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# *The Allocation and Monitoring Role of Capital Markets: Theory and International Evidence*

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# The Allocation and Monitoring Role of Capital Markets: Theory and International Evidence

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## Abstract

Capital markets perform two distinct functions: provision of capital and facilitation of good governance through information production and monitoring. I argue that the governance function has more impact on the efficiency with which resources are utilized within the firm. Based on industry level data across thirty-eight countries, I present evidence suggesting a positive relation between market-based governance and improvements in industry efficiency. The measures of governance are also positively correlated with productivity improvements and growth in real output. Furthermore, while governance affects efficiency, the capital provision services induce technological change. The evidence underscores the role of capital markets as a conduit of socially valuable governance services as distinct from capital provision.

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## I. Introduction

Why do we observe differences in economic performance among countries; across industries in the same economy; and across firms belonging to the same industry? What could be the role of the financial system in explaining cross-country and cross-industry variations in economic performance? While determinants of cross-country economic growth have been of great interest to development economists and growth economic theory, the role of financial markets and institutions has traditionally received very little attention. Recent finance literature reports strong relations between indicators of financial development and economic performance in the real sector, indicating a positive role for capital markets and institutions (see, e.g., Levine (1998), Levine and Zervos (1998); and Rajan and Zingales (1998)). Levine and Zervos (1998), for example, find a strong correlation between financial development, and growth in per capita GDP and productivity. Yet, despite such progress in exploring the finance-growth nexus, we are far from understanding the exact mechanisms through which the financial system could affect economic performance in the real sector. As Zingales (2003) notes, this lack of understanding has been one of the reasons why it has been so difficult to draw policy conclusions from the finance-growth literature. Identifying the channels of influence is also important for instilling confidence in the documented first-order relations between finance and growth by strengthening the argument for causality running from the financial to the real sector.

In this study, I utilize a corporate finance framework to investigate empirically the finance-growth link by examining possible channels through which financial market functions could influence economic performance at industry level. I begin from a premise that financial markets and institutions play two critical roles in an economy: allocation of risk capital through saving mobilization and risk-pooling and sharing; and promotion of responsible governance and control through providing outside investors a variety of mechanisms for monitoring inside decision makers. In its allocation function, the financial system helps transfer resources from individual savers to agents with managerial and entrepreneurial talents with investment opportunities and provides firms and investors risk-pooling and sharing facilities. As its governance function, it provides monitoring and information production services by which it helps mitigate the various agency problems of the firm resulting in better project evaluation and selection even in the absence of external finance need. While recognizing the twin roles of the financial system, modern corporate finance theory emphasizes the monitoring and information production function; in contrast, the recent finance-growth literature focuses on the capital mobilization role. Bridging the gap, I argue that the two functions systematically affect different sources of growth.

I postulate that economic performance in the real sector, for example, as measured by growth in output ( $\dot{y}$ ), is partly a function of the effectiveness of the supporting financial system in delivering governance (G) and capital allocation (A) functions,

(1)
$$\dot{y} = g(A, G)$$

Part of the growth in output ( $\dot{y}$ ) is attributable to a mere change in the use of constituent factors of production. The remaining is considered to be a result of growth in total factor productivity ( $T\dot{F}P$ ), and generally, accounts for all changes in output not accounted by growth in production inputs. Denoting $\dot{I}$ to be growth in inputs.

(2)
$$\dot{y} = \dot{I} + T\dot{F}P.$$

The recent literature on the nexus between finance and growth explores the role of financial development in explaining variations in output growth ( $\dot{y}$ ) and its components $\dot{I}$ and $T\dot{F}P$ (see Levine (1997) and Levine (2003) for a review of this literature). Country-level studies of Levine (1998) and Levine and Zervos (1998)), industry-level studies of Rajan and Zingales (1998) and firm-level studies such as Demerguc and Maksimovic (1998) confirm strong positive relation between overall financial development and output growth ( $\dot{y}$ ). Levine and Zervos (1998) further documents that financial development is strongly correlated with productivity growth ( $T\dot{F}P$ ), establishing the potential role of the financial system in explaining real performance. My paper complements and contributes to this literature by identifying the specific channels through which the financial system could affect economic performance via its twin functions of governance and allocation. First, I break down productivity growth ( $T\dot{F}P$ ) into two sources: efficiency improvements and technological change. I then extend the extant empirical evidence by showing how the allocation (A) and governance (G) functions of the financial system affect these primal sources of productivity. Finally, instead of focusing on overall financial development and its relation to growth, I develop and focus on measures of how effectively financial systems deliver their twin functions of governance and allocation. In so doing, I answer the following research questions: Through what productivity channels (i.e. efficiency or technological change) does the financial system affect growth? Which capital market function, allocation versus governance, matters more for productivity growth?

I find that both governance and allocation are significant determinants of output growth and productivity. However, taken together, governance dominates allocation in its impact on productivity. Furthermore, while governance works through the channel of improving efficiency to promote productivity growth, the allocation function appears to have more impact on the technological change component of productivity. The correlations between the measures of governance and efficiency, and the measures of allocation and technological change are robust to alternative model specification in which I use legal and institutional variables that are deemed to be more exogenous as instruments, indicating that the relations identified could be causal. The empirical results are also robust to alternative definitions of the focal constructs of 'efficiency' and 'governance', and alternative specifications of latent variables as random- or fixed-effects.

The evidence, therefore, suggests the following: (1) the financial system positively affects growth and productivity via two channels: through improving efficiencies and through enabling technological inventions and innovations, (2) while the governance services of financial markets help induce improvements in efficiency, the allocation services help accelerate technological advances, and (3) while both governance and allocation are determinants of productivity, the impact of governance (via efficiency) dominates the impact of allocation (via technological change).

The evidence underscores the role of particularly the equity market as a conduit of socially valuable governance services as distinct from capital provision. The value of this service is economically large. An industry operating in a country with a stock market that is one standard deviation above the mean of the proxy for the governance function would have a growth rate of 1.05 percent per annum in real output more than that for the average industry. Cumulating over the sample period of 15 years, real output for such industry would have been about 17 percent higher at the end of study period.

The rest of the paper is organized as follows. Section II provides the theoretical framework and develops the hypotheses to be investigated. I describe the data and methodology in Section III. Section IV and V examine the empirical relations between economic performance, focusing on sources of productivity, and capital market functions. Section VI summarizes the results with policy implications.

## II. Theoretical Framework and Hypotheses Development

Corporate finance theory suggests that the link between finance and investment at the micro level is a consequence of contractual imperfections. In fact, financial markets and institutions arise to mitigate problems of informational and transactional frictions. To that end, financial markets and institutions perform various functions. They aggregate and mobilize capital, provide risk pooling and sharing services, assess and select projects and management through producing information, and monitor inside decision making. These diverse services could be classified into two analytically separable functions: capital allocation and governance. The allocation function involves mobilizing savings from economic units with excess capital to individuals with entrepreneurial talents and with investment opportunities, as well as providing risk pooling and sharing opportunities. The governance function encompasses the role of financial systems in alleviating agency problems that arise among stakeholders in the firm.

The degree to which the financial system influences economic performance in the real sector depends on how effectively it carries out both its allocation and governance functions.

## A. Governance and Economic Performance: The Economic Efficiency Channel

A primary function of financial markets is one of facilitating responsible governance within the firm. In a world of uncertainty and incomplete contracting, problems of imperfect information and moral hazard may prevent the first-best value-maximizing investment behavior. Markets and institutions mitigate the consequences of imperfect information and moral hazard by producing information and facilitating monitoring. The effectiveness with which markets perform this governance function bears on firm's economic efficiency in the sense that alleviation of the agency problems engenders convergence of the firm's observed economic behavior to its optimum. Economic efficiency is broadly defined as the degree to which observed economic behavior converges to the optimal given the constraints of the underlying technology[1].

As their vital role, financial markets process information (see, e.g., Grossman (1976)). Trading among market participants produces information that is conveyed through price signals. Information is also generated by financial institutions (see, e.g., Diamond (1984), and Leland and

[1] Assuming cost minimization as a behavioral goal, for example, economic efficiency could be operationalized as observed total cost compared to the optimal given the level of output and input prices.

Pyle (1977)). Instead of traders producing information through trading and conveying it via prices, banks hire loan officers who produce information while evaluating projects for loan financing.

This 'information production' role has consequences that have efficiency implications. First, security prices formed in financial markets convey valuable information about the profitability of current investment opportunities and thereby guide managerial decision-making (see Dow and Gorton (1997), Bresnahaan, Milgrom and Paul (1992); and Titman and Subrahmanyam (1999)). Second, simply that based on the information, bad firms, management teams or projects do not get funding, preventing waste of resources. In a nutshell, the information production function and firm economic efficiency are linked in that markets and institutions that generate better information enable firms to make better decisions.

In addition to information production, markets and institutions facilitate monitoring of inside decision-makers in various ways. First, markets generate information to evaluate the quality of past managerial decisions (Kihlstrom and Matthews (1990)). Second, information in stock prices allows effective managerial incentive schemes (Holmstrom and Tirole (1993)). Third, the threat of takeover via capital markets mitigates managerial inefficiencies (e.g. Scharfstein (1988)).

These various forms of market-based monitoring directly enhance efficiency at the firm level. Managerial incentives that use information in stock prices reduce shirking, leading to the alignment of managerial interest to that of shareholders. Inefficient management gets forced out through the mechanism of the market for corporate control. More importantly, the threat of takeover induces managerial discipline, preventing managerial actions that waste firm resources.

## B. Allocation and Economic Performance: The Technological Change Channel

A key function of financial institutions and markets is mobilizing capital to its efficient use - the Allocation function. Financial systems aggregate small savings of numerous investors for use by agents with entrepreneurial talents who need funds for large-scale capital investments. In so doing, they also provide investors as well as entrepreneurs with risk-pooling and sharing facilities.

The availability of capital and the ability of investors to share risk influence the degree of risk tolerance and the choice of technologies in an economy. Through easing the burden of risk to capital contributors and entrepreneurs, markets and institutions enable the undertaking of risky technological inventions and innovations. This link between the allocation function and technological innovations takes many forms. First, adoption of technologies requires large sums of capital that could easily be mobilized in well-developed financial systems. Second, well-developed capital markets and institutions encourage adoption of long-gestation productive technologies through reducing investors' liquidity risks (Bencivenga, Smith and Starr (1995). Finally, by providing hedging and other risk sharing possibilities, financial markets and institutions promote assimilation of specialized (versus generalized), thus risky and yet productive, technologies (see, e.g., Saint-Paul (1992)). The implication is that, other things constant, countries with mature banking sector and capital markets should achieve higher rates of technological change. This, in turn, translates into higher productivity and, therefore, to larger economic growth.

