

Finance and Growth:

Theory, Evidence, and Mechanisms

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I. Introduction

Nobel Prize Laureates and other influential economists disagree sharply about the role of the financial sector in economic growth. Finance is not even discussed in a collection of essays by the “pioneers of development economics,” which includes three winners of the Nobel Prize (Meier and Seers, 1984). Nobel Laureate Robert Lucas (1988) dismisses finance as a major determinant of economic growth calling its role “over-stressed.” Joan Robinson (1952, p. 86) famously argued that “where enterprise leads finance follows.” From this perspective, finance does not cause growth; finance responds automatically to changing demands from the “real sector.” At the other extreme, Nobel Laureate Merton Miller (1988, p.14) argues that, “[the idea] that financial markets contribute to economic growth is a proposition too obvious for serious discussion.” Similarly, Bagehot (1873), Schumpeter (1912), Gurley and Shaw (1955), Goldsmith (1969), and McKinnon (1973) have all rejected the idea that the finance-growth nexus can be safely ignored without substantially impeding our understanding of economic growth.

Resolving the debate and advancing our understanding about the role of financial factors in economic growth will help distinguish among competing theories of the process of economic growth. Furthermore, information on the importance of finance in the growth process will affect the intensity with which researchers study the determinants, consequences, and evolution of financial systems. Finally, a better understanding of the finance-growth nexus may influence public policy choices since legal, regulatory, tax, and macroeconomic policies all shape the operation of financial systems.

In reviewing the literature on the importance of financial systems for economic growth, the remainder of this paper is organized as follows. Section II reviews theoretical work on the connections between the operation of the financial sector and economic growth. Theoretical models show that financial instruments, markets, and institutions arise to mitigate the effects of information and transaction costs. Furthermore, theory demonstrates that differences in how well financial systems reduce information and transaction costs may influence saving rates, investment decisions, technological innovation, and steady-state growth rates. A comparatively less-developed theoretical literature examines how changes in economic activity can also influence financial systems with dynamic implications for economic growth. In all of these models, therefore, the financial sector provides a real service: it ameliorates information and transactions costs. Thus, these models eliminate the veil that sometimes rises between the so-called real and financial sectors.

Section III reviews the burgeoning empirical literature on finance and growth, which includes broad cross-country growth regressions, times-series analyses, panel studies, detailed country studies, and a recent movement to use more microeconomic-based studies that explore the mechanisms linking finance and growth. Besides reviewing the results, I critique the measures of financial development and describe some of the empirical methods. Each of the different econometric methodologies that have been used to study the finance-growth debate has serious shortcomings. Moreover, the empirical proxies of “financial development” frequently do not measure very accurately the concepts emerging from theoretical models.

Without ignoring the weaknesses of existing work and the absence of complete unanimity of results, three tentative observations emerge. Taken as a whole, existing work suggests that (1) countries with better functioning banks and markets grow faster, but the degree to which a country is bank-based or market-based does not matter much, (2) simultaneity bias does not seem to drive this conclusion, and (3) better functioning financial systems ease the external financing constraints that impede firm and industrial expansion, suggesting that this is one channel through which financial development matters for growth.

Section IV concludes. I use this section to (1) emphasize areas needing additional research and (2) discuss the fast-growing literature on the determinants of financial development. In particular, this new literature is motivated by the following question: If finance is important for growth, why do some countries have growth-promoting financial systems while others do not? Addressing this question is as fascinating and multi-disciplined, as it is important. Research on the determinants of financial development may fundamentally shape future research on this essay's core question: What is the role of financial factors in the process of economic growth?

Before continuing, it is important to emphasize that this review treats cursorily important issues. Here I highlight two. First, I do not discuss in sufficient depth the relationship between international finance and growth. This paper narrows its conceptual focus by studying the financial services available to an economy regardless of the geographic source of those services. A serious discussion of international finance and growth, however, would virtually double this already long review. There is a critical theoretical, empirical, and policy question, therefore, that only receives limited attention

in this essay: Can countries simply import financial services, or are there substantive growth benefits from countries having well-developed domestic financial systems.

Second, the paper only mentions policy in the conclusion. Given the links between the functioning of the financial system and economic growth, designing optimal financial sector policies is critically important. A rigorous discussion of financial sector policies, however, would require much more space. Instead, this chapter reviews the role of the financial system in economic growth and mentions ongoing work on the determinants – including policy determinants – of financial development in the conclusion.

II. Financial Development and Economic Growth: Theory

II.A. What is financial development?

The costs of acquiring information, enforcing contracts, and making transactions create incentives for the emergence of particular types of financial contracts, markets and intermediaries. Different types and combinations of information, enforcement, and transaction costs in conjunction with different legal, regulatory, and tax systems have motivated distinct financial contracts, markets, and intermediaries across countries and throughout history.

In arising to ameliorate market frictions, financial systems naturally influence the allocation of resources across space and time (Merton and Bodie, 1995, p. 12). To organize a discussion of how financial systems influence savings and investment decisions and hence economic growth, I focus on five functions provided by the financial system. That is, in easing information, enforcement, and transactions costs, financial systems provide five broad categories of services to the economy. While there are other ways to classify the functions of the financial system (Merton, 1992; Merton and Bodie,

1995), I believe that the following five categories are helpful in organizing a review of the theoretical literature and tying this literature to the history of economic thought on finance and growth.

In particular, financial systems:

- Produce information ex ante about possible investments and allocate capital
- Monitor investments and exert corporate governance after providing finance
- Facilitate the trading, diversification, and management of risk
- Mobilize and pool savings
- Ease the exchange of goods and services

While all financial systems provide these financial functions, there are large differences in how well financial systems provide these functions.

Financial development occurs when financial instruments, markets, and intermediaries ameliorate – though do not necessarily eliminate – the effects of information, enforcement, and transactions costs. Thus, financial development involves improvements in the (i) production of ex ante information about possible investments, (ii) monitoring of investments and implementation of corporate governance, (iii) trading, diversification, and management of risk, (iv) mobilization and pooling of savings, and (v) exchange of goods and services. Each of these financial functions may influence savings and investment decisions and hence economic growth. Since many market frictions exist and since laws, regulations, and policies differ markedly across economies, improvements along any single dimension may have different implications for resource allocation depending on other frictions.

In terms of integrating the links between finance and growth theory, two general points are worth stressing from the onset. First, a large growth accounting literature suggests that physical capital accumulation per se does not account for much of economic

growth.¹ Thus, if finance is to explain economic growth, we need theories that describe how financial development influences resource allocation decisions in ways that foster productivity growth.

Second, there are two general ambiguities between economic growth and the emergence of financial arrangements that improve resource allocation and reduce risk. Specifically, higher returns ambiguously affect saving rates due to well-known income and substitutions effects. Similarly, lower risk also ambiguously affects savings rates (Levhari and Srinivasan, 1969). Thus, financial arrangements that improve resource allocation and lower risk may lower saving rates. In a growth model with physical capital externalities, therefore, financial development could retard economic growth and lower welfare if the drop in savings and the externality combine to produce a sufficiently large effect. These ambiguities are general features of virtually all the models discussed below so I do not discuss them when describing each model.

The remainder of this section describes how market frictions motivate the emergence of financial systems that provide these five financial functions and also describes how the provision of these functions influence resource allocation and economic growth.

II.B. Producing information and allocating capital

There are large costs associated with evaluating firms, managers, and market conditions. Individual savers may not have the ability to collect, process, and produce information on possible investments. Since savers will be reluctant to invest in activities about which there is little reliable information, high information costs may keep capital from flowing to its highest value use. Thus, while many models assume that capital flows toward the most profitable firms, this presupposes that investors have good information about firms, managers, and market conditions. (Bagehot, 1873, p. 53)

Financial intermediaries may reduce the costs of acquiring and processing information and thereby improve resource allocation (Boyd and Prescott, 1986). Without intermediaries, each investor would face the large fixed cost associated with evaluating firms, managers, and economic conditions. Consequently, groups of individuals may form financial intermediaries that undertake the costly process of researching investment possibilities for others. In Boyd and Prescott (1986), financial intermediaries look like banks in that they accept deposits and make loans (Kashyap, Stein, and Rajan, 1998). Allen (1990), Bhattacharya and Pfleiderer (1985), and Ramakrishnan and Thakor (1984) also develop models where financial intermediaries arise to produce information on firms and sell this information to savers. Unlike in Boyd and Prescott (1986), however, the intermediary does not necessarily both mobilize savings and invest those funds in firms using debt contracts. For our purposes, the critical issue is that financial intermediaries -- by economizing on information acquisition costs-- improve the ex ante assessment of investment opportunities with positive ramifications on resource allocation.

