation (table 8), the R&D and investment equations are little affected by this change; in particular, in the R&D equation, both accounting standards and the size of banking systems continue to display a strong negative inter-relation with bank finance.

In addition to the experiments with different variable definitions, we ran robustness regressions to test for the effect of outliers. The procedure weights observations by their absolute residuals and regresses them again using these weights. It continues to iterate in this way until the maximum change in weights falls below a certain tolerance. The results using these robust regressions were similar to those reported in table 6.

To summarize, the results reported in table 6 are robust to different definitions of industry variables. However, accounting standards rather than the size of stock markets are associated with the growth of and R&D expenditure in external financed and skill-dependent industries. The effect is primarily associated with industries employing the most highly skilled labour force and relying on equity as against other forms of external financing.

4.4 Exogeneity tests

A major issue raised by the above analysis is whether the independent variables can be treated as exogenous. The fact that they are not measured prior to the dates over which growth, fixed capital formation and R&D are measured exacerbates this concern. But even if they were then the question of whether country structures and industry characteristics could be treated as exogenous would still arise.

La Porta et al (1997) argue that legal and regulatory factors are more fundamental characteristics of countries than ownership. In most countries, legal systems have a long history and have shaped the development of accompanying institutions. We have responded to this suggestion in two ways. Firstly, we have used a number of legal measures in place of the country variables previously described. Secondly, we have used the legal variables as instruments.

Three sets of legal variables have been taken from La Porta et al (1997): creditor rights, anti-director rights and the origin of legal systems. Substituting creditor rights[5] for accounting standards, the creditor rights variable is less significant

[5] The creditor rights index was constructed by marking out of 4 whether (a) a country imposes

in the growth and R&D equations but interacts positively with the industry skill variable and the bank dependence of an industry in the fixed capital formation equation. This suggests that stronger creditor rights are associated with higher fixed investment in skill intensive and bank finance dependent industries.

When accounting standards is replaced by anti-director rights[6], the interactive term with skill-dependent industries is significant in the growth equation and the interaction with equity financed industries enters strongly in the R&D equation. Anti-director rights may therefore be a better proxy than accounting standards for the factors that are relevant to shareholders' investment in R&D expenditures.

La Porta et al (1977) characterize countries' legal systems as being of English, French, German and Scandinavian origin. They argue that common law countries (English) protect both shareholders and creditors the most, French civil law countries the least and German and Scandinavian civil law countries somewhere in the middle. We constructed a variable which was 1 for French, 2 for Scandinavian, 3 for German and 4 for English law countries. A positive influence of investor protection (a higher score on this index) is found in both growth and R&D regressions. In the case of growth it is associated with skill-intensive industries and in the case of R&D with equity financed industries.

These results reinforce those of the previous section in suggesting that investor protection promotes growth in external financed and skill-intensive industries through R&D expenditure. Creditor protection may also play a role in promoting capital expenditure in skill-intensive and bank-dependent industries.

An alternative approach to the endogeneity problem is to instrument the variables used in the main regressions. The origin of the legal system is the one variable that could be genuinely argued to be exogenous. We instrumented all three country variables using the origin of the legal system interacted with the appropriate industry characteristic variable. Column 2 of table 9 reports that the results are similar to those of table 6.

As a further test of exogeneity we omitted the three countries which were used to construct the industry characteristic variables: Germany, Japan and the US. While growth, fixed capital formation and R&D of these three countries might affect

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restrictions (e.g. creditors' consent) on companies' abilities to file for reorganization, (b) there is no automatic stay on assets once a reorganization petition has been approved, (c) the debtor does not retain control of its property during reorganization and (d) secured creditors are ranked first in the distribution of proceeds from sale of assets.

[6] La Porta et al (1997) define an index of anti-director rights as a mark out of five which depends on whether (a) the country allows shareholders to mail their proxy votes, (b) shareholders are not required to deposit their shares prior to the General Meeting, (c) cumulative voting is allowed, (d) there is an oppressed minorities mechanism and (e) the minimum share capital which is required to call an Extraordinary General Meeting is less than 10%.

financing differences and skill levels in industries in these three countries, it is less plausible to argue that they are influenced by growth, fixed capital formation and R&D in other countries. Column 3 of table 9 reproduces the growth regression dropping Germany, Japan and the US. The main results reported above are invariant to omission of these three countries: there is a strong positive relation of growth with the interaction of high accounting standards and ownership concentration countries with both equity financed and skill dependent industries.

4.5 Stages of economic development

We have examined the relationship of the above results to the stage of economic development by introducing an additional four countries that had low per capita GDP in 1970 and for which growth data is available from the OECD STAN data-set.[7] Four countries had GDP per capita in 1970 in the range $2,200 to $6,300: Korea, Mexico, Portugal and Greece. These are referred to as low GDP per capita countries. The fourteen countries in the base sample had GDP per capita in the range $7,300 to $15,000 in 1970.