To sum up, how does the financial system affect real economic performance? I argue, as in equation (1) above, that how better off an economic unit will be, as measured by growth in output ($\dot{y}$), is partly determined by the effectiveness of the financial system in delivering governance (G) and capital allocation functions (A). Decomposing output growth ($\dot{y}$), as in equation (2), into input growth ($\dot{I}$), and productivity improvements ($T\dot{F}P$), it has been shown (e.g. Levine and Zervos (1998)) that financial development works through productivity improvements in affecting growth. Productivity improvements ($T\dot{F}P$), however, may result from shifts in the underlying technology or improvements in the efficiency of the production process. Thus, denoting $\dot{T}$ to be technological change and $\dot{E}$ to be changes in efficiency,

(3) $$T\dot{F}P = \dot{T} + \dot{E}$$

I argue that while the degree to which the financial system provides ***governance*** (G) affects the rate of improvements in the relative ***efficiency*** ($\dot{E}$) with which the firm utilizes its resources, the ***allocation function*** (A) has an impact on the rate of ***technological change*** ($\dot{T}$). In so doing, I trace the specific channels through which the financial system influences economic performance. My conceptual model is, therefore,

$$\dot{E} = \Phi(A, G)$$

(4) $$\dot{T} = \Psi(A, G)$$

and, $$\frac{\partial \Phi}{\partial G} > 0, \quad \frac{\partial \Psi}{\partial A} > 0$$

Allocation (A) could also have an impact on efficiency, as governance (G) on technological change ($\dot{T}$). However, the directions of the relations do not appear to be obvious a priori. For example, in an environment of capital abundance vis a vis investment opportunities, increased capital mobilization (A), may lead to over-investment, suggesting a negative relation between allocation (A) and efficiency ($\dot{E}$). Similarly, whether better governed (via markets or otherwise) firms experience faster technical change is an empirical question. While the direct route from governance to technical change may not be obvious, Allen (1993) suggests a possible indirect link whereby financial market's role as information aggregator (part of governance) could be more useful to industries with complex decision environments, such as those characterized by rapid technological change. Thus, one would expect a positive correlation between technological change and the measure of governance, but this link does not indicate causation.

## III. Data and Measurement of Proxies

To estimate the measures of economic performance, I use industry-level production data for ten manufacturing industries over the period 1980 to 1995 for thirty-eight countries from the United Nations Industrial Statistics database. I use financial development indicators to construct measures of the allocation and governance functions of the financial system. These include stock market capitalization, value traded and turnover ratio obtained from Emerging Markets Fact-book (various issues) published by the World Bank, and size of domestic credit and size of the private credit sector from the International Financial Statistics (IFS) published by the IMF. The stock market data is available on a systematic manner since 1980, thus limiting the study period.

### A. Measurement of Capital Market Functions

Ideally, one would like to have a measure of the ability of firms to raise capital to meet their financial needs and to benefit from the related governance services provided by financial systems. I use measures of financial system size as proxies for the capital mobilization (allocation) function and measures of financial market activity as proxies for the governance function.

The allocation function represents the ability of a country's financial system to mobilize capital and enable participants to pool and share risk. The larger, broader, and deeper a country's financial system, the more effectively it mobilizes capital and distribute financial risk. Hence, I use the sizes of a country's equity and credit markets relative to its GDP as broad indicators of the allocation function. In so doing, I follow Levine and Zervos (1998), La Porta et al (1997) and Rajan and Zingales (1998) which use the size as measures of financial development. The size of equity markets is represented by stock market capitalization to GDP ratio (**MKTCAP**). The size of the credit sector is measured, alternatively, by (a) the size of total domestic credit relative to GDP (**BANK**), and (b) the size of total credit to the private sector relative to GDP (**PRIVATE**). While

BANK is a broader indicator of the depth of the credit sector, PRIVATE is a tighter measure of the ability of the intermediary sector in mobilizing capital to the private sector. As such, conditional on finding relations, PRIVATE is expected to have a larger coefficient.

As a broad indicator of the degree of governance services provided by a country's financial system, I use a measure of the country's stock market activity for which I use the ratio of total value of equity traded to stock market capitalization – turnover ratio (**TURNOVER**). Alternatively, for robustness, I use the degree of accounting disclosure, which reflects the extent of information flow and ease of monitoring.

There are strong theoretical reasons for using TURNOVER as a measure of the governance function. First, greater market liquidity implies more and better information—prices reflect information about the firm and its investment prospects more accurately. Increased market activity induces more information-acquisition, which, in turn, increases the information content of stock prices (see Holmstrom and Tirole (1993)). The more shares of stock actively being traded and the more liquid the market, the easier it becomes for an informed party to make a good return on investment (Kyle (1984)). The resultant increased information flow into the market improves the information content of stock prices. Hence, a measure of market liquidity is an indicator of the degree of "information aggregation".

Second, informative security prices in liquid markets facilitate the monitoring[2] of management, as well as the implementation of incentive-based compensation designed to align management's interests with those of shareholders. Incentive contracts in the form of managerial option and equity related compensations are useful for reducing agency costs only to the extent that the underlying equity prices are informative of firm performance. Holmstrom and Tirole (1993) show how liquidity via increased informativeness of security prices enhances monitoring.

[2] Effective monitoring and control could be exercised through other mechanisms such as via intermediaries and board effectiveness,

Third, greater liquidity makes it easier for active shareholders to build positions so as to bring about changes in corporate policies. Bhide (1993) argues that more liquidity implies less monitoring, since shareholders can dispose easily of positions if they disagree with management's policies. On the other hand, Maug (1998) shows that the benefits to shareholders from building positions and inducing good governance is so significant that the impact of greater market liquidity on effective monitoring is unambiguously positive.

Finally, the effective use of the secondary equity markets for corporate-control activities requires that the market be liquid. Takeovers require a liquid capital market—a market where bidders can access a vast amount of capital on *short* notice. Therefore, with liquid markets, investors who want to acquire a firm can do so.

Market liquidity as a measure of governance applies only to stock markets. Banks also provide governance services both as information producers and delegated monitors. However, the opaqueness of banks' dealings with their borrowers makes it difficult to construct a comparable proxy for governance. Ideally, one would like to have cross-country differences in loan rejections, corporate restructurings, board actions, and other governance activities initiated by banks to represent bank monitoring. The cross-country differences in the size of the banking sector (measured, alternatively, by the variables BANK and PRIVATE) may pick up some of the differences in banking governance role. However, while the size directly mirrors the ability of the sector to mobilize capital, size does not translate into good governance. Recent failures in corporate governance from Japan to Southeast Asia despite large banking sectors provide a counter example. Similarly, it should be noted that differences in the size of the stock market across countries as measured by MKTCAP might contain information about differences in governance. Yet, size again does not directly translate into good governance. A large market with many listed companies that

which may not be captured by our proxy for governance.

rarely trade, as is the case in many emerging economies, does little to generate information and facilitate monitoring.

Table 1 presents a summary of the measures of capital market functions. Panel (a) shows averages of the variables over the period of 1980-1995 for each country. We observe a number of patterns. First, there is a wide variation. For example, Germany has a turnover ratio of 1.0394 vis a vis Bangladesh's 0.0327. Second, stock market size does not necessarily correspond with stock market activity. For example, Chile has a relatively large stock market (MKTCAP 0.4717) and yet is one of the thinnest, with turnover of 0.0661. On the other hand, Turkey has one of the smallest markets (MKTCAP equals 0.0624) and is relatively busy (TURNOVER 0.5041). Third, by all measures, developed countries have more advanced financial systems than emerging countries. The correlations (in Table 2) between the log of real per capita income and proxy variables are significantly positive.

If we divide the countries into developed and emerging using International Finance Corporation's classification, the distribution of countries along the spectrum of the financial variables is highly skewed in favor of developed economies. For example, 32% of emerging and 0% of developed countries fall in the lowest quartile of TURNOVER; and over 40% of emerging and only 5% of developed economies fall in the bottom quartile of MKTCAP. 45% of emerging and 0% of developed economies belong to the bottom quartile on BANK. In contrast, only 9% of emerging and 43 % of the advanced markets falls in the top quartile of MKTCAP.

## B. Measurement of Economic Performance

An aggregate index of improvement in an economic unit, extensively used in the literature, is the growth rate in some measure of output. My measure of aggregate performance is **GV**, the annual compounded growth rate in real value-added. GV is an empirical equivalent of ( $\dot{y}$ ) in equation (1). Output growth could be a result of either growth in the component factors of production or improvements in productivity. My second measure of aggregate performance is **GP**, the annual compounded growth rate in total factor productivity. GP operationalizes $T\dot{F}P$ in equation (2) above. Furthermore, productivity gains in economic activities could be caused by two different factors: adoption of technological innovations in products and processes (measured by the rate of technological change), and improvements in efficiency which reflects the capacity of insider decision-makers to improve production, given inputs and available technology.

I define efficiency as the degree to which the firm's observed attainment converges to its optimal behavioral goal, under conditions of technological and market constraints. I operationalize my sense of efficiency using Farrell's (1957) concept of **production efficiency** and Leibenstein's (1966) **economic efficiency**. Production efficiency reflects the degree to which a producer achieves the maximum attainable quantity of output for a given bundle of inputs. The optimum is in terms of production possibilities and, as such, efficiency is defined in reference to the technical relations between observed and attainable quantities.

The optimum can also be defined in terms of some behavioral goal the producer is assumed to pursue, such as cost minimization or profit maximization. Efficiency then refers to the degree to which that assumed objective is achieved. In the cost minimization framework, an empirical measure of efficiency would be the ratio of the minimum attainable cost for a given level of output to the actual cost incurred by the producer. This is what is called **economic efficiency**. A firm can achieve production efficiency by obtaining the maximum output for whatever bundle of inputs it chooses to employ. It may yet be inefficient if it purchases what is not the best bundle of inputs given the input prices and their marginal productivities in production. This latter concept of efficiency is called "price efficiency". Economic efficiency subsumes both production and price efficiencies.

Improvements in firm's productivity are not the result of efficiency gains alone. They may arise from adoption of technological innovations in processes and products that enable the firm to achieve higher production quantities with lower input usage or equivalently the same level of output at lower costs. While efficiency reflects managerial actions in reference to a behavioral goal, this source of productivity reflects both the state of the available technology and the ability of firms to acquire new technologies in their production processes.

Empirically, I measure production efficiency based on a stochastic production frontier, in which efficiency is calculated as the proportion of actual output to the maximally attainable one. The closer is the actual to the optimal level of output, the more efficient the firm is. The empirical measure of growth in efficiency thus estimated is **ΔPRODEFF**, the annual rate of improvements in production efficiency. ΔPRODEFF is one of the empirical proxies of growth in efficiency, $\dot{E}$, in equation (4) above. I measure economic efficiency based on a stochastic cost frontier as the proportion of the minimum attainable cost to actual cost. The resultant variable is **ΔECONEFF**, the annual rate of economic efficiency, and serves as the alternative empirical proxy for $\dot{E}$ in equation (4). I measure the effect of technical progress as the shift in the production frontier over time holding input quantities at the same level, and the resulting variable, **TC**, the annual rate of technological change, is my empirical proxy for $\dot{T}$ in equation (4).