By improving information on firms, managers, and economic conditions, financial intermediaries can accelerate economic growth. Assuming that many entrepreneurs solicit capital and that capital is scarce, financial intermediaries that produce better information on firms will thereby fund more promising firms and induce a more efficient allocation of capital (Greenwood and Jovanovic, 1990). The Greenwood and Jovanovic (1990) paper is also particularly novel because it formally models the dynamic interactions between finance and growth. Financial intermediaries produce better information, improve resource allocation, and foster growth. Growth means that more individuals can afford to join financial intermediaries, which improves the ability of the financial intermediaries to produce better information.

Besides identifying the best production technologies, financial intermediaries may also boost the rate of technological innovation by identifying those entrepreneurs with the best chances of successfully initiating new goods and production processes (King and Levine, 1993b). This lies at the core of Joseph Schumpeter's (1912, p. 74) view of finance in the process of economic development:

The banker, therefore, is not so much primarily a middleman ... He authorizes people in the name of society ... (to innovate).

Stock markets may also stimulate the production of information about firms. As markets become larger and more liquid, agents may have greater incentives to expend resources in researching firms because it is easier to profit from this information by trading in big and liquid markets (Grossman and Stiglitz, 1980) and more liquid (Kyle, 1984; and Holmstrom and Tirole, 1993). Intuitively, with larger and more liquid markets, it is easier for an agent who has acquired information to disguise this private information and make money by trading in the market. Thus, larger more liquid markets

will boost incentives to produce this valuable information with positive implications for capital allocation (Merton, 1987). While some models hint at the links between efficient markets, information, and steady-state growth (Aghion and Howitt, 1999), existing theories do not draw the connection between market liquidity, information production, and economic growth very tightly.

II.C. Monitoring firms and exerting corporate governance

Standard agency theory defines the corporate governance problem in terms of how equity and debt holders influence managers to act in the best interests of the providers of capital (e.g., Coase, 1937; Jensen and Meckling, 1976; Fama and Jensen, 1983a,b; Myers and Majluf, 1984). The absence of financial arrangements that enhance corporate governance may impede the mobilization of savings from disparate agents and thereby keep capital from flowing to profitable investments (Stiglitz and Weiss, 1983). To the extent that shareholders and creditors induce managers to maximize firm value, this will improve the efficiency with which firms allocate resources and make savers more willing to finance production and innovation. Since this vast literature has been insightfully reviewed (Shleifer and Vishny, 1997), we simply note a few ways in which financial markets and institutions may improve corporate governance and discuss how these arrangements influence capital accumulation, resource allocation, and long-run growth.

Although Berle and Means (1932) observed that small, diffuse equity holders may not find it worthwhile to undertake the costly process of exerting corporate governance and may instead attempt to free ride, much research argues that financial markets will develop effective mechanisms for exerting corporate control (Easterbrook and Fischel,

1991). According to this view, diffuse shareholders exert corporate governance by directly voting on crucial issues, such as mergers, liquidation, and fundamental changes in business strategy. Shareholders also oversee management indirectly by electing the boards of directors to monitor managers, writing managerial incentives contracts, and reviewing managerial decisions. Also, monitoring by a few large shareholders may ameliorate the free rider problem (Demsetz and Lehn, 1985). Furthermore, the threat of takeovers in a well-functioning equity market may reduce free riding and enhance corporate governance (Manne, 1965).²

Others, however, hold that large informational asymmetries between firm managers and potential investors, however, may (a) keep diffuse shareholders from effectively exerting corporate governance, (b) allow managers to use their effective control rights to pursue projects that benefit themselves rather than the firm (for citations, see Shleifer and Vishny, 1997), and therefore (c) hurt resource allocation unless alternative financial arrangements arise to improve corporate governance. Small shareholders frequently lack the expertise and incentives to monitor managers. General voting rights frequently do not work effectively because managers have enormous discretion over the flow of information. Furthermore, the elected representatives of shareholders, the boards of directors, often do not represent the interests of the minority shareholders because they are “captured by management.” Also, in many countries, legal codes do not protect the rights of minority shareholders and legal systems frequently do not enforce the legal codes that are actually on the books concerning minority shareholder rights. Thus, the large costs associated with verifying managerial

performance may impede diffuse equity holders from overseeing firm behavior effectively, with adverse effects on resource allocation and potentially economic growth.

Consequently, other types of financial arrangements besides diffuse equity holders may arise to reduce the corporate governance problem. An extensive literature demonstrates how debt contracts may arise to lower the costs of monitoring firm insiders (e.g., Townsend, 1979; Gale and Hellwig, 1985; Boyd and Smith, 1994).

Aghion, Dewatripont, and Rey (1999) link the use of debt contracts to growth. Using Jensen's "free cash flow argument," Aghion, Dewatripont, and Rey (1999) show that debt instruments reduce the amount of free cash available to firms. This in turn reduces managerial slack and accelerates the rate at which managers adopt new technologies.

In an extraordinarily influential paper, Diamond (1984) develops a model in which a financial intermediary improves corporate governance. The intermediary mobilizes the savings of many individuals and lends these resources to firms. This "delegated monitor" economizes on aggregate monitoring costs and eliminates the free-rider problem since the intermediary does the monitoring for all the investors. Furthermore, as financial intermediaries and firms develop long-run relationships, this can further lower information acquisition costs.

Financial intermediaries that reduce informational asymmetries may ease external financing constraints and facilitate better resource allocation. Boyd and Smith (1992) show that capital may flow from capital scarce regions to capital abundant regions if the capital abundant regions have financial intermediaries that are sufficiently more effective at reducing the costs of monitoring than the capital scarce regions. Thus, even though the

physical product of capital is higher in the capital scarce areas, investors recognize that their actual returns depend crucially on the monitoring performed by intermediaries.

Poor financial intermediation will lead to sub-optimal allocation of capital.

In terms of economic growth, Bencivenga and Smith (1993) show that financial intermediaries that improve corporate governance by economizing on monitoring costs will reduce credit rationing and thereby boost productivity, capital accumulation, and growth. Sussman (1993) and Harrison, Sussman, and Zeira (1999) develop models where financial intermediaries facilitate the flow of resources from savers to investors in the presence of informational asymmetries with positive growth effects. Focusing on innovative activity, De la Fuente and Marin (1996) develop a model in which intermediaries arise to undertake the particularly costly process of monitoring innovative activities. This improves credit allocation among competing technology producers with positive ramifications on economic growth.

Turning to equity markets, a large literature debates the importance of well functioning stock markets in promoting corporate governance. Influential work advertises the important governance role of markets (Jensen and Meckling, 1976). For example, public trading of shares in stock markets that efficiently reflect information about firms allows owners to link managerial compensation to stock prices. Linking stock performance to manager compensation helps align the interests of managers with those of owners (Diamond and Verrecchia, 1982; and Jensen and Murphy, 1990). Similarly, if takeovers are easier in well-developed stock markets and if managers of under-performing firms are fired following a takeover, then better stock markets can promote better corporate control by easing takeovers of poorly managed firms. The

threat of a takeover will help align managerial incentives with those of the owners (Scharfstein, 1988; and Stein, 1988). Many, however, argue that well functioning stock markets actually hurt corporate governance. I discuss this below when reviewing the bank-based versus market-based debate. Finally, I am not aware of models, however, that assess the role of markets in boosting steady-state growth through its impact on corporate governance.

II.D. Risk amelioration

With information and transactions costs, financial contracts, markets and intermediaries may arise to ease the trading, hedging, and pooling of risk with implications for resource allocation and growth. I divide the discussion into three categories: cross-sectional risk diversification, intertemporal risk sharing, and liquidity risk.

Traditional finance theory focuses on cross-sectional diversification of risk. Financial systems may mitigate the risks associated with individual projects, firms, industries, regions, countries, etc. Banks, mutual funds, and securities markets all provide vehicles for trading, pooling, and diversifying risk. The financial system's ability to provide risk diversification services can affect long-run economic growth by altering resource allocation and the saving rates. The basic intuition is straightforward. While savers generally do not like risk, high-return projects tend to be riskier than low-return projects. Thus, financial markets that ease risk diversification tend to induce a portfolio shift toward projects with higher expected returns (Gurley and Shaw, 1955; Patrick, 1966; Greenwood and Jovanovic, 1990; Saint-Paul 1992; Devereux and Smith, 1994; and Obstfeld, 1994).