Table 10 describes the results of estimating the equation referred to in column 2 of table 6 on the low GDP per capita sample and reproduces the results for the base sample. It shows that the highly significant positive interrelation between accounting standards and equity finance is characteristic of both samples. The size of the coefficient is much higher for the low GDP per capita countries suggesting that transparency has a greater impact on growth in equity dependent industries in low than high GDP per capita countries.

Nearly all of the other coefficients are of opposite sign and many significantly so. This is confirmed by a Chow test performed on the two samples of countries. The hypothesis that the coefficients in the two equations reported in table 10 are the same and that the samples can be pooled is strongly rejected.[8] The most striking difference between the two groups of countries relates to ownership concentration. In the high income countries there are a positive coefficients on the interactive terms in concentration and both equity finance and skills, implying a positive association between countries' ownership concentration and growth of equity financed and skill-intensive industries. In the low GDP per capita countries these coefficients are significantly negative.

[7] By restricting the sample to OECD countries, we ensure that the data is of higher quality and achieve a greater degree of comparability between countries in the study. However, we can then only perform a limited analysis of the influence of economic development on the relation between country structures and industrial activity. A fuller analysis requires a more extensive data set drawn from, for example, the UN source referred to above.

[8] $F(12,446)=8.796$; the value of the F-statistic at the 95% level is 1.75.

The interactive terms with the size of banking systems also differs between high and low GDP samples. It is positively associated with growth of equity dependent industries in high GDP countries and with growth of bank-finance dependent industries in low GDP countries.

5 Implications for the hypotheses on financial systems and governance arrangements

Figure 4 summarizes the results for the estimated coefficients of the matrix **B** in the growth, R&D and fixed capital formation equations. It synthesizes the signs of coefficients in four sets of regressions: the OLS regressions reported in table 6, the robust regressions (not shown), the instrumental variable specifications (table 9) and the OLS regressions for which the USA, Germany and Japan are excluded (table 9). The sign of a significant coefficient is indicated in the table when it is present in at least two of the four specifications.

Figure 4 – Summary of Signs of Regression Coefficients: base sample of 14 OECD countries

Growth	Country (k)			
		1 (accounting standards)	2 (bank credit/GDP)	3 (ownership concentration)
Industry (i)	1 (equity finance)	+ (3)	0	+ (4)
	2 (bank finance)	0	0	0
	3 (skills)	+ (4)	0	+ (4)

R&D	Country (k)			
Industry (i)	1 (equity finance)	+ (3)	0	0
	2 (bank finance)	- (2)	- (2)	0
	3 (skills)	+ (3)	0	0

FCF	Country (k)			
Industry (i)	1 (equity finance)	- (2)	0	- (4)
	2 (bank finance)	0	0	0
	3 (skills)	0	0	0

A clear pattern emerges from these and the other results reported above. There is a strong relationship between country structures, industry characteristics and the

types of activities undertaken in different countries. The two most relevant country structural features are the degree of information disclosure as measured by accounting standards and concentration of ownership.

Accounting disclosure is associated with faster growth of industries that are equity dependent and have a skilled labour force, particularly those where the labour force is highly qualified. A larger share of output is devoted to R&D and less to fixed capital formation in these industries in countries with more information disclosure. In contrast, bank finance dependent industries have smaller R&D shares. This is inconsistent with Bhattacharya and Chiesa's (1995) theory that bank finance may conserve the value of proprietary information. There is a more pronounced relation of growth and investment to information disclosure than to the size of financial markets measured in relation to either stock markets or banking systems. This points to the importance of information theories in explaining the link between finance and growth and to its relevance in R&D rather than fixed capital formation.

Ownership concentration is also associated with faster growth of equity dependent and skilled labour forces but in this case the link does not come via R&D. Furthermore, there is, if anything, a negative relation between ownership concentration and fixed capital formation in equity dependent industries. Instead, the contribution of ownership concentration may come from the incentives that committed large owners can provide to other parties, in particular labour and related firms.

The results are consistent with hypotheses 1 and 3 and in particular provide support for information and commitment theories. Hypothesis 2, which is based on control (hard budget constraint) theories, receives less support – dispersed ownership is not associated with faster growth of equity, bank or skill-dependent industries, banking systems are not associated with fixed capital formation and ownership concentration is not related to R&D and fixed capital formation.

The results for the 4 low GDP countries show a different picture (Figure 5). Again there is an association between countries' accounting standards and growth of equity dependent industries but now countries with larger banking systems also display higher growth of bank dependent industries, as predicted by hypothesis 4. Furthermore, in contrast to the high GDP countries, equity financed and skill dependent industries grow faster in countries with more dispersed ownership. This is in contradiction to the prediction in hypothesis 4 that countries in the catch-up phase of development benefit from concentrated ownership. Rather it is consistent with notion that these industries benefit from the imposition of hard budget constraints. Control theories are therefore more relevant to countries at an early than a late stage of economic development.