Appendix 1 provides the details on the estimation of these variables. Tables 1 and 2 provide a summary. From Panel (a) of Table 1, there is wide variation in the estimates across countries. Growth is slower in advanced countries than in emerging economies, as would be expected, reflecting initial conditions. The growth rate in real value added (GV) is strongly negatively correlated with per capita real GDP in Table 2. On the other hand, productivity growth (GP) is not related to countries' level of economic development. Productivity growth in the U.S. (3.1%) compares well with that of the Philippines (3.3%), the highest being registered by industries in

Korea (4.9%) and in Sri Lanka (5.4%). More importantly, the growth rates in efficiency (ΔECONEF and ΔPRODEFF) are not related to countries' level of economic development. The growth rates in economic efficiency and in production efficiencies range from 0.93% and 0.54% in Korea to –0.74% in Bangladesh and -0.87% in Peru respectively. Yet, an advanced country like the U.S. (0.11%) could have realized growth in economic efficiency comparable to that for Chile (0.09%) and Colombia (0.09%). Industries in richer countries realize higher rates of technological change (TC). TC is positively correlated with per capita GDP (Table 2). This might be a reflection of the fact that richer countries do have the wherewithal to support advance R&D activities, which keeps them on the technological lead.

## IV. Market-Based Governance, Allocation, and Economic Performance

Panel (c) of Table 1 summarizes both the capital market function variables and the economic performance variables for the entire sample of 3605 industry-country-years. There are wide variations in realized performance measures. The median industry growth rate in real value added is 2.6% for the entire sample. The growth rate in economic efficiency has a median value of 0.032%, with a range from -21.5% to 26.8%. The median growth rate in production efficiency is 0.008% with a range of –20.1% to 29.1%. The rate of technological change averages at 1.9% per annum. The average industry contributes about 5% of the manufacturing sectors' total real value added or real output.

These variations in performance appear to be closely associated with variations in the measures of capital market functions across countries. Table 3 explores the relations between the two sets of variables further by presenting difference-of-means test of the performance measures across sub-samples formed on the basis of rankings in the finance variables. From panel (a), more active equity markets are strongly associated with higher growth rates in value added, productivity and efficiency. On the other hand, the size of equity markets is weakly related to growth rates in value added, productivity, and efficiency (see panel (b)). Better allocation by the credit sector is strongly related to productivity gains, and technical change (panel (c) and (d)).

## A. Financial System Functions and Aggregate Measures of Performance

I begin the analysis of the relations between financial systems and economic performance, by examining the link between capital market functions and aggregate measures of industry performance. This would facilitate a comparison with the extant literature. I use the growth rates in real value added, and productivity as measures of how well off an industry is. My empirical model is a four-way error component (random effects) of the following form:

(5) $$GV_{cit} = \sum_k \beta^k F_{ct}^{\ k} + \gamma Z_{ct} + \varepsilon_{cit}$$

(6) $$GP_{cit} = \sum_k \beta^k F_{ct}^{\ k} + \gamma Z_{ct} + \varepsilon_{cit}$$

where, $GV_{cit}$ and $GP_{cit}$ are, respectively, the annual compounded growth rates of real value-added and total factor productivity of industry i in country c over period t. c=1,…,C; i=1,…,$I_c$ ; and, t=1,…,$T_{ci}$. $F_{ct}^{\ k}$ is the kth financial function indicator variable for country c in period t. The financial function variables are TURNOVER, MKTCAP, BANK and PRIVATE. The control variable $Z_{ct}$ represents the relative significance of industry i in country c during period t. I use the share of value added of the industry in the total value added of the manufacturing sector of the country (SHARE). The model is a four-way error-component (random effects) specification with the following error structure:

(7) $$\begin{aligned} &\varepsilon_{cit} = \alpha_c + \eta_i + \lambda_t + \nu_{cit} \\ &\textit{where,} \\ &\alpha_c \approx IID(0, \sigma_\alpha^{\ 2}), \\ &\eta_i \approx IID(0, \sigma_\eta^{\ 2}), \\ &\lambda_t \approx IID(0, \sigma_\lambda^{\ 2}), \textit{and} \\ &\nu_{cit} \approx IID(0, \sigma_\nu^{\ 2}). \end{aligned}$$

$\alpha_c$, $\eta_i$, $\lambda_t$ and $\nu_{cit}$ are independent from each other and also independent of the F and Z variables in Equations (5) and (6) above. $\alpha_c$ is unobservable time and industry invariant, country specific effects; $\eta_i$ is unobservable country and time invariant, industry effects; $\lambda_t$ represents unobservable country and industry invariant, time effects; and, $\nu_{cit}$ is a random disturbance term.

Hence, I control for country, industry and time heterogeneity, thereby avoiding the risk of bias in our estimates[3]. Moreover, I treat these latent country, industry and time effects as random variables rather than fixed parameters[4]. I estimate the model by the method of maximum likelihood (ML) under the distributional assumption of normality for the error components and the residual. The ML estimates are consistent and asymptotically efficient, and have a known asymptotic sampling information matrix[5].

Table 4 presents the estimates of the empirical model. From Panel (a), the results indicate a very strong relation between the degree to which capital markets perform their governance functions and industry aggregate performance. The coefficient estimates of TURNOVER – the proxy for the governance function - is positive (0.0570) and statistically significant at 1%. Moreover, the contributions of these services are economically significant. For example, using the coefficient estimates, a one standard deviation increase in TURNOVER (0.294) would increase the growth rate in real value added of the average industry by about 1.68% per annum[6].

[3] The model rests on the premise that a sensible representation of relations among variables of interest across diverse countries, industries and time-periods cannot explicitly capture all important variables. These variables could be simply too many to be included, since some may be un-measurable and others unobservable.

[4] For robustness, I also estimate the models in this section and the sections that follow as fixed effects specifications. The results are qualitatively similar to the ones under the error-components specification.

[5] Alternative estimation methods that include ANOVA type, ML, restricted maximum likelihood (REML), and Minimum Quadratic Unbiased Estimation (MINQUE) vary in the way the variances of the error components are estimated. Simple ANOVA type estimates no longer apply for unbalanced panel with three error-components. I use REML, a procedure in which variance components are estimated based on the portion of the likelihood function that depends on the error components alone. In a balanced data, the REML estimators of the variance components are identical to ANOVA estimators, which have optimal minimum variance properties. The results do not change when we estimate the models by ML, and by MINQUE procedures.

[6] This is calculated by multiplying the coefficient estimate for TURNOVER from Table 4 (i.e. 0.0570) by the standard deviation of TURNOVER from Table 1 (i.e. 0.294).

While stock market size (MKTCAP) is not significant, the variables BANK and PRIVATE (proxies for the allocation function of credit markets) are positive and statistically significant. The larger coefficient on PRIVATE reflects the fact that the variable is a tighter measure of capital mobilization to the private sector. A one standard deviation increase in the size of domestic credit (BANK) would increase the growth rate in real value added of the average industry by 2.32% per annum, the same order of magnitude as the estimates of the effect of bank development on per capita GDP (2.52%) in Levine (1998). Note, however, that a one standard deviation (0.329) increase is approximately the difference in size of domestic credit between India and the United States.

Industries that account for a larger portion of the country's manufacturing have higher growth rates. This may be a reflection of the effects of other sources of comparative advantage (i.e. other than the financial system). Developed countries have lower growth rates (the coefficient of log per capita GDP (not reported) is significantly negative) reflecting the convergence effect[7]. With respect to the latent variables, overall, the country, industry and time effects are significant in explaining variations in industry growth (all error components are statistically significant). Unobservable country factors appear to be relatively more important than the others. For example, based on model I, the sum of variances of the error components associated with country, industry, time and the noise term amount to 0.0340. Country, industry and time effects account for about 10% (i.e. 0.0033) of the total unexplained variations in industry growth, out of which country-specific (but industry and time invariant) factors account for more than 50% (i.e. 0.0018).

Panel (b) presents the relations between capital market functions and growth in real gross output (instead of value added). The results are qualitatively similar to the value-added regressions.

[7] The results here and in the sections to follow are not sensitive to inclusion or exclusion of these variables.

Table 5 presents the relations between productivity growth, which is an amalgam of technological change and efficiency gains, and capital market functions. TURNOVER - the governance proxy - has a statistically positive relation with productivity growth. On the other hand, while productivity growth is significantly related to the size of the credit sector (BANK and PRIVATE), it is not related to stock market capitalization (MKTCAP). This is consistent with Levine and Zervos (1998). The productivity consequences of the governance and allocation proxies are economically very significant. To illustrate, consider Mexico which has an average turnover of 0.5394 (Table 1) and a productivity growth of 0.9% (Table 1). Using our estimates in model I, if Mexico were able to increase market activity by a mere 10% of the present level, it would increase its rate of productivity growth of the average industry to about 0.12% per annum.

Including the proxies in combination (models V through XII), TURNOVER carries a strong positive coefficient, whereas the allocation proxies (BANK and PRIVATE) lose their significance. In impacting productivity growth, the governance function dominates the allocation role. In models VI, VIII and X, TURNOVER was interacted with MKTCAP, BANK and PRIVATE respectively to assess if the productivity impact of stock market governance depends on the relative importance of the credit sector vis a vis the stock market in capital provision. The interaction terms for BANK and PRIVATE are negative and significant. The marginal productivity effect of market-based governance is lower in countries where the credit sector is dominant in capital provision. This might be because in such economies, much of the governance is undertaken by the credit sector as well. To the extent that there are overlaps in the governance services provided through the two media, the more important is the credit sector as a conduit of capital, the lower would be the marginal benefit of stock market monitoring.

## *B*. Governance and Economic Performance: The Efficiency Channel

Productivity growth is an amalgam of effects of technological innovations and improvements in efficiency. This section explores in detail the impact of capital market functions on efficiency growth. My hypothesis is that financial markets through their information aggregation and monitoring function induce economic efficiency within the firm. I use a four-way error components (random effects) model of the following form:

(8) $$\Delta ECONEFF_{cit} = \beta_0 + \sum_k \beta^k F_{ct}{}^k + \gamma Z_{cit} + \varepsilon_{cit}$$

(9) $$\Delta PRODEFF_{cit} = \beta_0 + \sum_k \beta^k F_{ct}{}^k + \gamma Z_{cit} + \varepsilon_{cit}$$

where ΔECONEFF is the growth rate in the economic efficiency of industry i of country c in period t; and ΔPRODEFF is the growth rate in the production efficiency of industry i of country c in period t. $F_{ct}{}^k$ is the kth financial function variable for country c in period t. The finance function variables are TURNOVER, MKTCAP, BANK and PRIVATE. The model is a four way random-effects model with random country, industry, time effects as specified in equation (7) above.

Table 6 reports a very strong association between the degree to which capital markets perform their governance functions and improvements in industry economic efficiency (ΔECONEFF). In model I, TURNOVER – the governance proxy - enters with a positive coefficient that is statistically different from zero. The relation between MKTCAP and efficiency, while positive, lacks statistical significance (model II), as does the relation between the size of the credit sector (BANK and PRIVATE) and efficiency (models III and IV).

Higher TURNOVER is also accompanied by larger efficiency improvements on the margin after controlling for the other financial proxies. In model V, TURNOVER is positive (0.0057) and significant at 1% level, while MKTCAP is not different from zero. Similarly, in Models VII and IX, which includes the proxies for capital mobilization by the credit sector, TURNOVER is positive (0.0063 and 0.0062) and significant at 1%. The coefficients on the other variables fall sharply and remain statistically insignificant. Models VIII and X where TURNOVER is interacted with BANK and PRIVATE, the interaction term is negative and significant, indicating again that the marginal efficiency effect of market-based governance is lower in countries where the credit sector is the dominant medium for capital provision. Finally, in model XI, which include BANK and MKTCAP, the governance proxy, is robustly positive (0.0060, significant at 1%); and none of the other variables are marginally significant. The same result holds when we use PRIVATE in model XII. Thus, controlling for the allocation services of both stock markets and the credit sector, the proxy for the governance function of markets adds value to efficiency growth.