Acemoglu and Zilibotti (1997) carefully model the links between cross-sectional risk, diversification, and growth. They note that (i) high-return, risky projects are frequently indivisible and require a large initial investment, (ii) people dislike risk, (iii) there are lower-return, safe projects, and (iv) capital is scarce. In the absence of financial arrangements that allow agents to hold diversified portfolios, agents will avoid the high-return, risky projects because they require agents to invest disproportionately in a risky endeavor. Acemoglu and Zilibotti (1997) endogenize the degree of diversification and examine the impact of diversification choices on economic growth. Financial systems that allow agents to hold a diversified portfolio of risky projects will permit society to invest more in high-return projects with positive implications for growth.

In terms of technological change, King and Levine (1993b) show that cross-sectional risk diversification can stimulate innovative activity. Agents are continuously trying to make technological advances to gain a profitable market niche. Engaging in innovation is risky, however. The ability to hold a diversified portfolio of innovative projects reduces risk and promotes investment in growth-enhancing innovative activities (with sufficiently risk averse agents). Thus, financial systems that ease risk diversification can accelerate technological change and economic growth.

Besides cross-sectional risk diversification, financial systems may improve intertemporal risk sharing. In examining the connection between cross-sectional risk sharing and growth, theory has tended to focus on the role of markets, rather than intermediaries. However, in examining intertemporal risk sharing, theory has focused on the advantageous role of intermediaries in easing intertemporal risk smoothing (Allen and Gale, 1997). Risks that cannot be diversified at a particular point in time, such as

macroeconomic shocks, can be diversified across generations. Long-lived intermediaries can facilitate intergenerational risk sharing by investing with a long-run perspective and offering returns that are relatively low in boom times and relatively high in slack times. While this type of risk sharing is theoretically possible with markets, intermediaries may increase the feasibility of intertemporal risk sharing by lowering contracting and transactions costs.

A third type of risk is liquidity risk. Liquidity is the ease and speed with which agents can convert financial instruments into purchasing power at agreed prices. Liquidity risk arises due to the uncertainties associated with converting assets into a medium of exchange. Informational asymmetries and transaction costs may inhibit liquidity and intensify liquidity risk. These frictions create incentives for the emergence of financial markets and institutions that augment liquidity.

The standard link between liquidity and economic development arises because some high-return projects require a long-run commitment of capital, but savers do not like to relinquish control of their savings for long-periods. Thus, if the financial system does not augment the liquidity of long-term investments, less investment is likely to occur in the high-return projects. Indeed, Hicks (1969, p. 143-145) argues that the products manufactured during the first decades of the Industrial Revolution had been invented much earlier. Rather, the critical innovation that ignited growth in 18th century England was capital market liquidity. With liquid capital markets, savers can hold liquid assets -- like equity, bonds, or demand deposits -- that they can quickly and easily sell if they seek access to their savings. Simultaneously, capital markets transform these liquid financial instruments into long-term capital investments. Thus, the industrial revolution

required a financial revolution so that large commitments of capital could be made for long periods (Bencivenga, Smith, and Starr, 1995)

In Diamond and Dybvig's (1983) seminal model of liquidity, a fraction of savers receive shocks after choosing between two investments: an illiquid, high-return project and a liquid, low-return project. Those receiving shocks want access to their savings before the illiquid project produces. This risk creates incentives for investing in the liquid, low-return projects. The model assumes that it is prohibitively costly to verify whether another individual has received a shock or not. This information cost assumption rules out state-contingent insurance contracts and creates an incentive for financial markets -- *markets where individuals issue and trade securities* -- to emerge.

Levine (1991) takes the Diamond Dybvig (1983) set-up, models the endogenous formation of equity markets, and links this to a growth model. Specifically, savers receiving shocks can sell their equity claims to the future profits of the illiquid production technology to others. Market participants do not verify whether other agents received shocks or not. Participants simply trade in impersonal stock exchanges. Thus, with liquid stock markets, equity holders can readily sell their shares, while firms have permanent access to the capital invested by the initial shareholders. By facilitating trade, stock markets reduce liquidity risk. Frictionless stock markets, however, do not eliminate liquidity risk. That is, stock markets do not replicate the equilibrium that exists when insurance contracts can be written contingent on observing whether an agent receives a shock or not. Nevertheless, as stock market transaction costs fall, more investment occurs in the illiquid, high-return project. If illiquid projects enjoy sufficiently large externalities, then greater stock market liquidity induces faster steady-state growth.

Thus far, information costs -- the costs of verifying whether savers have received a shock -- have motivated the existence of stock markets. Trading costs can also highlight the role of liquidity. In Bencivenga, Smith, and Starr (1995), high-return, long-gestation production technologies require that ownership be transferred throughout the life of the production process in secondary securities markets. If exchanging ownership claims is costly, then longer-run production technologies will be less attractive. Thus, liquidity -- as measured by secondary market trading costs -- affects production decisions. Greater liquidity will induce a shift to longer-gestation, higher-return technologies.

Besides stock markets, financial intermediaries may also enhance liquidity and reduce liquidity risk. As discussed above, Diamond and Dybvig's (1983) model assumes it is prohibitively costly to observe shocks to individuals, so it is impossible to write incentive compatible state-contingent insurance contracts. Under these conditions, banks can offer liquid deposits to savers and undertake a mixture of liquid, low-return investments to satisfy demands on deposits and illiquid, high-return investments. By providing demand deposits and choosing an appropriate mixture of liquid and illiquid investments, banks provide complete insurance to savers against liquidity risk while simultaneously facilitating long-run investments in high return projects. Banks replicate the equilibrium allocation of capital that exists with observable shocks. As noted by Jacklin (1987), however, the banking equilibrium is not incentive compatible if agents can trade in liquid equity markets. If equity markets exist, all agents will use equities; none will use banks. Thus, in this context, banks will only emerge to provide liquidity if there are sufficiently large impediments to trading in securities markets (Diamond,

1991).³ Under the assumption of pre-existing impediments to liquid equity markets, Bencivenga and Smith (1991) show that, by eliminating liquidity risk, banks can increase investment in the high-return, illiquid asset and accelerate growth.

Financial systems can also promote the accumulation of human capital by easing liquidity constraints. In particular, financial arrangements may facilitate borrowing for the accumulation of skills. If human capital accumulation is not subject to diminishing returns on a social level, financial arrangements that ease human capital creation help accelerate economic growth (DeGregorio, 1996).

Another form of liquidity involves firm access to credit. Holmstrom and Tirole (1998) note that firm production processes are long-term, uncertain, and subject to liquidity shocks. Thus, some firms may receive shocks after receiving outside financing and need additional injections of capital to complete the project. In the presence of informational asymmetries, intermediaries can sell an option to a line of credit during the initial financing of the firm that entitles the firm to access additional credit at an intermediate stage in certain states of nature. This improves the efficiency of the capital allocation process, but this type of liquidity has not been formally connected to models of economic growth.

II.E. Pooling of savings

Mobilization -- *pooling* -- is the costly process of agglomerating capital from disparate savers for investment. Mobilizing savings involves (a) overcoming the transaction costs associated with collecting savings from different individuals and (b) overcoming the informational asymmetries associated with making savers feel comfortable in relinquishing control of their savings. Indeed, much of Carosso's (1970) history of Investment Banking in America is a description of the diverse costs associated with raising capital in the United States during the 19th and 20th centuries.

In light of the transaction and information costs associated with mobilizing savings from many agents, numerous financial arrangements may arise to mitigate these frictions and facilitate pooling. Specifically, mobilization may involve multiple bilateral contracts between productive units raising capital and agents with surplus resources. The joint stock company in which many individuals invest in a new legal entity, the firm, represents a prime example of multiple bilateral mobilizations.

To economize on the costs associated with multiple bilateral contracts, pooling may also occur through intermediaries, where thousands of investors entrust their wealth to intermediaries that invest in hundreds of firms (Sirri and Tufano 1995, p. 83). For this to occur, "mobilizers" have to convince savers of the soundness of the investments (Boyd and Smith, 1992). Toward this end, intermediaries worry about establishing stellar reputations, so that savers feel comfortable about entrusting their savings to the intermediary (DeLong, 1991; and Lamoreaux, 1995).