Figure 5 – Low GDP per Capita Countries

Growth	Country (k)			
Industry (i)		1 (accounting standards)	2 (bank credit/GDP)	3 (ownership concentration)
	1 (equity finance)	+	0	-
	2 (bank finance)	0	+	0
	3 (skills)	0	0	-

In sum, there is a strong relationship of financial systems with type of economic activity, which differs by characteristics of industries and stages of economic development. In advanced countries, information disclosure is associated with growth of equity financed and skill-intensive activities. The effect comes through R&D rather than fixed capital formation. In high GDP countries, there is also faster growth of externally financed and skill intensive industries in the presence of high ownership concentration. This effect does not come from either R&D or fixed capital formation and probably reflects the commitments that concentrated owners can offer to other stakeholders. In contrast, in less developed countries, these same equity dependent and skill-intensive industries benefit from the control that dispersed ownership can provide.

6 Conclusions

The objective of this paper is to use information that is becoming available on differences in corporate and financial systems to examine their effect on industrial activity. We have used a different approach from the existing literature to examine the interaction of these country structures with industry characteristics on growth, fixed capital formation and R&D. This provides both larger data sets and better controls than traditional international comparisons.

We were concerned with four sets of relations. The first came from bank-firm relations, which have received a great deal of prominence in the comparative systems literature. The second was the development of securities markets. The third was concentration of ownership where there are conflicting views as to whether this resolves or creates agency problems. The final relation was with legal systems which, it has recently been suggested, might be fundamental to the operation of financial systems and corporate sectors.

We find some support for all four of these relations. There is a strong relation

of market systems and legal protection of investors with growth of equity financed and skill-intensive industries. For the advanced countries, we find no evidence for a role of bank-firm relations, but a positive role for ownership concentration in equity financed and skill-intensive industries. For the low income countries, market transparency promotes growth in equity dependent industries, development of the banking system supports bank-dependent industries and dispersed ownership diminishes agency problems in equity-dependent and skill-intensive industries.

A very striking result concerns not the nature of these relations but their form. It might have been expected at the outset that it would be hard to establish relations between country structure, industry characteristics and R&D expenditure and comparatively easy to find relations with fixed capital formation since the former are frequently intangible and the latter tangible. In fact we find just the converse. We can explain a significant amount of cross industry and country variation in R&D expenditure and very little of fixed capital formation. Why is that?

Before we hazard an answer, we reiterate the caveats made above. There may be some variables that have been omitted from the analysis that would render financial systems and corporate structures important in explaining capital expenditure. Still more seriously, the nature of the analysis means that we cannot interpret the absence of a relation as implying that country structures do not affect overall differences in investment across countries. Close relations between banks and industry may have significantly increased growth in countries with high bank ownership. All we can say is that they are not associated with comparatively higher growth of bank financed industries in developed countries.

But the results may also be telling us that the relations of industrial growth to financial and corporate systems are sensitive to stages of economic development. In high GDP per capita countries, growth of equity and high skill dependent industries is promoted through information disclosure encouraging expenditure on R&D rather than fixed capital formation and through concentrations of ownership providing commitments to other stakeholders. In contrast, in lower GDP per capita countries, banking systems are important in promoting bank finance dependent industries and dispersed ownership is required to control agency problems in skill-intensive and equity financed industries.

If these results are valid then they suggest that policies concerning the structure of financial and corporate systems should be sensitive to countries' industrial composition and stages of economic development. In the early stages of development, policy may be best focused on the creation of efficient banking systems and the control of ownership concentrations. At later stages, some activities may benefit from greater information disclosure and the commitments that concentrated owners can

provide.

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Table 1: Average and Decomposition of Annual Growth Rates of Manufacturing Industry of 14 OECD Countries, 1970 to 1995

The table reports the annual average compound growth rates of manufacturing industry in column 2. In column 3 the difference between the country growth rate and the average of the 14 countries is shown, which in columns 4, 5 and 6 is decomposed into "share", "growth" and "interactive"effects. These are the first, second and third terms respectively of the right hand side of the equation:

$$\Sigma_i\{a_{ik}g_{ik} - a_{i-}g_{i-}\} = \Sigma_i\{a_{ik} - a_{i-}\}g_{i-} + \Sigma_i a_{i-}\{g_{ik} - g_{i-}\} + \Sigma_i\{a_{ik} - a_{i-}\}\{g_{ik} - g_{i-}\}$$

where a_{ik} is the share of industry i in country k's total manufacturing in 1970, g_{ik} is the growth rate of industry i in country k over the period 1970 to 1995 and subscript – denotes the average across all countries. *Source*: OECD, Structural Analysis Industrial (STAN) Database and own calculations.