The evidence is consistent with the hypothesis that the information aggregation and monitoring function of markets determines the relative efficiency with which firms utilize resources. Increases in my proxy for the governance function raise industry efficiency after controlling for unobservable country, industry and time effects and other services provided by the financial sector. The contributions of these services to industry economic efficiency are economically large. For example, using the coefficient estimates in model I, a one standard deviation increase in the proxy for the governance function (0.294) would increase the growth rate in economic efficiency of the average industry by about 0.18% per annum. Accumulating over the 15 years of the sample period, the average industry would have been about 3% more efficient by the end of the study period, compared to the actual fifteen years median of 0.032 percent.

The results based on growth in production efficiency (ΔPRODEFF)*,* the alternative measure of efficiency, are presented in Table 7. In the individual regressions, TURNOVER again has a relatively large and positive effect on production efficiency (0.004 and significant at 1%). MKTCAP has no effect on production efficiency. On the other hand, BANK and PRIVATE have positive and significant coefficients in the individual regressions; but they lose significance once turnover is controlled for. The results from models V to XII are similar to the results on economic efficiency (ΔECONEFF) in Table 6.

In light of the structural differences between developed and emerging countries discussed in section III (A) above, I estimate equations (8) and (9) on the sub samples of developed and emerging countries separately. The results (not reported) are qualitatively similar to Table 6 and 7 for the total sample. TURNOVER is positively correlated with ΔECONEFF and none of the size variables enter the regressions with statistical significance. Raising TURNOVER also increases ΔPRODEFF in both sub-samples, while raising the size variables does not affect ΔPRODEFF. The consistency of the results across the sub-groups provides additional robustness.

## C. *Allocation and Economic Performance: The Technological Change Channel*

Productivity growth is made up of efficiency improvements and technological change. This section explores in detail the impact of capital market functions on technological change. My hypothesis is that the financial system through its allocation function enables firms to adopt technological innovations and inventions.

Table 8 presents the results in which I regress industry technological changes (TC) on proxies of the governance and allocation functions. In the individual regressions, TURNOVER fails to be statistically significant. MKTCAP enters positively but is significant only at 10%. On the other hand, both BANK and PRIVATE, my measures of the allocation function by credit markets, carry statistically significant positive coefficients, indicating a strong relation between the degree to which the supporting financial system provides allocation services and the rate of technological change attainable by industries. Raising the size of domestic credit (BANK) by one standard deviation (0.329) increases the rate of technical change of the average industry by about 0.07 percent per annum (double the effect of MKTCAP).

In version V, where MKTCAP appears with TURNOVER, both variables enter positively but both fail to be significant. In models VI and VII, where TURNOVER and MKTCAP are included respectively besides BANK, TURNOVER and MKTCAP fail to be significant while BANK is robustly positive (0.0025 and 0.0026). Increasing the size of domestic credit raises the rate of technological change even after controlling for effects of equity markets. Similarly, the coefficients of PRIVATE are significantly positive in models VIII and IX. Finally, in models X and XI, where both TURNOVER and MKTCAP appear in addition to BANK and PRIVATE respectively, only the credit market variables (BANK and PRIVATE) remain statistically significant. Controlling for the governance and allocation services of the equity market, increasing allocation by the credit sector increases the rate of technical change.

Industries that account for a larger portion of the country's manufacturing realize higher technical change. This may be a reflection of the effects of other sources of comparative advantage. Also, not surprisingly, industries in developed countries achieve higher rate of technical change.

Given the differences between developed and emerging countries discussed in section III (A) above, I estimate the model on the sub samples of developed and emerging countries separately. Again the results (not reported) are qualitatively similar to those on Table 8 for the total sample. Increasing BANK or PRIVATE – the proxies for Allocation – increases technological change in both sub samples, whereas TURNOVER and MKTCAP do not explain variation in technological change. As would be expected, the impact of mobilization in emerging markets appears to be larger than that in developed countries. While statistically significant, the coefficients for BANK and PRIVATE in emerging markets (0.0048 and 0.0087) are larger than those for the developed countries (0.0019 and 0.0020 respectively).

Overall, the results are consistent with the hypotheses. First, industries that are supported by financial systems with greater capital mobilization ability exhibit faster rates of technological change. This is true even after controlling for the governance function of the capital markets. Second, in its role as capital mobilizer, the credit sector appears to have stronger and larger impact on technological change than stock markets. The effects of BANK and PRIVATE on technological change remain significantly positive even in models that include MKTCAP. Third, the role of markets as providers of governance appears to have little impact on technical change. TURNOVER invariably fails to explain differences in technological change.

## V. Robustness

### A. Accounting Disclosure and Efficiency

I use market turnover as my main proxy for information production and monitoring. An alternative way to measure the degree of information flow in a capital market is to look at the accounting standards that determine the amount and quality of disclosure by firms trading in the market. I have an index of accounting reporting quality for different countries developed by the Center for International Financial Analysis and Research. The index rates the annual reports of at least three companies in each country based on the inclusion or omission of 90 reportable items. The sample of companies used in each country is designed to represent a cross-section of representative industries. The index could be viewed as a measure of the degree of sophistication and efficiency of the capital market in processing information. Also, more disclosure as measured by the index indicates the availability of public information that might be associated with some of the governance functions of markets we intend to measure. The index ranges from 0 to 90, the higher score indicating more mandated public disclosure. For our sample (I have the index only for 31 countries), the range is from 24 to 83, the lowest registered by Egypt and the highest by Sweden. The US scores 71 on this index. More developed countries have higher accounting standards (correlation with log per capita GDP is 0.56); yet, there are exceptions. The U.S. (score 71), Norway (74) and Canada (74), Australia (75), score less than that of Malaysia (78); whereas Philippines (65), and Mexico (60) score as high as Italy (65), Japan (62) and Germany (62).

Table 9 presents the results using this index, instead of TURNOVER, as a proxy for governance. Governance as measured by the index of accounting quality is strongly related with improvements in economic as well as production efficiency. The coefficient estimates of the accounting quality index in panel (a) and in panel (b) are positive (around 0.0001) and statistically significant at 5%). On the other hand, the index is not important in explaining differences in technological change (panel (c)). The index is also positive and significant on the margin in models II through VI in which we control for the capital mobilization proxies. Thus, after controlling for capital provision in equity market (models II and model V) and in credit markets (models III, IV, V and VI), higher accounting standard quality is related to larger gains in efficiency. Also, consistent with the earlier results, none of the proxies for allocation appear to be associated with efficiency gains. Thus, market-based governance is strongly related to firm efficiency, whether governance is measured in terms of level of market activity or in terms of quality of accounting disclosure.

## *B.* Causality Issues

So far, I examined the association between economic performance and the degree to which capital markets discharge governance and allocation services. I measure the latter using variables that I assume to be exogenous and predetermined. It may be argued that our proxies for capital market functions are not exogenous enough in that capital market development may simply be "a leading indicator rather than a causal factor". In an attempt to isolate the exogenous component of capital market functions, Table 10 uses two sets of variables as instruments. These are indices of investor-protecting legal codes, and country of legal origin. La Porta et al (1997) argues that legal protections and country's legal origin determine financial development and that these, in turn, are primarily determined by a country's colonial history. Hence, the two sets of variables would be ideal instruments for capital market functions in that while the variables are strongly correlated with our proxies, they do not directly correlate with economic performance. Levine and Zervos (1998) use these variables as instruments for financial development.

In Model I of Table 10, the component of TURNOVER predetermined by the extent of legal protection afforded to investors has a positive, statistically large impact on growth in economic efficiency (Panel (a)), and on growth in production efficiency (Panel (b)). The exogenous component of the governance proxy is robustly positively related to growth in economic and production efficiency on the margin after controlling for stock market size, and the size of the credit sector. Similarly, the size of the credit sector predetermined by the extent of legal protection is strongly related to technical change (Panel (c)). In Model II, the component of the governance proxy predetermined by legal origin has a significant positive impact on growth in economic efficiency (Panel (a)), and on growth in production efficiency (Panel (b)), as does the allocation proxy on the rate of technical change (Panel (c)). Hence, the relations between governance and efficiency, and allocation and technological change identified so far are less likely to be explained by endogeneity.

## VI. Conclusion

I examine the causal relations between capital market functions and firms' real economic performance focusing on the governance roles of capital markets. I begin from a premise that financial markets and institutions play two critical roles in an economy: allocation of risk capital through saving mobilization and risk-pooling and sharing (the allocation function); and promotion of responsible governance and control through providing outside investors a variety of mechanisms for monitoring inside decision makers (the governance function). The paper argues that the two functions systematically affect different sources of growth. Specifically, I argue that the governance services contribute to improvements in the relative efficiency with which the firm utilizes its resources, while the allocation function allows firms to adopt new and costly technologies. In so doing, I trace the mechanisms through which financial development influences economic growth.

Based on industry level data for ten manufacturing industries across thirty-eight countries over the period 1980-1995, I find evidence consistent with these hypotheses. First, I find that both governance and allocation are significant determinants of real output growth and productivity. Second, I report that the impact of governance on productivity dominates the impact of allocation. Third, I find that while governance works through the channel of improving economic efficiency to promote productivity, the allocation function affects the technological change component of productivity.

The finding of a strong association between economic performance and the effectiveness of financial markets suggests the importance of financial development as a policy for accelerating economic growth. It provides evidence that financial sector policies that promote financial market's functional capacities lead to better real economic performance. It points out the incompleteness of traditional development strategies that exclusively focus on real-sector reforms to induce economic development.

Furthermore, through linking the multiple functions of the financial system to the primal sources of economic performance, the study underscores the importance of a functional perspective in guiding financial sector policies. The study documents that the different functions of the financial system play distinct roles in the economic growth process. In particular, the governance function promotes economic efficiency. The depth of the financial infrastructure of an economy has to be judged in terms of the effectiveness and efficiency with which it delivers these multiple functions. A mere launching of financial markets and institutions is not sufficient for accelerating growth; what also matters is their efficient functioning.

The prevailing policy discussions of financial systems, particularly in developing countries, have focused on their role in mobilizing savings for industrialization. Such emphasis on the capital provision role was inevitable given the dominant economic thinking on the subject, the McKinnon-Shaw (see, McKinnon, 1973; and Shaw, 1973) paradigm, which views the financial system as a mere conduit of capital provision. In this study, based on a corporate-finance paradigm, I attempt to show the shortcomings of such a policy perspective by providing evidence that the value of financial markets lies in their governance services that are distinct from capital mobilization.