Financial systems that are more effective at pooling the savings of individuals can profoundly affect economic development. Besides the direct effect of better savings

mobilization on capital accumulation, better savings mobilization can improve resource allocation and boost technological innovation. Without access to multiple investors, many production processes would be constrained to economically inefficient scales (Sirri and Tufano, 1995). (Bagehot 1873, p. 3-4) argued that a major difference between England and poorer countries was that in England the financial system could mobilize resources for “immense works.” Bagehot was very explicit in noting that it was not the national savings rate per se, it was the ability to pool society’s resources and allocate those savings toward the most productive ends. Furthermore, mobilization frequently involves the creation of small denomination instruments. These instruments provide opportunities for households to hold diversified portfolios (Sirri and Tufano, 1995). Acemoglu and Zilibotti (1997) show that with large, indivisible projects, financial arrangements that mobilize savings from many diverse individuals and invest in a diversified portfolio of risky projects facilitate a reallocation of investment toward higher return activities with positive ramifications on economic growth.

II.F. Easing exchange

Financial arrangements that lower transaction costs can promote specialization, technological innovation and growth. The links between facilitating transactions, specialization, innovation, and economic growth were core elements of Adam Smith’s (1776) Wealth of Nations. He argued that division of labor -- specialization -- is the principal factor underlying productivity improvements. With greater specialization, workers are more likely to invent better machines or production processes (Smith, 1776, p. 3).

Men are much more likely to discover easier and readier methods of attaining any object, when the whole attention of their minds is directed

towards that single object, than when it is dissipated among a great variety of things.

Smith (1776) focused on the role of money in lowering transaction costs, permitting greater specialization, and fostering technological innovation. Information costs, however, may also motivate the emergence of money. Since it is costly to evaluate the attributes of goods, barter exchange is very costly. Thus, an easily recognizable medium of exchange may arise to facilitate exchange (King and Plosser, 1986; and Williamson and Wright, 1994). The drop in transaction and information costs is not necessarily a one-time fall when economies move to money, however. Transaction and information costs may continue to fall through financial innovation.

Greenwood and Smith (1996) have modeled the connections between exchange, specialization, and innovation. More specialization requires more transactions. Since each transaction is costly, financial arrangements that lower transaction costs will facilitate greater specialization. In this way, markets that promote exchange encourage productivity gains. There may also be feedback from these productivity gains to financial market development. If there are fixed costs associated with establishing markets, then higher income per capita implies that these fixed costs are less burdensome as a share of per capita income. Thus, economic development can spur the development of financial markets.

In the Greenwood and Smith (1996) model, however, the reduction in transaction costs does not stimulate the invention of new and better production technologies. Instead, lower transaction costs expands the set of "on the shelf" production processes that are economically attractive. Also, the model defines better "market" as a system for supporting more specialized production processes. This does not explain the emergence

of financial instruments or institutions that lower transactions costs and thereby produce an environment that naturally promotes specialized production technologies. This is important because we want to understand the two links of the chain: what features of the economic environment create incentives for the emergence of financial arrangements, and what are the implications for economic activity of the emerging financial arrangements.

III. Are bank- or market-based systems better? Theory

III.A. The case for a bank-based system

Besides debates concerning the role of financial development in economic growth, financial economists have debated the comparative importance of bank-based and market-based financial systems for over a century (Goldsmith, 1969; Boot and Thakor, 1997; Allen and Gale, 2000; Demirguc-Kunt and Levine, 2001c). As discussed, financial intermediaries can improve the (i) acquisition of information on firms, (ii) intensity with which creditors exert corporate control, (iii) provision of risk-reducing arrangements, (iv) pooling of capital, and (v) ease of making transactions. These are arguments in favor of well-developed banks. They are not reasons for favoring a bank-based financial system.

Rather than simply noting the growth-enhancing role of banks, the case for a bank-based system derives from a critique of the role of markets in providing financial functions.

In terms of acquiring information about firms, Stiglitz (1985) emphasizes the free-rider problem inherent in atomistic markets. Since well-developed markets quickly reveal information to investors at large, this dissuades individual investors from devoting

resources toward researching firms. Thus, greater market development, in lieu of bank development, may actually impede incentives for identifying innovative projects that foster growth. Banks can mitigate the potential disincentives from efficient markets by privatizing the information they acquire and by forming long-run relationships with firms (Boot, Greenbaum, and Thakor, 1993). Banks can make investments without revealing their decisions immediately in public markets and this creates incentives for them to research firms, managers, and market conditions with positive ramifications on resource allocation and growth. Furthermore, Rajan and Zingales (1999) emphasize that powerful bank with close ties to firms may be more effective at exerting pressure on firms to repay their debts than atomistic markets.

On corporate governance, a large literature stresses that markets do not effectively monitor managers (Shleifer and Vishny, 1997). First, takeovers may not be an effective corporate control device because insiders have better information than outsiders. This informational asymmetry mitigates the takeover threat as a corporate governance mechanism since ill-informed outsiders will outbid relatively well-informed insiders for control of firms only when they pay too much (Stiglitz, 1985). Second, some argue that the takeover threat as a corporate control device also suffers from the free-rider problem. If an outsider expends lots of resources obtaining information, other market participants will observe the results of this research when the outsider bids for shares of the firm. This will induce others to bid for shares, so that the price rises. Thus, the original outsider who expended resources obtaining information must pay a higher price for the firm than it would have paid if “free-riding” firms could not bid for shares in a liquid equity market. The rapid public dissemination of costly information reduces incentives

for obtaining information, making effective takeover bids, and wielding corporate control (Grossman and Hart, 1980). Third, existing managers often take actions – poison pills – that deter takeovers and thereby weaken the market as an effective disciplining device (DeAngelo and Rice, 1983). There is some evidence that, in the United States, the legal system hinders takeovers and grants considerable power to management. Fourth, although in theory shareholder control management through boards of directors, an incestuous relationship may blossom between boards of directors and management (Jensen, 1993). Members of a board enjoy their lucrative fees and owe those fees to nomination by management. Thus, boards are more likely to approve golden parachutes to managers and poison pills that reduce the attractiveness of takeover. This incestuous link may further reduce the effectiveness of the market as a vehicle for exerting corporate control (Allen and Gale, 2000).

The liquidity of stock markets can also adversely influence resource allocation. Liquid equity markets may facilitate takeovers that while profiting the raiders may actually be socially harmful (Shleifer and Summers, 1988). Moreover, liquidity may encourage a myopic investor climate. In liquid markets, investor can inexpensively sell their shares, so that they have fewer incentives to undertake careful – and expensive – corporate governance (Bhide, 1993). Thus, greater stock market development may hinder corporate governance and induce an inefficient allocation of resources according to the bank-based view. As noted above, Allen and Gale (1997, 2000) argue that bank-based systems offer better intertemporal risk sharing services than markets with beneficial effects on resource allocation.

In response to the problems associated with relying on diffuse shareholders, large, concentrated ownership may arise to prevent managers from deviating too far from the interests of owners. Large investors have the incentives and ability to acquire information, monitor managers and exert corporate control. Concentrated ownership, however, raises other problems. Besides the fact that concentrated ownership implies that wealthy investors are not diversified (Acemoglu and Zilibotti, 1997), concentrated owners may benefit themselves at the expense of minority shareholders, debt holders, and other stakeholders in the firm, with adverse effects on corporate finance and resource allocation. Large investors may pay themselves special dividends, exploit business relationships with other firms they own that profit themselves at the expense of the corporation, and in general maximize the private benefits of control at the expense of minority shareholders (Dann and DeAngelo, 1985; Zingales, 1994). Furthermore, large equity owners may seek to shift the assets of the firm to higher-risk activities since shareholders benefit on the upside, while debt holders share the costs of failure. Thus, according to the bank-based view, concentrated ownership is unlikely to resolve the shortcomings associated with market-based systems.

In sum, proponents of bank-based systems argue that there are fundamental reasons for believing that market-based systems will not do a good job of acquiring information about firms and overseeing managers. This will hurt resource allocation and economic performance. Banks do not suffer from the same fundamental shortcomings as markets. Thus, they will do a correspondingly better job at researching firms, overseeing managers, and financing industrial expansion (Gerschenkron, 1962).

III.B. The case for a market-based system

The case for a market-based system is essentially a counterattack that focuses on the problems created by power banks.