Country	Growth Rate	Difference from Average	Share Effect	Growth Effect	Interactive Effect
Italy	0.030	0.010	-0.005	0.015	-0.001
Japan	0.027	0.006	0.000	0.011	-0.005
Finland	0.027	0.006	-0.001	0.011	-0.003
Spain	0.026	0.005	-0.001	0.010	-0.004
USA	0.023	0.003	0.002	0.005	-0.004
Canada	0.023	0.002	0.001	0.007	-0.005
Australia	0.017	-0.003	0.000	-0.001	-0.002
Netherlands	0.017	-0.004	0.002	-0.006	0.000
France	0.016	-0.004	-0.001	-0.002	-0.001
Denmark	0.015	-0.005	0.000	-0.003	-0.002
Sweden	0.012	-0.009	0.000	-0.008	-0.001
Germany	0.010	-0.011	0.003	-0.012	-0.002
Norway	0.006	-0.014	-0.001	-0.011	-0.002
UK	0.004	-0.017	0.001	-0.016	-0.002

Table 2: Average Ratio of Fixed Capital Formation to Value Added, 1970-1990 and R&D to Value Added, 1973 to 1994

This table reports the average ratio of investment (gross domestic fixed capital formation) to value added in manufacturing industries in column 2 and the average ratio of R&D to value added in manufacturing in column 4. *Source*: OECD Structural Analysis Industrial (STAN) Database for fixed capital formation and value added, and OECD Analytical BERD (ANBERD) Database for R&D

Fixed Capital Formation/ Value Added 1970-90		**R&D/ Value Added 1973-94**	
Finland	0.198	USA	0.079
Japan	0.194	Sweden	0.071
Norway	0.189	UK	0.055
Italy	0.174	Japan	0.054
Netherlands	0.169	Germany	0.052
Canada	0.162	Netherlands	0.051
Sweden	0.159	France	0.051
Denmark	0.153	Norway	0.038
France	0.148	Finland	0.033
Australia	0.131	Denmark	0.031
UK	0.124	Canada	0.027
Germany	0.121	Italy	0.021
USA	0.113	Australia	0.020
Spain	0.077	Spain	0.010

Table 3: Fixed Capital Formation/ Value Added Ratios and Research and Development/Value Added Ratios in Selected Industries in All and Four Individual OECD Countries

Panel A in the table reports the annual average growth rate of output in the three industries with the highest growth rates in the 14 OECD countries and individually in four countries (Germany, Japan the UK and US) over the period 1970-1995. Panel B in the table reports the average ratio of investment (gross domestic fixed capital formation) to value added in the three industries with the highest ratio in the sample and individually in the same four countries over the period 1970-1990. Panel C reports the average ratio of research and development to value added in the three industries with the highest ratio in the sample and individually in the same four countries over the period 1973-1994. In each case, the industry definitions are described in the data appendix. *Source*: OECD Structural Analysis Industrial (STAN) Database

All Countries		**Germany**		**Japan**		**UK**		**US**	
Panel A: Growth									
Electr. Machin.	0.0545	Plastic Product	0.0513	Electr. Machin.	0.1415	Other Chem.	0.0459	Plastic Product	0.0744
Profess. Goods	0.0461	Electr. Machin.	0.0358	Profess. Goods	0.0586	Plastic Product	0.0406	Electr. Machin.	0.0619
Plastic Product	0.0450	Non-ferrous Metals	0.0334	Motor Vehicle	0.0542	Electr. Machin.	0.0396	Non-electr. Machin.	0.0493
Panel B: Fixed capital formation/Value Added									
Indust. Chem.	0.3065	Profess. Goods	0.1819	Petrol & Coal	0.5173	Indust. Chem.	0.2226	Indust. Chem.	0.2494
Non-ferrous metals	0.2355	Indust. Chem.	0.1813	Tobac.	0.4492	Glass & Product	0.2199	Paper & Product	0.1845
Paper & Product	0.2286	Motor Vehicle	0.1676	Indust. Chem.	0.3796	Non-metallic	0.2048	Plastic Product	0.1574
Panel C: Research and Development/Value Added									
Electr. Machin.	0.1351	Electr. Machin.	0.1257	Chem.	0.1178	Electr. Machin.	0.1557	Electr. Machin.	0.1781
Chem.	0.0867	Non-electr.	0.0649	Electr. Machin.	0.1122	Non-electr.	0.0565	Motor Vehicle	0.1470
Profess. Goods	0.0841	Profess. Goods	0.0352	Profess. Goods	0.0991	Profess. Goods	0.0491	Profess. Goods	0.1244

Table 4: Industry Characteristics

This table records three industry variables used in the regression analyses. Column 2 is the fraction of capital expenditure financed with net equity by US firms during the 1980's as reported in Rajan and Zingales (1998). Column 3 is the average proportion of net physical investment financed by bank loans in Japan over the period 1981 to 1990. The source of these data is the Japanese Ministry of Finance (n.a. = not available). Column 4 is one minus the proportion of employees reported by Oulton (1996) as having no skill qualifications in different German industries in 1987.