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# Table 1
## Financial Function Proxy Variables and Measures of Economic Performance: Averages over the period 1980-1995.

| | *Turnover Ratio* (TURNOVER) | *Stock Market Cap./GDP* (MKTCAP) | *Domestic Credit/GDP* (BANK) | *Private Credit/GDP* (PRIVATE) | *Growth in Real Value Added* (GV) | *Growth in Productivity* (PG) | *Growth in Economic Efficiency* (ΔECONEFF) | *Growth in Production Efficiency* (ΔPRODEFF) | *Technical Change* (TC) | *Industry Share in Manufacturing* (SHARE) | *Log(Per Capita GDP)* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Panel (a): Summary by Country** | | | | | | | | | | | |
| Australia | 0.2923 | 0.4712 | 0.6133 | 0.4930 | 0.008 | 0.020 | 0.0003 | -0.0000 | 0.023 | 0.043 | 9.704 |
| Austria | 0.4422 | 0.0783 | 1.1361 | 0.8656 | 0.019 | 0.028 | 0.0017 | 0.0007 | 0.023 | 0.038 | 9.856 |
| Bangladesh | 0.0327 | 0.0158 | 0.2976 | 0.1732 | 0.045 | -0.064 | -0.0074 | 0.0000 | -0.011 | 0.034 | 5.234 |
| Belgium | 0.1202 | 0.2767 | 0.9036 | 0.3970 | -0.001 | 0.003 | -0.0008 | -0.0015 | 0.027 | 0.032 | 9.791 |
| Canada | 0.3084 | 0.4687 | 0.5763 | 0.5021 | 0.030 | 0.019 | -0.0001 | -0.0000 | 0.024 | 0.029 | 9.899 |
| Chile | 0.0661 | 0.4717 | 0.7692 | 0.5848 | 0.053 | 0.038 | 0.0048 | 0.0120 | 0.012 | 0.026 | 6.086 |
| Colombia | 0.0863 | 0.0725 | 0.2091 | 0.1587 | 0.039 | 0.011 | 0.0009 | 0.0021 | 0.014 | 0.061 | 7.711 |
| Denmark | 0.2086 | 0.2386 | 0.5974 | 0.4461 | 0.029 | 0.018 | 0.0009 | 0.0014 | 0.020 | 0.050 | 7.096 |
| Egypt | 0.0636 | 0.0442 | 0.9532 | 0.2618 | 0.029 | 0.013 | -0.0002 | 0.0002 | 0.015 | 0.061 | 10.085 |
| Finland | 0.2019 | 0.1936 | 0.7882 | 0.7063 | 0.000 | 0.021 | 0.0016 | 0.0005 | 0.020 | 0.042 | 10.081 |
| Germany | 1.0394 | 0.1995 | 1.1282 | 0.8856 | 0.025 | 0.022 | 0.0003 | -0.0002 | 0.033 | 0.045 | 9.963 |
| Greece | 0.1218 | 0.0881 | 0.7134 | 0.2482 | 0.022 | 0.038 | 0.0022 | 0.0018 | 0.017 | 0.054 | 8.968 |
| India | 0.4261 | 0.1460 | 0.5075 | 0.2602 | 0.089 | 0.027 | 0.0040 | 0.0043 | 0.015 | 0.051 | 5.780 |
| Indonesia | 0.1855 | 0.0669 | 0.2557 | 0.2655 | 0.171 | 0.030 | 0.0033 | 0.0050 | 0.007 | 0.040 | 6.315 |
| Israel | 0.6492 | 0.3208 | 1.2850 | 0.6854 | -0.019 | -0.013 | -0.0039 | -0.0027 | 0.014 | 0.037 | 9.287 |
| Italy | 0.2986 | 0.1285 | 0.7939 | 0.3591 | -0.015 | -0.018 | -0.0031 | -0.0027 | 0.028 | 0.051 | 9.757 |
| Japan | 0.4329 | 0.7859 | 1.2702 | 1.0759 | 0.042 | 0.018 | 0.0002 | -0.0003 | 0.036 | 0.046 | 9.966 |
| Jordan | 0.1571 | 0.5552 | 0.8809 | 0.6056 | 0.008 | -0.021 | -0.0049 | -0.0045 | 0.022 | 0.123 | 7.008 |
| Korea | 0.8502 | 0.2710 | 0.5470 | 0.5155 | 0.113 | 0.049 | 0.0093 | 0.0054 | 0.022 | 0.055 | 8.527 |
| Kuwait | 0.2363 | 0.5051 | 0.6614 | 0.6219 | 0.030 | 0.007 | -0.0018 | 0.0015 | 0.000 | 0.026 | 9.632 |
| Malaysia | 0.2392 | 1.2054 | 0.7274 | 0.6362 | 0.108 | 0.019 | 0.0000 | 0.0016 | 0.016 | 0.043 | 7.730 |
| Mexico | 0.5394 | 0.1551 | 0.3576 | 0.1958 | 0.021 | 0.009 | -0.0015 | -0.0006 | 0.016 | 0.055 | 7.975 |
| Netherlands | 0.3656 | 0.4485 | 0.9683 | 0.7700 | 0.017 | 0.016 | 0.0002 | -0.0002 | 0.025 | 0.057 | 9.786 |
| New Zealand | 0.1854 | 0.4242 | 0.5030 | 0.4306 | -0.016 | 0.009 | -0.0004 | -0.0008 | 0.015 | 0.068 | 9.444 |
| Norway | 0.3265 | 0.1624 | 0.6211 | 0.5155 | -0.002 | 0.024 | 0.0011 | 0.0000 | 0.021 | 0.043 | 10.179 |
| Pakistan | 0.1413 | 0.0945 | 0.5135 | 0.2771 | 0.075 | -0.029 | -0.0025 | 0.0005 | 0.006 | 0.043 | 5.794 |
| Peru | 0.1630 | 0.0649 | 0.1606 | 0.1020 | -0.118 | -0.049 | -0.0110 | -0.0087 | 0.019 | 0.051 | 7.524 |
| Philippines | 0.2161 | 0.2419 | 0.3489 | 0.2544 | 0.017 | 0.033 | 0.0004 | 0.0017 | 0.010 | 0.058 | 6.566 |
| Portugal | 0.1537 | 0.0968 | 0.9816 | 0.5543 | 0.013 | 0.022 | 0.0024 | 0.0009 | 0.022 | 0.048 | 8.690 |
| Singapore | 0.3254 | 1.3511 | 0.7614 | 0.7564 | 0.040 | 0.012 | 0.0008 | 0.0003 | 0.013 | 0.037 | 9.422 |
| Spain | 0.2695 | 0.1966 | 0.9965 | 0.6928 | 0.011 | 0.013 | -0.0028 | -0.0019 | 0.025 | 0.045 | 6.496 |
| Sri Lanka | 0.0694 | 0.1333 | 0.4171 | 0.2138 | 0.155 | 0.054 | 0.0002 | 0.0003 | -0.005 | 0.079 | 9.344 |
| Sweden | 0.2984 | 0.4141 | 0.7613 | 0.4552 | 0.008 | 0.018 | 0.0001 | 0.0001 | 0.021 | 0.040 | 10.123 |
| Turkey | 0.5041 | 0.0624 | 0.3672 | 0.1894 | 0.054 | 0.028 | 0.0019 | 0.0014 | 0.018 | 0.046 | 7.880 |
| U. K. | 0.3783 | 0.8100 | 0.8814 | 0.7901 | 0.002 | 0.021 | -0.0051 | -0.0006 | 0.030 | 0.044 | 6.984 |
| U.S. | 0.5379 | 0.6273 | 0.8337 | 0.6891 | 0.033 | 0.031 | 0.0010 | 0.0002 | 0.035 | 0.039 | 9.654 |
| Venezuela | 0.1275 | 0.0717 | 0.2965 | 0.2271 | -0.005 | -0.005 | 0.0011 | 0.0004 | 0.024 | 0.047 | 9.949 |
| Zimbabwe | 0.0653 | 0.1705 | 0.2849 | 0.1286 | 0.027 | -0.032 | -0.0053 | -0.0037 | 0.004 | 0.071 | 7.876 |
| **Panel (b): Summary by Industry** | | | | | | | | | | | |
| Food Products (ISIC 311) | | | | | 0.036 | 0.012 | -0.0008 | 0.0000 | 0.022 | 0.116 | |
| Beverages (ISIC 313) | | | | | 0.041 | 0.023 | 0.0010 | 0.0014 | 0.023 | 0.041 | |
| Tobacco (ISIC 314) | | | | | 0.014 | 0.014 | 0.0012 | 0.0005 | 0.019 | 0.028 | |
| Textiles (ISIC 321) | | | | | -0.003 | 0.011 | -0.0011 | -0.0008 | 0.021 | 0.056 | |
| Wearing Apparel (ISIC 322) | | | | | 0.037 | 0.013 | 0.0003 | 0.0010 | 0.008 | 0.029 | |
| Industrial Chemicals(ISIC351) | | | | | 0.041 | 0.030 | 0.0012 | 0.0011 | 0.026 | 0.050 | |
| Rubber Products (ISIC355) | | | | | 0.006 | 0.006 | -0.0010 | -0.0008 | 0.017 | 0.015 | |
| Plastic Products (ISIC 356) | | | | | 0.062 | 0.015 | 0.0000 | 0.0011 | 0.014 | 0.021 | |
| Iron and Steel (ISIC 371) | | | | | -0.008 | 0.014 | -0.0008 | -0.0007 | 0.026 | 0.041 | |
| Machinery, except Electrical (ISIC 382) | | | | | 0.043 | 0.016 | -0.0001 | 0.0010 | 0.016 | 0.067 | |
| **Panel (c): Summary of Overall Sample** | | | | | | | | | | | |
| No. of observations | 3420 | 3203 | 3558 | 3558 | 3301 | 3272 | 3261 | 3272 | 3577 | 3508 | 38 |
| Mean | 0.282 | 0.272 | 0.668 | 0.476 | 0.027 | 0.015 | -0.0001 | 0.00035 | 0.019 | 0.047 | 8.477 |
| Median | 0.210 | 0.140 | 0.640 | 0.440 | 0.026 | 0.016 | 0.00032 | 0.00008 | 0.019 | 0.031 | 9.344 |
| Standard Dev. | 0.294 | 0.345 | 0.329 | 0.279 | 0.205 | 0.180 | 0.026 | 0.022 | 0.013 | 0.044 | 1.527 |
| Minimum | 0.005 | 0.001 | 0.078 | 0.021 | -0.976 | -1.076 | -0.215 | -0.201 | -0.029 | 0.001 | 5.234 |
| Maximum | 2.000 | 3.500 | 2.300 | 1.7600 | 0.960 | 0.950 | 0.268 | 0.291 | 0.056 | 0.326 | 10.179 |

Turnover Ratio is total market value of equity traded during the year relative to total stock market capitalization at the end of the year. Stock Market Capitalization to GDP is total market value of publicly traded equity at end of year as reported by IFC divided by the Gross Domestic Product of that year. Domestic credit to GDP ratio is the sum of assets held by the monetary authority and depository institutions excluding inter-bank deposits (i.e. IFS lines 32a-32f excluding 32e) divided by GDP. The ratio of private credit to GDP is the proportion of claims against the private sector (IFS line 32d) divided by GDP. Growth in real value added is the annual compounded growth rate in real value added for each of the ten industries in each of the thirty-eight countries over the period 1980 to 1995. Productivity and efficiency are computed based on parameter estimates of cross-country stochastic production and cost frontiers on the panel of industry production and cost data. Production efficiency is a Farrell (1957) output related measure of efficiency which measures the degree to which an industry diverges from the efficient production frontier. Economic efficiency measures the degree to which an industry diverges from the best practice cost frontier. Technological change measures the shift in the production frontier over time, and represents increases in real output (or decrease in total cost) due to adoption of better technology. Industry Share in Manufacturing is calculated by dividing the real output of the industry in the country by the total real output of the manufacturing sector of the country.