Bank-based systems may involve intermediaries with a huge influence over firms and this influence may manifest itself in negative ways. For instance, once banks acquire substantial, inside information about firms, banks can extract rents from firms; firms must pay for their greater access to capital. In terms of new investments or debt renegotiations, banks with power can extract more of the expected future profits from the firm (than in a market-base system) (Hellwig, 1991). This ability to extract part of the expected payoff to potentially profitable investments may reduce the effort extended by firms to undertake innovative, profitable ventures (Rajan, 1992). Furthermore, Boot and Thakor (2000) model the potential tensions between bank-based systems characterized by close ties between banks and firms and the development of well-functioning securities markets.

Banks -- as debt issuers -- also have an inherent bias toward prudence, so that bank-based systems may stymie corporate innovation and growth (Morck and Nakamura, 1999). Weinstein and Yafeh (1998) find evidence of this in Japan. While firms with close ties to a "main bank" have greater access to capital and are less cash constrained than firms without a main bank, the main bank firms tend to (i) employ conservative, slow growth strategies and do not grow faster than firms without a "main bank," (ii) use more capital intensive processes than non-main bank firms holding other features constant, and (iii) produce lower profits, which is consistent with the powerful banks extracting rents from the relationship.

Allen and Gale (2000) further note that although banks may be effective at eliminating duplication of information gathering and processing, which is likely to be helpful when people agree about what needs to be gathered and how it should be processed, banks may be ineffective in non-standard environments. Thus, banks may not be effective gatherers and processors of information in new, uncertain situations involving innovative products and processes (Allen and Gale, 1999). Similarly, but in a model of loan renegotiations, Dewatripont and Maskin (1995) demonstrate that in a bank-based system characterized by long-run links between banks and firms, banks will have a difficult time credibly committing to not renegotiate contracts. In contrast, more fragmented banking systems can more easily commit to impose short-term, tighter budget constraints. The credible imposition of tight budget constraints may be necessary for the funding of newer, higher-risk firms. Thus, concentrated banks may be more conducive to the funding of mature, less risky firms, while more market-based systems, according to these theories, more easily support the growth of newer, riskier industries.

Another line of attack on the efficacy of bank-based systems involves corporate governance. Bankers act in their own best interests. Bankers may collude with firms against other creditors. Thus, influential banks may prevent outsiders from removing inefficient managers if these managers are particularly generous to the bankers (Black and Moersch, 1998).⁴ Wenger and Kaserer (1998) provide convincing evidence for the case of Germany. In Germany, bank managers voted the shares of a larger number of small stockholders. For instance, in 1992, bank managers exercised on average 61 percent of the voting rights of the 24 largest companies and in 11 companies this share was higher than 75%. This control of corporations by bank management extends to the

banks themselves! In the shareholder meetings of the three largest German banks, the percentage of proxy votes was higher than 80 percent, much of this voted by the banks themselves. For example, Deutsche Bank held voting rights for 47 percent of its own shares, while Dresdner votes 59 percent of its own shares (Charkham, 1994). Thus, the bank management has rested control of the banks from the owners of the banks and also exerts a huge influence on the country's major corporations. Wenger and Kaserer (1998) also provide examples in which banks misrepresent the accounts of firms to the public and systematically fail to discipline management. Thus, to extent that banks actually weaken corporate governance, bank-based systems represent sub-optimal mechanisms for overseeing firms and improving resource allocation.

Finally, proponents of market-based financial systems claim that markets provide a richer set of risk management tools that permit greater customization of risk ameliorating instruments. While bank-based systems may provide inexpensive, basic risk management services for standardized situations, market-based systems provide greater flexibility to tailor make products. Thus, as economies mature and need a richer set of risk management tools and vehicles for raising capital, they may concomitantly benefit from a legal and regulatory environment that supports the evolution of market-based activities, or overall growth may be retarded.⁵

III.C. Financial function and legal views

Some reject the importance of the bank-based versus market-based debate. As noted above, information, transaction, and enforcement costs create incentives for the emergence of financial markets and intermediaries. In turn, these components of the financial system provide financial functions: they evaluate project, exert corporate control, facilitate risk management, ease the mobilization of savings, and facilitate exchange. Thus, the financial function view rejects the importance of distinguishing financial systems as bank-based or market-based (Merton, 1992, 1995; Merton and Bodie, 1995; Levine, 1997). According to this view, the exact composition of the financial system is of secondary importance.

Furthermore, the financial function view notes that markets and banks may provide complementary services (Boyd and Smith, 1998; Levine and Zervos, 1998a; Huybens and Smith, 1999). For instance, stock markets may positively affect economic development even though not much capital is raised through them. Specifically, stock markets may play a prominent role in facilitating custom-made risk management services and boosting liquidity. In addition, stock markets may complement banks. For instance, by spurring competition for corporate control and by offering alternative means of financing investment, securities markets may reduce the potentially harmful effects of excessive bank power.

While the theoretical literature is making progress in modeling the co-evolution of banks and markets (Boyd and Smith, 1996; Allen and Gale, 2000), some microeconomic evidence suggest the important complementarities between intermediaries and markets. Using firm-level data, Demirguc-Kunt and Maksimovic (1996) show that increases in

stock market development actually tend to increase the use of bank finance in developing countries. Thus, these two components of the financial system may act as complements during the development process. We may not want to view bank-based and market-based systems as representing a tradeoff in all circumstances. Policymakers may instead want to focus on providing a legal and regulatory environment that allows both banks and markets to flourish without tipping the playing field in favor of either banks or markets

La Porta et al. (2000) reject the primacy of the bank-based versus market-based debate and instead argue that the legal system is the fundamental source of differences in the level of financial development. The law and finance view holds that finance is a set of contracts. These contracts are defined and made more or less effective by legal rights and enforcement mechanisms. From this perspective, a well-functioning legal system facilitates the operation of both markets and intermediaries. It is the overall level and quality of the financial functions that are provided to the economy that influences resource allocation and economic growth. The law and finance view holds that distinguishing countries by the efficiency of national legal systems in supporting financial transactions is more useful than distinguishing countries by whether they have bank-based or market-based financial systems. While focusing on the law is not inconsistent with banks or markets playing a particularly important role, La Porta et al. (2000) clearly argue that legal institutions are a more useful way to distinguish financial systems than focusing on whether a countries are bank-based or market-based.

IV. Evidence on Finance and Growth

Empirical work on finance and growth assesses the impact of the operation of the financial system on economic growth, whether the impact is economically large, and whether certain components of the financial system, e.g., banks and stock markets, play a particularly important role in fostering growth at certain stages of economic development.

This section is organized around econometric approaches to examining the relationship between finance and growth. Thus, the first subsection discusses cross-country studies of growth and finance. The second subsection presents evidence from panel studies, pure time-series investigations, and country case-studies. The third subsection examines industry and firm level analyses that provide direct empirical evidence on the mechanisms linking finance and growth. Finally, I summarize existing work on the relationship between financial structure – the degree to which an economy is bank-based or market-based – and economic growth.

The organization of the empirical evidence advertises an important weakness in the finance and growth literature: there is frequently an insufficiently precise link between theory and measurement. Theory focuses on particular functions provided by the financial sector – producing information, exerting corporate governance, facilitating risk management, pooling savings, and easing exchange – and how these influence resource allocation decisions and economic growth. Thus, I would prefer to organize the empirical section around studies that precisely measure each of the functions stressed by theory. Similarly, while empirical studies focus on measures of the size of banks or stock markets, Petersen and Rajan (1997) and Demirguc-Kunt and Maksimovic (2001) show that firms frequently act as financial intermediaries in providing trade credit to related

firms. This source of financial intermediation may be very important, especially in countries with regulatory restrictions on financial intermediaries and in countries with undeveloped legal systems that do not effectively support formal financial development. This further advertises the sub-optimal connection between theory and measurement in much of the finance and growth literature.

While fully recognizing this problem, many of the biggest advances in empirical studies of finance and growth have been methodological. Thus, I organize the discussion around econometric approaches. While serious improvements have been made in measuring financial development, which I discuss below, future research that more concretely links the concepts from theory with the data will substantively improve our understanding of the finance and growth link.

IV.A. Cross-Country Studies of Finance and Growth

1. Goldsmith, the question, and the problems

Goldsmith (1969) motivated his path breaking study of finance and growth as follows.