Industry	**US Equity Dependence**	**Japanese Bank/Net Physical Investment**	**German Skill Levels**
Food	0	0.52	0.658
Beverages	0	0.52	0.745
Tobacco	-0.08	0.52	0.619
Textiles	0.01	0.86	0.593
Clothing	0	1.49	0.646
Leather &Products	0	na	0.586
Footwear	0.04	na	0.586
Wood Products	0.04	1.78	0.724
Furnitures & Fixtures	0.01	na	0.724
Paper & Products	0.02	0.68	0.628
Printing & Publishing	0.03	0.80	0.771
Industrial Chemicals	0.07	0.04	0.758
Other Chemicals	0.02	0.04	0.758
Petroleum & Coal Products	0.06	na	0.769
Rubber Products	0.11	na	0.641
Plastic Products, nec	0.26	na	0.641
Pottery, China etc	0.11	0.63	0.623
Glass & Products	0.02	0.63	0.623
Non-Metallic Products, nec	0.01	0.63	0.707
Iron & Steel	0.01	-1.01	0.691
Non-Ferrous Metals	0.02	0.11	0.655
Metal Products	0.02	1.03	0.703
Non-Electrical Machinery	0.11	0.81	0.791
Electrical Machinery	0.36	0.37	0.732
Shipbuilding & Repairing	0.02	-3.41	0.843
Motor Vehicles	0.01	0.39	0.723
Professional Goods	0.62	0.72	0.737
Mean	0.07	0.39	0.692

Correlation matrix			
	Equity dependence	Bank finance	Skills
Equity dependence	1.000		
Bank finance	0.0734	1.000	
Skills	0.1717	-0.4551	1.000

Table 5: Country Variables

Column 2 is the number of accounting standards on a scale from 0 to 90 reported in Rajan and Zingales (1998) from a survey conducted by the Center for International Financial Analysis and Research normalized to lie in the range 0 to 1 by dividing by 90. Column 3 is the proportion of total equity market capitalization in different countries held by banks. No single source of data is available for this series. Where possible, it was collected directly from Central Banks as detailed in the data appendix, otherwise the source was OECD Financial Statistics (n.a. = not available). Column 4, shows 1 minus percentage of widely held of the 20 largest publicly traded firms in1995, reported in La Porta et al (1998). Column 5 is market capitalization (reported in the IFC Emerging Stock Market Factbook 1992) to GDP ratios averaged over the period 1982 to 1991. Column 5 are bank credit (reported in IMF International Financial Statistics) to GDP ratios averaged over the period 1980 to 1990. Column 6 shows the precentage of pyramids in the 20 largest firms, reported in Table 4 in La Porta et al.(1998).

Country	**Accounting Standards**	**Equity Owned by Banks**	**Ownership Concentration**	**Market Capitalization/ GDP**	**Credit/GDP**	**Pyramids**
Australia	0.833	0.042	0.45	0.472	0.357	0.14
Canada	0.822	0.080	0.50	0.444	0.471	0.13
Denmark	0.689	n.a.	0.90	0.231	0.477	0.08
Finland	0.856	0.150	0.85	0.152	0.653	0.00
France	0.767	0.064	0.70	0.187	0.817	0.38
Germany	0.689	0.136	0.65	0.201	0.856	0.40
Italy	0.689	0.057	0.85	0.125	0.520	0.25
Japan	0.722	0.232	0.50	0.853	1.018	0.00
Netherlands	0.711	0.053	0.70	0.401	0.709	0.14
Norway	0.822	0.082	0.95	0.142	0.473	0.13
Spain	0.567	0.095	0.85	0.179	0.684	0.38
Sweden	0.922	0.000	1.00	0.395	0.456	0.53
UK	0.867	0.017	0.10	0.751	0.422	0.00
USA	0.789	0.004	0.20	0.563	0.687	0.00
Mean	0.768	0.078	0.657	0.364	0.614	0.18

Correlation matrix

	Accounting standards	Bank equity	Ownership concentration	Market cap/GDP	Credit/GDP	Pyramids
Accounting standards	1.000					
Bank equity	-0.3672	1.000				
Ownership concentration	-0.2032	0.1673	1.000			
Market cap/GDP	0.2895	0.0471	-0.7548	1.000		
Credit/GDP	-0.4643	0.6846	-0.0423	0.1252	1.000	
Pyramids	-0.1678	-0.2106	0.5235	-0.4768	0.0498	1.000