# Table 2

## Correlation Matrix

| | Turnover Ratio (TURNOVER) | Stock Market Capitalization (MKTCAP) | Domestic Credit (BANK) | Credit to Private Sector (PRIVATE) | Growth in Real Value Added (GV) | Growth in Productivity (PG) | Growth in Production Efficiency (ΔPRODEFF) | Growth in Economic Efficiency (ΔECONEFF) | Technical Change (TC) | Industry Share in Manufacturing (SHARE) |
|---|---|---|---|---|---|---|---|---|---|---|
| Stock Market Capitalization (MKTCAP) | 0.186$^{***}$ | | | | | | | | | |
| Domestic credit (BANK) | 0.249$^{***}$ | 0.242$^{***}$ | | | | | | | | |
| Credit to Private Sector (PRIVATE) | 0.328$^{***}$ | 0.517$^{***}$ | 0.774$^{***}$ | | | | | | | |
| Growth in Real Value Added (GV) | 0.120$^{***}$ | 0.008 | 0.004 | 0.043 | | | | | | |
| Growth in Productivity (PG) | 0.115$^{***}$ | 0.033 | 0.085$^{**}$ | 0.083$^{**}$ | 0.901$^{***}$ | | | | | |
| Growth in Production Efficiency (ΔPRODEFF) | 0.083$^{**}$ | 0.040 | 0.046 | 0.060 | 0.899$^{***}$ | 0.937$^{***}$ | | | | |
| Growth in Economic Efficiency (ΔECONEFF) | 0.140$^{***}$ | 0.011 | 0.049 | 0.074 | 0.740$^{***}$ | 0.831$^{***}$ | 0.895$^{***}$ | | | |
| Technical Change (TC) | 0.357$^{***}$ | 0.255$^{***}$ | 0.465$^{***}$ | 0.487$^{***}$ | -0.125$^{***}$ | 0.006 | -0.089$^{**}$ | 0.037 | | |
| Industry Share in Manufacturing (SHARE) | -0.031 | -0.071 | -0.061 | -0.108$^{**}$ | 0.063 | 0.008 | 0.052 | 0.048 | -0.028 | |
| Per capita GDP | 0.236$^{***}$ | 0.308$^{***}$ | 0.500$^{***}$ | 0.609$^{***}$ | -0.145$^{***}$ | 0.033 | -0.050 | 0.043 | 0.650$^{***}$ | -0.270$^{***}$ |

*, ** and *** indicate significance at the 10%, 5% and 1% respectively.

# Table 3

## Inter-Quartile Mean Differences in Industry Performance

| Variables | Bottom 25% | Middle 50% | Top 25% | Bottom 25% vs Top 25%: Wilcoxon Test | Bottom 25% vs Top 25%: T test |
|---|---|---|---|---|---|
| **Panel (a): Ranking by Stock Market Turnover Ratio** | | | | | |
| Growth in Real Value Added | 0.0240 | 0.0176 | 0.0468 | -3.48*** | -2.28** |
| Growth in Real Gross Output | 0.0330 | 0.0150 | 0.0443 | 1.87* | -1.42 |
| Growth in Productivity | 0.0073 | 0.0128 | 0.0268 | -3.77*** | -2.12** |
| Growth in Production Efficiency | -0.0002 | 0.0002 | 0.0013 | -2.81*** | -1.37 |
| Growth in Economic Efficiency | -0.0025 | 0.0001 | 0.0020 | -4.21*** | -3.17*** |
| Technical Change | 0.0133 | 0.0204 | 0.0246 | -18.51*** | -20.7*** |
| **Panel (b): Ranking by Market Capitalization** | | | | | |
| Growth in Real Value Added | 0.0237 | 0.0282 | 0.0334 | -1.85* | -0.89 |
| Growth in Real Gross Output | 0.0307 | 0.0257 | 0.0303 | -0.29 | 0.05 |
| Growth in Productivity | 0.0096 | 0.0209 | 0.0141 | -1.62 | -0.46 |
| Growth in Production Efficiency | -0.0006 | 0.001 | -0.00006 | -1.05 | -0.43 |
| Growth in Economic Efficiency | -0.0030 | 0.0013 | 0.0004 | -2.54** | -2.28** |
| Technical Change | 0.0134 | 0.0203 | 0.0250 | 16.05*** | -18.04*** |
| **Panel (c): Ranking by Domestic Credit to GDP** | | | | | |
| Growth in Real Value Added | 0.0268 | 0.0287 | 0.0315 | -0.24 | -0.41 |
| Growth in Real Gross Output | 0.0254 | 0.0287 | 0.0313 | 0.41 | -0.64 |
| Growth in Productivity | 0.0085 | 0.0151 | 0.0256 | -2.82*** | -1.67* |
| Growth in Production Efficiency | -0.0003 | 0.0007 | 0.0009 | -1.21 | -1.05 |
| Growth in Economic Efficiency | -0.0021 | 0.0009 | 0.0002 | -2.57*** | -1.59 |
| Technical Change | 0.00118 | 0.0195 | 0.0252 | 20.5*** | -23.1*** |
| **Panel (d): Ranking by Credit to Private Credit to GDP** | | | | | |
| Growth in Real Value Added | 0.0396 | 0.0240 | 0.0261 | 2.40** | 1.19 |
| Growth in Real Gross Output | 0.0376 | 0.0249 | 0.0260 | 2.72*** | 1.19 |
| Growth in Productivity | 0.0166 | 0.0155 | 0.0164 | -0.46 | 0.02 |
| Growth in Production Efficiency | 0.0013 | 0.0002 | 0.0003 | 1.14 | 0.80 |
| Growth in Economic Efficiency | -0.0008 | 0.0004 | -0.0001 | 0.11 | -0.53 |
| Technical Change | 0.0108 | 0.0207 | 0.0240 | 19.77*** | -21.9*** |
| **Panel (e): Ranking by average per capita GDP** | | | | | |
| Growth in Real Value Added | 0.0427 | 0.0230 | 0.0209 | 2.89*** | 2.05** |
| Growth in Real Gross Output | 0.0416 | 0.0253 | 0.0159 | 4.77*** | 2.97*** |
| Growth in Productivity | 0.0086 | 0.0131 | 0.0232 | -3.23*** | -1.51 |
| Growth in Production Efficiency | 0.0008 | 0.0002 | 0.0002 | -1.04 | 0.52 |
| Growth in Economic Efficiency | -0.0015 | 0.0002 | 0.0007 | -2.22** | -1.40 |
| Technical Change | 0.0097 | 0.0198 | 0.0262 | -26.4*** | -31.6*** |

Sample is classified into quartiles based on stock market turnover ratio, market capitalization, domestic credit, credit to private sector and average per capita GDP respectively over the period 1980-1995. Turnover Ratio is the value of total shares of stock traded divided by market capitalization. Stock Market Capitalization is the ratio of the total market value of publicly traded equity to GDP. Domestic Credit is the sum of assets held by the monetary authority and depository institutions excluding inter-bank transfer divided by GDP. Credit to Private Sector equals claims against the private sector divided by GDP. *, ** and *** indicate significance at the 10%, 5% and 1% respectively.

# Table 4

## Aggregate Performance and Capital Market Functions

| Dependent Variable | Panel (a) Growth in Real Value Added | | | | Panel (b) Growth in Real Gross Output | | | |
|---|---|---|---|---|---|---|---|---|
| **Independent Variables** | **I** | **II** | **III** | **IV** | **I** | **II** | **III** | **IV** |
| Turnover Ratio (TURNOVER) | 0.0570*** (0.015) | | | | 0.0358*** (0.012) | | | |
| Stock Market Capitalization (MKTCAP) | | 0.0161 (0.016) | | | | 0.0100 (0.013) | | |
| Domestic Credit (BANK) | | | 0.0706*** (0.021) | | | | 0.0854*** (0.018) | |
| Credit to Private Sector (PRIVATE) | | | | 0.0940*** (0.024) | | | | 0.1049*** (0.021) |
| Industry's Share in Manufacturing (SHARE) | 0.6178*** (0.097) | 0.6008*** (0.098) | 0.6159*** (0.102) | 0.6187*** (0.102) | 0.3830*** (0.081) | 0.3718*** (0.080) | 0.4085*** (0.087) | 0.4106*** (0.087) |
| Error Components | | | | | | | | |
| $\sigma_\alpha^2$ | 0.0018*** | 0.0013*** | 0.0020*** | 0.0015*** | 0.0014*** | 0.0011*** | 0.0019*** | 0.0015*** |
| $\sigma_\eta^2$ | 0.0007* | 0.0007* | 0.0006* | 0.0006* | 0.0005* | 0.0004* | 0.0004* | 0.0004* |
| $\sigma_\lambda^2$ | 0.0008** | 0.0009** | 0.0009** | 0.0009** | 0.0006** | 0.0007** | 0.0005** | 0.0006** |
| $\sigma_v^2$ | 0.0307*** | 0.0317*** | 0.0365*** | 0.0366*** | 0.0215*** | 0.0213*** | 0.0263*** | 0.0263*** |

The parameter estimates are maximum likelihood estimates of four-way error component models containing random country, industry and time effects. The dependent variables are the annual compound growth rate in the real value added and the annual compound growth rate in the real gross output for each of the ten industries over thirty-eight countries for the period 1980-1995. Turnover Ratio is the value of total shares of stocks traded divided by market capitalization. Stock Market Capitalization is the ratio of the total market value of publicly traded equity to GDP. Domestic Credit is the sum of assets held by the monetary authority and depository institutions excluding inter-bank transfer divided by GDP. Credit to Private Sector equals claims against the private sector divided by GDP. Industry Share in Manufacturing is calculated by dividing the real output of the industry in the country by the total real output of the manufacturing sector of the country. Coefficients of the intercept are not reported. Asymptotic standard errors are given in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% respectively.