One of the most important problems in the field of finance, if not the single most important one, ... is the effect that financial structure and development have on economic growth. (p. 390)

Thus, he sought to assess whether finance exerts a causal influence on growth and whether the mixture of markets and intermediaries operating in an economy influences economic growth. Toward this end, Goldsmith (1969) carefully compiled data on 35 countries over the period 1860 to 1963 on the value of financial intermediary assets as a share of economic output. He assumed, albeit with ample qualifications, that the size of

the financial intermediary sector is positively correlated with the provision and quality of financial functions provided by the financial sector to the rest of the economy.

Goldsmith (1969) met with varying degrees of success in providing confident answers to these questions. After showing that financial intermediary size relative to the size of the economy rises as countries develop, Goldsmith graphically documented a positive correlations between financial development and the level of economic activity. Goldsmith just as clearly asserted his unwillingness to draw causal interpretations from his graphical presentations. Thus, Goldsmith ultimately did not take a stand on whether financial causes growth. In terms of the relationship between economic growth and the structure of the financial system, Goldsmith was unable to provide much cross-country evidence because of the absence of data on securities market development for a broad range of countries.

Goldsmith's (1969) work raises several problems, all of which Goldsmith presciently stresses, that subsequent work has tried to resolve.

- (1) The investigation involves only 35 countries.
- (2) It does not systematically control for other factors influencing economic growth.
- (3) It does not examine whether financial development is associated with productivity growth and capital accumulation, which theory stresses.
- (4) The indicator of financial development, which is a measure of the size of the financial intermediary sector, may not represent an accurate proxy for the functioning of the financial system.
- (5) The close association between financial system size and growth does not identify the direction of causality.
- (6) The study did not shed light on the whether the mix of financial markets and institutions operating in an economy exerts a first-order impact on economic growth.

2. More countries, more controls, and predictability

In the early 1990s, King and Levine (1993a, henceforth KL) built on Goldsmith's work. They study 77 countries over the period 1960-1989, systematically control for other factors affecting long-run growth, examine the capital accumulation and productivity growth channels, construct additional measures of the level of financial development, and analyze whether the level of financial development predicts long-run economic growth, capital accumulation, and productivity growth.

In terms of measures of financial development, KL first examine DEPTH, which is simply a measure of the size of financial intermediaries. It equals liquid liabilities of the financial system (currency plus demand and interest-bearing liabilities of banks and nonbank financial intermediaries) divided by GDP. They also construct the variable BANK that measures the relative degree to which the central bank and commercial banks allocate credit. BANK equals the ratio of bank credit divided by bank credit plus central bank domestic assets. The intuition underlying this measure is that banks are more likely to provide the five financial functions than central banks. There are two notable weaknesses with this measure, however. Banks are not the only financial intermediaries providing valuable financial functions and banks may simply lend to the government or public enterprises. KL also examine PRIVY, which equals credit to private enterprises divided by GDP. The assumption underlying this measure is that financial systems that allocate more credit to private firms are more engaged in researching firms, exerting corporate control, providing risk management services, mobilizing savings, and facilitating transactions than financial systems that simply funnel credit to the government or state owned enterprises. While BANK and PRIVY seek to improve upon

DEPTH by capturing who is doing the allocating and to whom society's savings are flowing, these measures still do not directly proxy for the five financial functions stressed in theoretical models of finance and growth. KL find very consistent results across the different financial development indicators.

KL then assess the strength of the empirical relationship between each of these indicators of the level of financial development averaged over the 1960-1989 period and three growth indicators also averaged over the 1960-1989 period. The three growth indicators are as follows: (1) the average rate of real per capita GDP growth, (2) the average rate of growth in the capital stock per person, and (3) total productivity growth, which is a "Solow residual" defined as real per capita GDP growth minus (0.3) times the growth rate of the capital stock per person. In other words, if $F(i)$ represents the value of the i th indicator of financial development averaged over the period 1960-1989, $G(j)$ represents the value of the j th growth indicator (per capita GDP growth, per capita capital stock growth, or productivity growth) averaged over the period 1960-1989, and X represents a matrix of conditioning information to control for other factors associated with economic growth (e.g., income per capita, education, political stability, indicators of exchange rate, trade, fiscal, and monetary policy), then they estimated the following regressions on a cross-section of 77 countries:

$$G(j) = \alpha + \beta F(i) + \gamma X + \varepsilon.$$

Table 1 is adapted from KL and indicates that there is a strong positive relationship between each of the financial development indicators, $F(i)$, and the three growth indicators $G(i)$, long-run real per capita growth rates, capital accumulation and

productivity growth. The sizes of the coefficients are economically large. Ignoring causality, the coefficient on DEPTH implies that a country that increased DEPTH from the mean of the slowest growing quartile of countries (0.2) to the mean of the fastest growing quartile of countries (0.6) would have increased its per capita growth rate by almost 1 percent per year. This is large. The difference between the slowest growing 25 percent of countries and the fastest growing quartile of countries is about five percent per annum over this 30-year period. Thus, the rise in DEPTH alone eliminates 20 percent of this growth difference. King and Levine (1993b,c) confirm these findings using alternative econometric methods and robustness checks.

To examine whether finance simply follows growth, KL study whether the value of financial depth in 1960 predicts the rate of economic growth, capital accumulation, and productivity growth over the next 30 years. Table 2 summarizes these results. The dependent variable is, respectively, real per capital GDP growth, real per capita capital stock growth, and productivity growth averaged over the period 1960-1989. The financial indicator in each of these regressions is the value of DEPTH in 1960. The regressions indicate that financial depth in 1960 is a good predictor of subsequent rates of economic growth, physical capital accumulation, and economic efficiency improvements over the next 30 years even after controlling for income, education, and measures of monetary, trade, and fiscal policy. The relationship between the initial level of financial development and growth is economically large. For example, the estimated coefficients suggest that if in 1960 Bolivia had increased its financial depth from 10 percent of GDP to the mean value for developing countries in 1960 (23 percent), then Bolivia would have grown about 0.4 percent faster per annum, so that by 1990 real per capita GDP would

have been about 13 percent larger than it was. These examples do not consider causal issues or how to increase financial development. They simply illustrate the potentially large long-term growth effects from changes in financial development.

La Porta et al (2001) use an alternative indicator of financial development. They examine the degree of public ownership of banks around the world. To the extent that publicly-owned banks are less effective at acquiring information about firms, exerting corporate governance, mobilizing savings, managing risk, and facilitating transactions, then this measure provides direct evidence on connection between economic growth and the services provided by financial intermediaries. The authors show that (1) higher degrees of public ownership are associated with lower levels of bank development and (2) high levels of public ownership of banks are associated with slower economic growth.

While addressing many of the weaknesses in earlier work, cross-country growth regressions do not eliminate them. Thus, while KL show that finance predicts growth, they do not deal formally with the issue of causality. While researchers improve upon past measures of financial development, they only focus on one segment of the financial system, banks, and their indicators do not directly measure the degree to which comparative financial systems ameliorate information and transaction costs.

3. Adding stock markets to cross-country studies of growth.

There are good reasons to study the relationship between long-run economic growth and the operation of equity markets. First, as stressed above, theoretical debate exists on whether larger, more liquid equity markets exert a positive or negative influence on economic growth, capital accumulation, and productivity growth. Second, as stressed above, some theories focus on the competing roles of banks and markets in funding

corporate expansion, while others stress that banks and markets may arise, coexist, and prosper by providing different financial functions to the economy, and still other theories stress complementarities between banks and markets. Thus, simultaneously considering the potential roles of banks and markets permits one to distinguish among competing theories and provide evidence to policy makers on the independent roles of markets and banks in the process of economic growth.

Levine and Zervos (1998a, henceforth LZ) construct numerous measures of stock market development to assess the relationship between stock market development and economic growth, capital accumulation, and productivity growth in a sample of 42 countries over the 1976-93 period.⁶ They control for many other potential growth determinants, including banking sector development. Their study builds on pioneering work by Atje and Jovanovic (1993).

For brevity, I focus on only one of LZ's liquidity indicators, the turnover ratio. This equals the total value of shares traded on a country's stock exchanges divided by stock market capitalization (the value of listed shares on the country's exchanges). The turnover ratio is not a direct measure of trading costs or of the ability to sell securities at posted prices. Rather, the turnover ratio measures trading relative to the size of the market. It therefore reflects trading frictions and information that induces transactions. This ratio exhibits substantial cross-country variability. Very active markets such as Japan and the United States had turnover ratios of almost 0.5 during the 1976-93 period, while less liquid markets, such as Bangladesh, Chile, and Egypt have turnover ratios of 0.06 or less.