Table 5b: Low GDP countries

Country	**Accounting Standards**	**Equity Owned by Banks**	**Ownership Concentration**	**Market Capitalization/ GDP**	**Credit/GDP**	**Pyramids**
Greece	0.611	n.a.	0.95	0.074	0.314	0.11
Mexico	0.667	n.a.	1.00	0.093	0.128	0.25
Portugal	0.711	n.a.	1.00	0.085	0.562	0.44
South Korea	0.689	n.a.	0.60	0.253	0.483	0.33

Table 6 Regression of Growth, Fixed Capital Formation and R&D on Interaction of Country Structure and Industry Characteristic Variables

The table reports the results of regressions of annual average growth rates in column 2, of the share of fixed capital formation in value added in column 3 and of the share of research and development in value added in column 3. The country and industry pools are defined in the data appendix. There are ten demeaned independent variables: initial value added shares of industries at the start of the period (initial shares) and nine interactive terms between three country structure variables (bank credit/GDP ratios (credit), accounting standards (acc) and concentration of ownership (own)) and three industry characteristics (external bank finance in Japan (bank), proportion of workers with any skill training in Germany (allskill) and external equity finance in the US (equity)). A constant, and 0,1 dummy variables relating to industries and countries with missing independent variables have been included but are not reported below. Huber-corrected t-statistics are shown in brackets. * = significant at 10% level, ** = significant at 5% level, and *** = significant at 1% level.

Variables	Growth 1970-1995	Fixed capital formation 1970-1990	R&D 1973-1994
Initial shares	-0.2670 (5.77) ***		
acc*equity	0.1952 (2.73) ***	-0.2895 (1.69) *	0.4700 (1.90) *
acc*bank	-0.0170 (0.70)	-0.0484 (1.00)	-0.0670 (2.77) ***
acc*allskill	0.4392 (2.87) ***	-0.4218 (0.71)	0.8873 (3.17) ***
Credit*equity	0.0830 (1.70) *	0.0437 (0.35)	-0.0008 (0.01)
Credit*bank	-0.012 (1.47)	-0.0120 (0.58)	-0.0198 (2.20) **
Credit*allskill	0.1063 (1.43)	-0.2631 (0.67)	0.1810 (1.37)
own*equity	0.0441 (2.25) **	-0.1581 (2.79) ***	0.1056 (1.29)
own*bank	-0.0019 (0.33)	0.0060 (0.77)	0.0005 (0.07)
own*allskill	0.0976 (2.07) **	0.0745 (0.51)	-0.1017 (1.09)
Observations	369	331	171
R^2	0.1600	0.0183	0.1745
F [p-value]	F(11,357)=6.0 [0.000]	F(10,320)=1.70 [0.080]	F(10,160)=2.86 [0.003]

Table 7 Regression of Growth on Predicted Values of Fixed Capital Formation and R&D

Panel A of the table reports the results of the regression of annual average growth on the predicted values from the fixed capital formation and R&D regressions. For comparison, the result of running the standard growth regression (as reported in table 6) on the sample used here is reported in panel B. * = significant at 10% level, ** = significant at 5% level, and *** = significant at 1% level.

A. Constrained regression

Initial share	Predicted value of fixed capital formation	Predicted value of R&D	Observations	R^2	F [p-value]
-0.0880 (2.72) ***	0.0994 (0.83)	0.4657 (3.99) ***	157	0.1215	F(3,153) = 7.98 [0.0001]

B. Unconstrained regression

Initial share	Nine interactive variables			
-0.0842 (2.54) **	No	157	0.0489	F(1,155) = 4.01 [0.0120]
-0.0874 (2.55) **	Yes	157	0.1937	F(11,145)= 6.45 [0.0000]

Table 8. Signs on Interactive Terms in Growth Regression Using Alternative Independent Variable Definitions

This table reports the signs on the interactive terms of regressions on annual average growth rates over the period 1970 to 1995 using alternative variable definitions from those shown in table 6 for both country structure and industry characteristic variables. The outcomes of using different industry variables are shown in the rows, where each row R1 to R3 represents a separate equation in which an alternative industry variable has been used. The outcomes of using different country variables are shown in the columns, where each column C1 to C3 represents a separate equation in which an alternative country variable has been used. For ease of comparison, the results from table 6 are reproduced in the lower right hand quadrant of this table. The entries refer to the signs in the growth regressions. + = positive sign significant at 10% level, ++ = positive sign significant at 5% level, +++ = a positive sign significant at 1% level, - = negative sign significant at 10% level, -- = negative sign significant at 5% level, --- = negative sign significant at 1% level, 0 = insignificant coefficient.