# Table 5

## Productivity Growth and Capital Market Functions

| Variable | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turnover Ratio (TURNOVER) | 0.0389*** (0.011) | | | | 0.0344*** (0.010) | 0.0393*** (0.014) | 0.0385*** (0.012) | 0.1073*** (0.027) | 0.0393*** (0.012) | 0.0933*** (0.025) | 0.0348*** (0.010) | 0.0335*** (0.011) |
| Stock Market Capitalization (MKTCAP) | | -0.0077 (0.010) | | | -0.0087 (0.009) | -0.0020 (0.015) | | | | | -0.0087 (0.009) | -0.0090 (0.010) |
| Domestic Credit (BANK) | | | 0.0267** (0.012) | | | | -0.0016 (0.013) | 0.0218 (0.015) | | | -0.0093 (0.011) | |
| Credit to Private Sector (PRIVATE) | | | | 0.0426*** (0.015) | | | | | -0.0079 (0.017) | 0.0222 (0.020) | | -0.0007 (0.016) |
| Interaction | | | | | | -0.0190 (0.034) | | -0.079*** (0.028) | | -0.0934** (0.038) | | |
| Industry's Share in Manufacturing (SHARE) | 0.2431*** (0.072) | 0.2458*** (0.073) | 0.2486*** (0.072) | 0.2619*** (0.073) | 0.2230*** (0.071) | 0.2245*** (0.071) | 0.2539*** (0.072) | 0.2495*** (0.071) | 0.2525*** (0.072) | 0.2562*** (0.072) | 0.2281*** (0.069) | 0.2290*** (0.070) |
| Error Components | | | | | | | | | | | | |
| $\sigma_\alpha^2$ | 0.0001 | 0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | <0.0001 | <0.0001 |
| $\sigma_\eta^2$ | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| $\sigma_\lambda^2$ | 0.0008** | 0.0008** | 0.0009** | 0.0009** | 0.0007** | 0.0007** | 0.0008** | 0.0008** | 0.0008** | 0.0008** | 0.0007** | 0.0007** |
| $\sigma_\nu^2$ | 0.0267*** | 0.0272*** | 0.0300*** | 0.0300*** | 0.0258*** | 0.0258*** | 0.0266*** | 0.0266*** | 0.0266*** | 0.0266*** | 0.0257*** | 0.0257*** |

The parameter estimates are maximum likelihood estimates of four-way error component models containing random country, industry and time effects. The dependent variable is the annual growth in total factor productivity for each of the ten industries over thirty-eight countries for the period 1980-1995. Economic efficiency is in terms of deviation of actual cost to the optimal minimum cost on a stochastic cost frontier. Turnover Ratio is the value of total shares of stocks traded divided by market capitalization. Stock Market Capitalization is the ratio of the total market value of publicly traded equity to GDP. Domestic Credit is the sum of assets held by the monetary authority and depository institutions excluding inter-bank transfer divided by GDP. Credit to Private Sector equals claims against the private sector divided by GDP. The variable Interaction represents the product of the two other variables in the respective model. Industry Share in Manufacturing is calculated by dividing the real output of the industry in the country by the total real output of the manufacturing sector of the country. Coefficients of the intercept are not reported. Asymptotic standard errors are given in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% respectively.

# Table 6

## Growth in Economic Efficiency and Capital Market Functions

| Variable | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turnover Ratio (TURNOVER) | 0.0061$^{***}$ | | | | 0.0057$^{***}$ | 0.0077$^{***}$ | 0.0063$^{***}$ | 0.0181$^{***}$ | 0.0062$^{***}$ | 0.0152$^{***}$ | 0.0060$^{***}$ | 0.0057$^{***}$ |
| | (0.002) | | | | (0.002) | (0.002) | (0.002) | (0.004) | (0.002) | (0.004) | (0.002) | (0.002) |
| Stock Market Capitalization (MKTCAP) | | 0.0003 | | | -0.0002 | 0.0026 | | | | | -0.0001 | -0.0001 |
| | | (0.002) | | | (0.002) | (0.002) | | | | | (0.002) | (0.002) |
| Domestic Credit (BANK) | | | 0.0015 | | | | -0.0020 | 0.0021 | | | -0.0023 | |
| | | | (0.002) | | | | (0.002) | (0.002) | | | (0.002) | |
| Credit to Private Sector (PRIVATE) | | | | 0.0038 | | | | | -0.0013 | 0.0038 | | -0.0005 |
| | | | | (0.002) | | | | | (0.003) | (0.003) | | (0.003) |
| Interaction | | | | | | -0.0077 | | -0.014$^{***}$ | | - 0.0154$^{***}$ | | |
| | | | | | | (0.005) | | (0.004) | | (0.006) | | |
| Industry's Share in Manufacturing (SHARE) | 0.0236$^{**}$ | 0.0243$^{**}$ | 0.0283$^{**}$ | 0.0289$^{**}$ | 0.0221$^{**}$ | 0.0226$^{**}$ | 0.0256$^{***}$ | 0.0251$^{**}$ | 0.0255$^{**}$ | 0.0260$^{**}$ | 0.0244$^{***}$ | 0.0245$^{***}$ |
| | (0.011) | (0.011) | (0.011) | (0.011) | (0.011) | (0.011) | (0.011) | (0.011) | (0.011) | (0.011) | (0.011) | (0.011) |
| Error Components | | | | | | | | | | | | |
| $\sigma_\alpha^2$ | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| $\sigma_\eta^2$ | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| $\sigma_\lambda^2$ | <0.001$^{**}$ | <0.001$^{**}$ | <0.001$^{**}$ | <0.001$^{**}$ | <0.001$^{**}$ | <0.001$^{**}$ | <0.001$^{**}$ | <0.001$^{**}$ | <0.001$^{**}$ | <0.001$^{**}$ | <0.001$^{**}$ | <0.001$^{**}$ |
| $\sigma_\nu^2$ | 0.0006$^{***}$ | 0.0006$^{***}$ | 0.0006$^{***}$ | 0.0006$^{***}$ | 0.0006$^{***}$ | 0.0006$^{***}$ | 0.0006$^{***}$ | 0.0006$^{***}$ | 0.0006$^{***}$ | 0.0006$^{***}$ | 0.0006$^{***}$ | 0.0006$^{***}$ |

The parameter estimates are maximum likelihood estimates of four-way error component models containing random country, industry and time effects. The dependent variable is the annual compound growth rate in economic efficiency for each of the ten industries over thirty-eight countries for the period 1980-1995. Economic efficiency is in terms of deviation of actual cost from the optimal minimum cost on a stochastic cost frontier. Turnover Ratio is the value of total shares of stocks traded divided by market capitalization. Stock Market Capitalization is the ratio of the total market value of publicly traded equity to GDP. Domestic Credit is the sum of assets held by the monetary authority and depository institutions excluding inter-bank transfer divided by GDP. Credit to Private Sector equals claims against the private sector divided by GDP. The variable Interaction represents the product of the two other variables in the respective model. Industry Share in Manufacturing is calculated by dividing the real output of the industry in the country by the total real output of the manufacturing sector of the country. Coefficients of the intercept are not reported. Asymptotic standard errors are given in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% respectively.

# Table 7

## Growth in Production Efficiency and Capital Market Functions

| Variable | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turnover Ratio (TURNOVER) | 0.0040*** | | | | 0.0035*** | 0.0047*** | 0.0040*** | 0.0120*** | 0.0041*** | 0.0099*** | 0.0036*** | 0.0034*** |
| | (0.001) | | | | (0.001) | (0.002) | (0.001) | (0.003) | (0.001) | (0.004) | (0.001) | (0.001) |
| Stock Market Capitalization (MKTCAP) | | 0.00002 | | | -0.0002 | 0.0014 | | | | | -0.0003 | -0.0005 |
| | | (0.001) | | | (0.002) | (0.002) | | | | | (0.001) | (0.001) |
| Domestic Credit (BANK) | | | 0.0028* | | | | -0.0007 | 0.0020 | | | -0.0007 | |
| | | | (0.002) | | | | (0.002) | (0.002) | | | (0.001) | |
| Credit to Private Sector (PRIVATE) | | | | 0.0041** | | | | | -0.0014 | 0.0018 | | 0.0008 |
| | | | | (0.002) | | | | | (0.002) | (0.003) | | (0.002) |
| Interaction | | | | | | -0.0045 | | -0.009*** | | -0.0098** | | |
| | | | | | | (0.004) | | (0.003) | | (0.005) | | |
| Industry's Share in Manufacturing (SHARE) | 0.0166** | 0.0177** | 0.0204** | 0.0215** | 0.0147** | 0.0149** | 0.0180** | 0.0180** | 0.0178** | 0.0183** | 0.0162** | 0.0164** |
| | (0.008) | (0.008) | (0.009) | (0.009) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) |
| Error Components | | | | | | | | | | | | |
| $\sigma_\alpha^2$ | <0.001* | <0.001* | <0.001* | <0.001* | <0.001* | <0.001* | <0.001* | <0.001* | <0.001* | <0.001* | <0.001* | <0.001* |
| $\sigma_\eta^2$ | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| $\sigma_\lambda^2$ | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** |
| $\sigma_v^2$ | 0.0004*** | 0.0004*** | 0.0004*** | 0.0004*** | 0.0004*** | 0.0004*** | 0.0004*** | 0.0004*** | 0.0004*** | 0.0004*** | 0.0004*** | 0.0004*** |

The parameter estimates are maximum likelihood estimates of four-way error component models containing random country, industry and time effects. The dependent variable is the annual compound growth rate in production efficiency for each of the ten industries over thirty-eight countries for the period 1980-1995. Production efficiency is in terms of deviation of actual output from the optimal maximum output on a stochastic production frontier. Turnover Ratio is the value of total shares of stocks traded divided by market capitalization. Stock Market Capitalization is the ratio of the total market value of publicly traded equity to GDP. Domestic Credit is the sum of assets held by the monetary authority and depository institutions excluding inter-bank transfer divided by GDP. Credit to Private Sector equals claims against the private sector divided by GDP. The variable Interaction represents the product of the two other variables in the respective model. Industry Share in Manufacturing is calculated by dividing the real output of the industry in the country by the total real output of the manufacturing sector of the country. Coefficients of the intercept are not reported. Asymptotic standard errors are given in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% respectively.

# Table 8

## Technological Change and Capital Market Functions

| Variable | I | II | III | IV | V | VI | VII | VIII | IX | X | XI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Turnover Ratio (TURNOVER) | 0.0007<br>(0.0005) | | | | 0.0007<br>(0.0005) | | 0.0007<br>(0.0005) | 0.0007<br>(0.0005) | | 0.0007<br>(0.0005) | 0.0007<br>(0.0005) |
| Stock Market Capitalization (MKTCAP) | | 0.0010*<br>(0.0006) | | | 0.0009<br>(0.0006) | 0.0008<br>(0.006) | | | 0.0008<br>(0.0006) | 0.0008<br>(0.0006) | 0.0007<br>(0.0006) |
| Domestic Credit (BANK) | | | 0.0020***<br>(0.0007) | | | 0.0025***<br>(0.0008) | 0.0026***<br>(0.0008) | | | 0.0024***<br>(0.0008) | |
| Credit to Private Sector (PRIVATE) | | | | 0.0023***<br>(0.0008) | | | | 0.0034***<br>(0.0009) | 0.0030***<br>(0.0010) | | 0.0030***<br>(0.0010) |
| Industry's Share in Manufacturing (SHARE) | 0.0671***<br>(0.003) | 0.0667***<br>(0.003) | 0.0660***<br>(0.003) | 0.0660***<br>(0.003) | 0.0671***<br>(0.003) | 0.0671***<br>(0.003) | 0.0674***<br>(0.003) | 0.0674***<br>(0.003) | 0.0671***<br>(0.003) | 0.0674***<br>(0.003) | 0.0674***<br>(0.003) |
| Error Components | | | | | | | | | | | |
| $\sigma_\alpha^2$ | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** |
| $\sigma_\eta^2$ | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** |
| $\sigma_\lambda^2$ | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** |
| $\sigma_\nu^2$ | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** | <0.001*** |

The parameter estimates are maximum likelihood estimates of four-way error component models containing random country, industry and time effects. The dependent variable is the rate of technological change, computed based on estimate of the production frontier, for each of the ten industries over thirty-eight countries for the period 1980-1995. Turnover Ratio is the value of total shares of stocks traded divided by market capitalization. Stock Market Capitalization is the ratio of the total market value of publicly traded equity to GDP. Domestic Credit is the sum of assets held by the monetary authority and depository institutions excluding inter-bank transfer divided by GDP. Credit to Private Sector equals claims against the private sector divided by GDP. The variable Interaction represents the product of the two other variables in the respective model. Industry Share in Manufacturing is calculated by dividing the real output of the industry in the country by the total real output of the manufacturing sector of the country. Coefficients of the intercept are not reported. Asymptotic standard errors are given in parenthesis. . *, ** and *** indicate significance at the 10%, 5% and 1% respectively.