As summarized in Table 3, Levine and Zervos find that the initial level of stock market liquidity and the initial level of banking development (Bank Credit) are positively and significantly correlated with future rates of economic growth, capital accumulation, and productivity growth over the next 18 years even after controlling for initial income, schooling, inflation, government spending, the black market exchange rate premium, and political stability. Bank credit equals bank credit to the private sector as a share of GDP.⁷ These results are consistent with the view that stock market liquidity facilitates long-run growth (Levine, 1991; Holmstrom and Tirole, 1993; Bencivenga et al., 1995) and not supportive of models that emphasize the negative aspects of stock markets liquidity (Bhide, 1993). Furthermore, the results do not lend much support to models emphasize the tensions between bank-based and market-based systems. Rather, the results suggest that stock markets provide different financial functions from those provided by banks, or else they would not both enter the growth regression significantly.

The sizes of the coefficients also suggest an economically meaningful relationship. For example, the estimated coefficient implies that a one-standard-deviation increase in initial stock market liquidity (0.30) would increase per capita GDP growth by 0.80 percentage points per year (2.7×0.3). Accumulating over 18 years, this implies real GDP per capita would have been over 15 percentage points higher by the end of the sample. Similarly, the estimated coefficient on Bank Credit implies a correspondingly large growth effect. That is, a one-standard deviation increase in Bank Credit (0.5) would increase growth by 0.7 percentage point per year (1.3×0.5). Taken together, the results imply that if a country had increased both stock market liquidity and bank development by one-standard deviation, then by the end of the 18-year sample period,

real per capita GDP would have been almost 30 percent higher and productivity would have been almost 25 percent higher. As emphasized throughout, these conceptual experiments do not consider the question of causality or how to change the operation of the financial sector. The examples simply illustrate the potential growth effects of financial development. LZ go on to argue that the link between stock markets, banks, and growth runs most robustly through productivity growth, rather than physical capital accumulation, which is consistent with some theoretical models (Levine, 1991; Bencivenga, Smith, and Starr, 1995).

LZ also find that stock market size, as measured by market capitalization divided by GDP, is not robustly correlated with growth, capital accumulation, and productivity improvements. This is consistent with theory. Simply listing on the national stock exchange does not necessarily foster resource allocation. Rather, it is the ability to trade the economy's productive technologies easily that influences resource allocation and growth.

There are a number of weaknesses, however, associated with the LZ approach.

First, while they show that stock market liquidity and bank development predict economic growth, they do not deal formally with the issue of causality.

Second, there are difficulties in measuring liquidity as discussed by Grossman and Miller (1988). LZ do not measure the direct costs of conducting equity transactions. Furthermore, they do not control for the possibility that the arrival of information and the processing of that information may differ across countries and thereby induce cross-country differences in trading that does not reflect liquidity as defined by theory. While

LZ confirm their results using three additional measures of liquidity, measurement issues remain.⁸

Third, more broadly, the liquidity indicators measure domestic stock transactions on a country's national stock exchanges. The physical location of the stock market, however, may not necessarily matter for the provision of liquidity unless there are impediments to cross-location transactions. Physical location will matter less – and this measurement problem will matter more -- if economies become more financially integrated. Guiso, Sapienza, and Zingales (2002), however, find that local financial conditions matter even in a single country – Italy. They show that local financial conditions influence economic performance across the different regions of Italy. That is, local financial development is an important determinant of the economic success of an area even within a single country. Their results suggest that international financial integration is unlikely to eliminate the importance of national financial systems in the near future.⁹

Fourth, even more generally, the link between trading and future economic growth may not represent a link between liquidity and growth as suggested by some theories (Levine, 1991; Bencivenga, Smith, and Starr, 1995). The liquidity-stock market link may be generated by a third factor that produces both a surge in trading and a subsequent acceleration in economic growth, but where trading does not induce the growth acceleration. For instance, positive news about a technology shock may elicit different opinions about which sectors and firms will benefit most from the innovation. This would produce lots of trading today because of these differences of opinion. The subsequently surge in economic growth is due to the positive technology shock, not the

increase in stock transactions. In this “model,” trading does not necessarily facilitate the ability of the economy to exploit the growth benefits of the technology shock. From this perspective, it is difficult to interpret the LZ results as implying that liquidity fosters economic growth.

Fifth, while LZ include stock markets, they exclude other components of the financial sector, e.g., bond markets and the financial services provided by nonfinancial firms.

Sixth, stock markets may do more than provide liquidity. Stock markets may provide mechanisms for hedging and trading the idiosyncratic risk associated with individual projects, firms, industries, sectors, and countries. While a vast literature examines the pricing of risk, there exists very little empirical evidence that directly links risk diversification services with long-run economic growth. While LZ do not find a strong link between economic growth and the ability of investors to diversify risk internationally, they have extremely limited data on international integration. Future work needs to more fully assess the links between stock markets, banks, and economic growth.

4. Using instrumental variables in cross-country studies of growth

While KL and LZ show that financial development predicts economic growth, these results do not settle the issue of causality. It may simply be the case that financial markets develop in anticipation of future economic activity. Thus, finance may be a leading indicator rather than a fundamental cause.

To assess whether the finance-growth relationship is driven by simultaneity bias, one needs instrumental variables that explain cross-country differences in financial development but are uncorrelated with economic growth beyond their link with financial development. Levine (1998, 1999) and Levine, Loayza, and Beck (2000) use the La Porta et al (henceforth LLSV, 1998) measures of legal origin as instrumental variables. In particular, LLSV (1998) show that legal origin – whether a country’s Commercial/Company law derives from British, French, German, or Scandinavian law – importantly shapes national approaches to laws concerning creditors and the efficiency with which those laws are enforced. Since finance is based on contracts, legal origins that produce laws that protect the rights of external investors and enforce those rights effectively will do a correspondingly better job at promoting financial development. Indeed, LLSV (1998), Levine (1998, 1999, 2001), and Levine, Loayza, and Beck (2000) trace the effect of legal origin to laws and enforcement and then to the development of financial intermediaries. Since most countries obtained their legal systems through occupation and colonization, the legal origin variables may be plausibly treated as exogenous.

Following Levine, Loayza, and Beck’s (henceforth LLB, 2000) analysis of 71 countries with data averaged over 1960-95, consider the generalized method of moments (GMM) regression:

$$G(j) = \alpha + \beta F(i) + \gamma X + \varepsilon.$$

$G(j)$ is real per capita GDP growth over the 1960-95 period. The legal origin indicators, Z , are used as instrumental variables for the measures of financial development, $F(i)$. X is treated as an included exogenous variable. LLB use *linear* moment conditions, which

amounts to the requirement that the instrumental variables (Z) be uncorrelated with the error term (ε). The economic meaning of these conditions is that *legal origin* may affect per capita GDP growth only through the financial development indicators and the variables in the conditioning information set, X . Testing the validity of the moment conditions is crucial to ascertaining the consistency of GMM estimates. LLB use Hansen's (1982) test of overidentifying restrictions.¹⁰ If the regression specification "passes" the test, then we can safely draw conclusions taking the moment conditions as given. That is, we cannot reject the statistical and economic significance of the estimated coefficient on financial intermediary development as indicating an effect running from financial development to per capita GDP growth.

LLB extend the King and Levine (1993a,b) measures of financial intermediary development through to 1995, improve the deflating of the financial development indicators, and add a new measure of overall financial development.¹¹ The new measure of financial development, Private Credit, equals the value of credits by financial intermediaries to the private sector divided by GDP. The measure isolates credit issued to the private sector and therefore excludes credit issued to governments, government agencies, and public enterprises. Also, it excludes credits issued by central banks. Unlike the LZ Bank Credit measures, Private Credit included credits issued by non-deposit money bank. Not surprisingly, there is enormous cross-country variation in Private Credit. Private Credit is less than 10 percent of GDP in Zaire, Sierra Leone, Ghana, Haiti, and Syria, while it is greater than 85 percent of GDP in Switzerland, Japan, the United States, Sweden, and the Netherlands.