Industry Variables	**Country Variables**					
	New Variables			**Existing Variables**		
New Variables	Market cap/GDP (C1)	Bank own. of equity (C2)	Pyramid (C3)	Acc. Stand	Bank credit / GDP	Own conc.
External finance (R1)				++	0	0
Bank/ ext. finance(R2)				0	0	0
Lower & upper intermediate skills (R3)				+	0	+
Existing Variables						
Equity finance	0	0	0	+++	+	++
Bank finance	0	--	+	0	0	0
Skills	0	0	0	+++	0	++

Table 9 Exogeneity Tests on Growth Regression, 1970 to 1995		
Column 2 reports the regression described in column 2 of table 6, using origins of legal systems as an instrumental variable for all the country structure variables. Column 3 reproduces column 2 of table 6 excluding the three countries used in the country structure variables (Germany, Japan and the USA). Huber-corrected t-statistics are shown in brackets. * = significant at 10% level, ** = significant at 5% level, and *** = significant at 1% level.		
Variables	**Instrumental variable regression**	**Excluding Germany, Japan and USA**
initial shares	-0.2682 (4.95) ***	-0.2311 (5.23) ***
acc*equity	0.2184 (1.21)	0.1677 (2.57) **
acc*bank	-0.0602 (1.33)	-0.0176 (0.73)
acc*allskill	0.7481 (2.19) **	0.4533 (2.91) ***
credit*equity	0.0972 (1.08)	0.0187 (0.42)
credit*bank	-0.0291 (2.18 **	-0.0080 (0.57)
credit*allskill	0.1468 (1.18)	0.1269 (1.08)
own*equity	0.0492 (2.13) **	0.0669 (3.19) ***
own*bank	-0.0081 (0.88)	0.0006 (0.09)
own*allskill	0.1306 (2.18) **	0.1245 (2.15) **
Observations	369	290
R^2	0.1021	0.1575
F [p-value]	F(11,357)=5.44 [0.000]	F(11,278)=5.54 [0.000]

Table 10 Regression of Growth on Split Sample		
In column 2, the table replicates the regression described in column 2 of table 6 on 4 OECD countries with the lowest GDP per capita in 1970 (Korea, Mexico, Portugal and Greece). Column 3 reproduces the regression from Table 6, column 2. Huber-corrected t-statistics are shown in brackets. * = significant at 10% level, ** = significant at 5% level, and *** = significant at 1% level.		
Variables	**Low GDP per capita countries**	**High GDP per capita countries**
initial shares	-0.3685 (3.62) ***	-0.2670 (5.77) ***
acc*equity	1.5087 (4.06) ***	0.1952 (2.73) ***
acc*bank	-0.1143 (1.38)	-0.0170 (0.70)
acc*allskill	-0.0482 (0.05)	0.4392 (2.87) ***
credit*equity	-0.1251 (1.43)	0.0830 (1.70) *
credit*bank	0.3527 (2.16) **	-0.0120 (1.47)
credit*allskill	-0.3297 (1.54)	0.1063 (1.43)
own*equity	-0.2398 (2.49) **	0.0441 (2.25) **
own*bank	0.0685 (2.91) ***	-0.0019 (0.33)
own*allskill	-0.4649 (2.02) **	0.0976 (2.07) **
Observations	101	369
R^2	0.3961	0.1600
F [p-value]	F(11,89)=6.19 [0.000]	F(11,357)=6.04 [0.000]

Data Appendix[9]

In all OECD data used in this study, Germany refers to West Germany, even for the years after reunification.

1. Activity Measures

Growth rates:
Calculated using constant price value added data by country and industry from OECD, DSTI(STAN) 1997.

Fixed capital formation share:
Calculated using gross fixed capital formation (GFCF) and value added data by country and industry from OECD, DSTI(STAN) 1997.

R&D share:
Calculated using R&D expenditure from OECD, DSTI(ANBERD), 1998 and value added from OECD, DSTI(STAN) 1997, both by country and industry.
For Germany data stops in 1993; averages refer to 1973-1993.

2. Industry Variables

(1) Equity Finance and External Finance in the USA in the 1980s:
Table 1, Rajan and Zingales (1998)

(2) Bank finance in Japan by industry:
Japan, Ministry of Finance 1981-1990

Banknpi	=	bank loans / net physical investment
Bankinv	=	bank loans / (net investment - net retentions)

To correct for fluctuations in and possible time discrepancies between investment and loans received, the 1981-1990 sum of each term in the above equation was determined before the division.

(3) Employment broken down by category of skill and by industry in Germany:
Oulton(1996). Total employment in the industry is broken down into four skill categories: workers with no skills, low skilled, medium, and highly skilled.

3. Country Variables:

(1) Ownership concentration:
1. Ownconc.
One minus the mean of the percentage of the 20 largest firms widely held (i.e. less than 10% control), Table 3B , La Porta et al (1998)
2. Ownermed
Median ownership of the three largest shareholders in the 10 largest non-financial privately-owned domestic firms; Table 10, La Porta et al.(1996) [NBER paper 5661]
3. Pyramid
Mean of percentage of pyramids and not widely held 20 largest firms, Table 4, La Porta et al (1998). We changed the missing value for the UK into a zero.