# Table 9

## Accounting Disclosure and Economic Performance

| Variables | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|
| **Panel (a): Dependent Variable: Growth in Economic Efficiency** | | | | | | |
| Accounting Standard Quality | 0.0113** | 0.0099** | 0.0108** | 0.0113** | 0.0093* | 0.0100** |
| (x100) | (0.005) | (0.005) | (0.005) | (0.005) | (0.005) | (0.005) |
| Market Capitalization (x100) | | -0.0854 | | | -0.0727 | -0.1162 |
| (MKTCAP) | | (0.152) | | | (0.160) | (0.166) |
| Domestic Credit (x100) | | | -0.0715 | | -0.0755 | |
| (BANK) | | | (0.199) | | (0.183) | |
| Credit to Private Sector (x100) | | | | -0.0031 | | 0.0981 |
| (PRIVATE) | | | | (0.249) | | (0.239) |
| Industry Share in | 1.883* | 1.849* | 2.023** | 2.032** | 1.995** | 2.017** |
| Manufacturing (x100) | (0.989) | (1.000) | (0.997) | (0.997) | (1.008) | (1.008) |
| (SHARE) | | | | | | |
| **Panel (b): Dependent Variable: Growth in Production Efficiency** | | | | | | |
| Accounting Standard Quality | 0.0086** | 0.0069** | 0.0092** | 0.0084** | 0.0079** | 0.0073** |
| (x100) | (0.004) | (0.003) | (0.004) | (0.004) | (0.003) | (0.003) |
| Market Capitalization (x100) | | -0.0787 | | | -0.1012 | -0.1373 |
| (MKTCAP) | | (0.107) | | | (0.111) | (0.118) |
| Domestic Credit (x100) | | | 0.0970 | | 0.0888 | |
| (BANK) | | | (0.047) | | (0.0125) | |
| Credit to Private Sector (x100) | | | | 0.0720 | | 0.1844 |
| (PRIVATE) | | | | (0.186) | | (0.169) |
| Industry Share in | 1.671** | 1.607** | 1.785** | 1.782** | 1.728** | 1.745** |
| Manufacturing (x100) | (0.759) | (0.762) | (0.765) | (0.765) | (0.767) | (0.768) |
| (SHARE) | | | | | | |
| **Panel (c): Dependent Variable: Technological Change** | | | | | | |
| Accounting Standard Quality | -0.0075 | -0.0087 | -0.0061 | -0.0081 | -0.0073 | -0.0090 |
| (x100) | (0.009) | (0.009) | (0.009) | (0.009) | (0.009) | (0.009) |
| Market Capitalization (x100) | | 0.1137* | | | 0.0991 | 0.0959 |
| (MKTCAP) | | (0.059) | | | (0.060) | (0.061) |
| Domestic Credit (x100) | | | 0.219*** | | 0.1840** | |
| (BANK) | | | (0.080) | | (0.085) | |
| Credit to Private Sector (x100) | | | | 0.2710*** | | 0.2208** |
| (PRIVATE) | | | | (0.097) | | (0.104) |
| Industry Share in | 7.104*** | 7.154*** | 7.123*** | 7.121*** | 7.170*** | 7.167*** |
| Manufacturing (x100) | (0.323) | (0.341) | (0.325) | (0.325) | (0.342) | (0.342) |
| (SHARE) | | | | | | |

The parameter estimates are maximum likelihood estimates of four-way error component models containing random country, industry and time effects. Accounting standard quality is an index of the quality of company financial disclosure across countries. Stock Market Capitalization is the ratio of the total market value of publicly traded equity to GDP. Domestic Credit is the sum of assets held by the monetary authority and depository institutions excluding inter-bank transfer divided by GDP. Credit to Private Sector equals claims against the private sector divided by GDP. Industry Share in Manufacturing is calculated by dividing the real output of the industry in the country by the total real output of the manufacturing sector of the country. Coefficients of the intercept are not reported. Asymptotic standard errors are given in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% respectively.

# Table 10

## Capital Market Functions and Economic Performance: Instrumental Variables

| Variables | I | II |
|---|---|---|
| **Panel (a): Dependent Variable: Growth in Economic Efficiency** | | |
| Turnover Ratio | 0.0187*** | 0.0171** |
| (TURNOVER) | (0.007) | (0.009) |
| Market Capitalization | 0.0008 | -0.0030 |
| (MKTCAP) | (0.004) | (0.004) |
| Domestic Credit | 0.0081 | -0.0099 |
| (BANK) | (0.006) | (0.009) |
| **Panel (b): Dependent Variable: Growth in Production Efficiency** | | |
| Turnover Ratio | 0.0105** | 0.0149* |
| (TURNOVER) | (0.005) | (0.008) |
| Market Capitalization | 0.0018 | -0.0019 |
| (MKTCAP | (0.003) | (0.003) |
| Domestic Credit | 0.0079 | -0.0108 |
| (BANK) | (0.005) | (0.008) |
| **Panel ( c): Dependent Variable: Technological Change** | | |
| Turnover Ratio | 0.0096 | 0.0112 |
| (TURNOVER) | (0.012) | (0.008) |
| Market Capitalization | 0.0179 * | -0.0019 |
| (MKTCAP) | (0.010) | (0.005) |
| Domestic Credit | 0.0371*** | 0.0241*** |
| (BANK) | (0.009) | (0.008) |

The parameter estimates are maximum likelihood estimates of four-way error component models containing random country, industry and time effects. In Model I, the instruments are index of shareholder's legal rights provided in the country's legal codes, index of legal rights protecting debt holders, judicial efficiency and an index of rule of law from La Porta et al (1998). In Model II, the instruments are the origin of a country's legal system. The legal origin variables include dummy variables for "English origin", "French origin", "German origin", and "Scandinavian origin" from La Porta et al (1998). Industry Share in Manufacturing is calculated by dividing the real output of the industry in the country by the total real output of the manufacturing sector of the country. Coefficients of the intercept are not reported. Asymptotic standard errors are given in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% respectively.

## Appendix 1: Decomposition of Productivity into Efficiency and Technical Change

I assume that there exists an unobservable function, a production frontier, representing the maximum attainable output level for a given combination of inputs. I represent these ***best-practice*** production technologies by a translog production function of the form[8],

(1A)
$$\ln y_{ci}(t) = \beta_0 + \sum_j \beta_j \ln x_{ci}^{\,j}(t) + \beta_t t + \tfrac{1}{2}\Big(\sum_j \sum_k \beta_{jk} \ln x_{ci}^{\,j}(t) \ln x_{ci}^{\,k}(t) + \beta_{tt} t^2\Big) + \sum_j \beta_{jt} \ln x_{ci}^{\,j}(t) t + \mu_{ci}(t) + \varepsilon_{ci}(t)$$

*where,*

$$\varepsilon_{ci}(t) = \alpha_c + \eta_i + \nu_{ci}(t)$$

$x_{ci}^{j}(t)$ and $x_{ci}^{k}(t)$ are production inputs j and k used in industry i of country c during period t. The production inputs are capital (K) and labor (L). The variable t, an index of time, represents the level of technology. $\mu_{ci}(t)$ is a one-sided random variable and measures the degree of ***inefficiency*** of industry i of country c in period t. The specification is a random-effects model in which latent country and industry effects are specified as random variables. $\alpha_c$ and $\eta_i$ are the random unobservable country-specific and industry-specific effects respectively, and $\nu_{ci}(t)$ is the usual white noise. The distributional assumptions on the error components are:

(1B)
$$\alpha_c \approx iidN(0, \sigma_\alpha^{\,2})$$
$$\eta_i \approx iidN(0, \sigma_\eta^{\,2})$$
$$\mu_{ci}(t) \approx iid - halfNormal(0, \sigma_\mu^{\,2}), and, \mu_{ci}(t) \leq 0$$
$$\nu_{ci}(t) \approx iidN(0, \sigma_\nu^{\,2})$$

From eq. (1A), the estimate of the rate of technological change (**TC**) for industry i in country c for period t is given by,

(1C)
$$TC_{cit} = \frac{\partial \ln y_{ci}(t)}{\partial t} = \beta_t + \sum_j \beta_{jt} \ln x_{ci}^{\,j}(t) + \beta_{tt} t$$

[8] Mychoice of this particular functional form is dictated by its flexibility reducing the chance of inferring inefficiency when in fact the problem is a poor fit to the data of a more restrictive form. Moreover, there is evidence that manufacturing production is non-homothetic and exhibits scale economies, both of which are accommodated in the translog form.

Using the predicted value of the inefficiency term ($\mu_{ci}(t)$) from eq. 1A, the level of production efficiency of industry i of country c during period t is:

(1D) $$PRODEFF_{cit} = e^{-\mu_{ci}(t)}$$

PRODEFF represents the ratio of actual output to the maximum attainable output if the industry were efficient, holding the technology (i.e. the production frontier) and the level of input usage constant. Its value ranges from 0 to 1(i.e.100% efficient). Growth in production efficiency (ΔPRODEFF) for industry i in country c over period (t) is then given by,

(1E) $$\Delta PRODEFF = \frac{\partial \ln PRODEFF_{cit}}{\partial t}$$

This estimate using the production function framework measures only production efficiency. It does not account for the possible error of the firm in choosing an appropriate input mix given relative prices (i.e. price inefficiency). I estimate an economic efficiency score that reflects both production and price efficiencies based on the dual stochastic cost frontier[9] [10]. After estimating a translog cost function analogous to eq. (1A), the level of economic efficiency for industry i, in country c, and in period t is:

(1F) $$ECONEFF_{ci}(t) = e^{-\theta_{ci}(t)}$$

where $\theta_{ci}(t)$ is a one-sided random variable denoting the degree of economic *inefficiency*. Eq. (1F) is the ratio of the minimum cost on the frontier to actual cost incurred and ranges in value from 0 (inefficient) to 100% (efficient). Growth in economic efficiency (**ΔECONEFF**) is then given by,

(1G) $$\Lambda ECONEFF_{ci}(t) = \frac{\partial \ln ECONEFF_{ci}(t)}{\partial t}$$

[9] A cost function maps cost-minimizing points where relative prices are set to equal marginal productivities. This is a result of an optimization problem in which the firm minimizes cost (choosing input levels) subject to the technological constraints represented by the production function. Thus, a production unit on the cost frontier is both technically and allocatively efficient. The deviation of actual cost from the cost frontier, holding output level and input prices constant, would naturally measure the amount of total economic inefficiency.

[10] Duality theory suggests that under certain regularity conditions, if producers pursue cost minimizing objective, the production function can be uniquely represented by a dual cost function.

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