(2) Creditor Rights, Anti-director Rights, Origin of Legal System:

[9] Detailed information on data cleaning and adjustments to the data is available in a data appendix available from the authors.

Table 2, La Porta et al.(1997)

(3) Accounting Standards:
Table 2, Rajan and Zingales (1998) and Laporta et al (1997)

(4) Bank ownership of equity:[10]

$$\text{Percentage of equity held by banks} = \frac{\text{Market value of equity held by banks}}{\text{Market value of equity held by the private domestic sector}}$$

Where the source shown is the OECD Financial Statistics, the measure used was the average value of shares held by domestic monetary institutions (excluding central banks) divided by the sum of shares held by financial institutions (excluding central banks), shares held by non-financial enterprises and shares held by other sectors (including individuals) reported in OECD Financial Statistics II.

Australia:	1988-1990 average; Reserve Bank of Australia, Australian Financial Accounts Catalogue number 5232.0
Canada:	1981-1990 average; Bank of Canada
Finland:	1986-1990 average; Bank of Finland
France:	1980-1990 average; OECD Financial Statistics II
Germany:	1980-1990 average; Deutsche Bundesbank, and Deutsche Bundesbank Financial Accounts 1990 to 1996, X. Special Tables 6
Italy:	1985-1988 average; Banca d'Italia
Japan:	1980-1990 average; Tokyo Stock Exchange
Netherlands:	1980-1990 average; Bolt, W. and M. Peeters, "Corporate Governance in the Netherlands", in *Corporate Governance, Financial Markets and Global Convergence, Financial and Monetary Policy Studies*, v.33, May 1997, p. 97 (underlying data supplied by authors)
Norway:	1980-1990 average; Norges Bank
Spain:	1980-1990 average; Banco de Espana
Sweden:	1983-1990 average; OECD Financial Statistics II
UK:	1991; UK Financial Statistics 1997, Table 9.2A
USA:	1980-1990 average; OECD Financial Statistics II

(*5) Credit / GDP*
IMF, International Financial Statistics, lines 32d and 99b. 1980-1990 average.

(6) Market capitalization / GDP
Market capitalization in US$ is from Emerging Stock Markets Factbook 1992, IFC, p. 52-53. Exchange rate and GDP are from International Financial Statistics, lines ae and 99b. 1982-1991 average.

(7) Value traded / Market capitalization
Market capitalization and Value traded in US$ for 1980-1990 is from Emerging Stock Markets Factbook, IFC, 1990 and 1995 editions.

(8) Initial public offerings (IPO)
The number of domestic IPOs in 1996 is from the Federation Internationale des Bourses de Valeurs website, Table http://www.fibv.com/stata.htm, 1997 Annual Statistics, 1.1 Equity market: Number of newly listed companies.

[10] We are grateful to the staff of the many central banks who helped us collect these data.

(9) GDP per capita

GDP per capita for 1970 in US$ is from Maddison, A., 1995, "Monitoring the World Economy 1820-1992", OECD Development Center Studies, OECD: Paris

4. Definition of Pools used in Regressions

	Period	No. of countries	No. of industries
Growth	1970-80 1980-90 1990-95 1970-95	14 OECD countries	27
Fixed capital formation	1970-79 1980-90 1970-90	14 OECD countries	27
R&D	1973-79 1980-90 1991-94 1973-94	14 OECD countries	15

Industry pool for growth and investment regressions		Industry pool for research and development regressions	
Industry	ISIC	Industry	ISIC
Food	3110+3120	Food, Beverages and Tobacco	3100
Beverages	3130		
Tobacco	3140		
Textiles	3210	Textiles, Clothing , Leather & Footwear	3200
Clothing	3220		
Leather &Products	3230		
Footwear	3240		
Wood Products	3310	Wood Products, Furnitures & Fixtures	3300
Furnitures & Fixtures	3320		
Paper & Products	3410	Paper & Products, Printing & Publish	3400
Printing & Publishing	3420		
Industrial Chemicals	3510	Chemicals	3510+3520
Other Chemicals	3520		
Petroleum & Coal Products	3540		
Rubber Products	3550	Rubber Products and Plastic Products	3550+3560
Plastic Products, nec	3560		
Pottery, China etc	3610	Non-Metallic Products	3600
Glass & Products	3620		
Non-Metal Products, nec	3690		
Iron & Steel	3710	Iron & Steel	3710
Non-Ferrous Metals	3720	Non-Ferrous Metals	3720
Metal Products	3810	Metal Products	3810
Non-Electrical Machinery	3820	Non-Electrical Machinery	3820
Electrical Machinery	3830	Electrical Machinery	3830
Shipbuilding & Repairing	3841	Shipbuilding & Repairing	3841
Motor Vehicles	3843	Motor Vehicles	3843
Professional Goods	3850	Professional Goods	3850