The LLB results indicate a very strong connection between the exogenous component of financial intermediary development and long-run economic growth. They use various measures of financial intermediary development and different conditioning information sets, i.e., different X's. They find that the exogenous component of financial intermediary development is closely tied to long-run rates of per capita GDP growth. Furthermore, the data do not reject Hansen's (1982) test of the over-identifying restrictions. The inability to reject the orthogonality conditions plus the finding that the legal origin instruments (Z) are highly correlated with financial intermediary development indicators (i.e., the null hypothesis that the legal origin variables does not explain the financial intermediary indicators is rejected at the 0.01 significance level), suggest that the instruments are appropriate. These results indicate that the strong link between financial development and growth is not due to simultaneity bias. The estimated coefficient can be interpreted as the effect of the exogenous component of financial intermediary development on growth.

LLB's (2000) instrumental variable results also indicate an economically large impact of financial development on growth. For example, India's value of Private Credit over the 1960-95 period was 19.5 percent of GDP, while the mean value for developing countries was 25 percent of GDP. The estimated coefficients in LLB suggest that an exogenous improvement in Private Credit in India that had pushed it to the sample mean for developing countries would have accelerated real per capita GDP growth by an additional 0.6 of a percentage point per year.¹² Similarly, if Argentina had moved from its value of Private Credit (16) to the developing country sample mean, it would have grown more than one percentage point faster per year. This is large considering that

growth only averaged about 1.8 percent per year over this period. As emphasized throughout, however, these types of conceptual experiments must be treated as illustrative because they do not account for how to increase financial intermediary development.

IV.B. Panel, Time-Series, and Case-Studies of Finance and Growth

Studies of finance and growth have also employed panel data techniques, pure time-series methodologies, and case-studies to ameliorate a number of statistical problems with pure cross-country investigations. This section discusses the panel approach in some depth and finishes with shorter discussions of pure time-series and case-study approaches.

1. The dynamic panel methodology

LLB (2000) and Beck, Levine, and Loayza (2000, henceforth BLL) use a GMM estimator developed for panel data to assess the finance and growth relationship. This approach improves upon pure cross-country work in three respects.

The regression equation in levels can be specified in the following form:

$$y_{i,t} = \alpha' X_{i,t-1}^1 + \beta' X_{i,t}^2 + \mu_i + \lambda_t + \varepsilon_{i,t} \quad (1)$$

where y represents the dependent variable, X^1 represents a set of lagged explanatory variables and X^2 a set of contemporaneous explanatory variables, μ is an unobserved country-specific effect, λ is a time-specific effect, ε is the time-varying error term, and i and t represent country and (5-year) time period, respectively.

The first benefit from moving to a panel is the ability to exploit the time-series and cross-sectional variation in the data. LLB construct a panel that consists of data for 77 countries over the period 1960-95. The data are averaged over seven non-overlapping five-year periods. Moving to a panel incorporates the variability of the time-series dimension.¹³ This also raises a potential disadvantage from moving to panel data. With panel data, we employ data averaged over five-year periods, yet the models we are using to interpret the data are typically models of steady-state growth. To the extent that five years does not adequately proxy for long-run relationships, the panel methods may imprecisely assess the finance growth link.

The second benefit from moving to a panel is that panel estimators avoid systemic biases associated with cross-country regressions. In a pure cross-sectional regression, the unobserved country-specific effect is part of the error term so that correlation between μ and the explanatory variables results in biased coefficient estimates. Furthermore, if the lagged dependent variable is included in X^l (which is the norm in cross-country regressions), then the country-specific effect is certainly correlated with X^l . To control for the presence of unobserved, Arellano and Bond (1991) propose to first-difference the regression equation to eliminate the country-specific effect.

$$y_{i,t} - y_{i,t-1} = \alpha'(X_{i,t-1}^1 - X_{i,t-2}^1) + \beta'(X_{i,t}^2 - X_{i,t-1}^2) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (2)$$

This solves the country-specific effect problem, but introduces a correlation between the new error term $\varepsilon_{i,t} - \varepsilon_{i,t-1}$ and the lagged dependent variable $y_{i,t-1} - y_{i,t-2}$ when it is included in $X_{i,t-1}^l - X_{i,t-2}^l$. Arellano and Bond (1991) propose using the lagged values of the explanatory variables in levels as instruments. Assuming that there is no serial

correlation in the error term ε and that the explanatory variables X (where $X = [X^1 \ X^2]$) are weakly exogenous, the following moment conditions hold.

$$E[X_{i,t-s} \cdot (\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad \text{for } s \geq 2; t = 3, \dots, T \quad (3)$$

This *difference estimator* consists of the regression in differences plus the moment conditions in (3).

The third benefit from moving to a panel is that it permits the use of instrumental variables for all regressors and thereby provides more precise estimates of the finance-growth relationship. Levine (1998, 1999, 2001) use instrumental variables in pure cross-country regressions. But, the legal origin instruments are only used to extract the exogenous component of financial development. The pure cross-sectional estimator does not control for the endogeneity of all the other explanatory variables. This can lead to inappropriate inferences on the coefficient on financial development. The panel estimator uses instruments based on previous realizations of the explanatory variables to consider the potential joint endogeneity of the other regressors as well.^{14,15}

There are conceptual and statistical shortcomings with this *difference estimator*. Conceptually, first-differencing eliminates the cross-country dimension. Statistically, if the explanatory variables are persistent over time, then lagged levels are weak instruments for the variables in differences. Instrumental weakness can induce biased coefficients in small samples and poor precision even in large samples.

To address these problems, Arellano and Bover (1995) propose an alternative method that estimates jointly the regression in differences with the regression in levels. Note, however, that the regression in levels does not eliminate the country-specific effect.

Instead, appropriate instruments must be used. The *lagged differences* of the explanatory variables are valid instruments for the regression in levels if

$$E[X_{i,t+p} \cdot \mu_i] = E[X_{i,t+q} \cdot \mu_i] \quad \text{for all } p \text{ and } q \quad (4)$$

This assumption implies that financial intermediary development may be correlated with the country-specific effect, but this correlation does not change through time. This produces the following moment conditions for the regressions in levels:

$$E[(X_{i,t-s} - X_{i,t-s-1}) \cdot (\varepsilon_{i,t} + \mu_i)] = 0 \quad \text{for } s = 1; t = 3, \dots, T \quad (5)$$

The *system estimator* consists of the stacked regressions in differences and levels, with the moment conditions in (3) applied to the regression in differences and the moment conditions in (5) applied to the regressions in levels.¹⁶

2. Dynamic panel results on financial intermediation and growth

LLB use the system estimator to examine the relationship between financial intermediary development and growth, while BLL examine the relationship between financial development and the sources of growth, i.e., productivity growth, physical capital accumulation, and savings. They examine an assortment of indicators of financial intermediary development and also use a variety of conditioning information sets to assess the robustness of the results (Levine and Renelt, 1992). Here, we summarize the results in Table 4 using the Private Credit measure of financial development described above and a simple set of control variables.

The results indicate a positive relationship between the exogenous component of financial development and economic growth, productivity growth, and capital accumulation. The regressions pass the standard specification tests. Table 4 presents

both (1) instrumental variable results using a pure a cross-sectional analysis where the legal origin variables are the instruments and (2) the dynamic panel results just described. Remarkably the coefficient estimates are very similar using the two procedures and economically significant. Thus, the large, positive relationship between economic growth and Private Credit does not appear to be driven by simultaneity bias, omitted country-specific effects, or the routine use of lagged dependent variables in cross-country growth regressions. While BLL go on to argue that the finance-capital accumulation link is not robust to alternative specifications, they demonstrate a robust link between financial development indicators and both economic growth and productivity growth.

The regression coefficients suggest an economic large impact of financial development on economic growth. For example, Mexico's value for Private Credit over the period 1960-95 was 22.9% of GDP. An exogenous increase in Private Credit that had brought it up to the sample median of 27.5% would have resulted in a 0.4 percentage point higher real per capita GDP growth per year.¹⁷

Benhabib and Spiegel (2001) examine the relationship between an assortment of financial intermediary development indicators and economic growth, investment, and total factor productivity growth. While they use a panel estimator, they do not use the system estimator described above that allows for the endogeneity of all the regressors and the routine use of lagged dependent variables. They find that the indicators of financial development are correlated with both total factor productivity growth and the accumulation of both physical and human capital. Their paper raises an important qualification, however. Different indicators of financial development are linked with different components of growth (total factor productivity, physical capital accumulation,

and human capital accumulation). Their findings reiterate an important qualification running throughout this survey: it is difficult to measure financial development and link empirical constructs with theoretical concepts.

Loayza and Ranciere (2002) differentiate between the long-run and short-run relationships connecting finance and economic activity. They note that short-run surges in bank lending can actually signal the onset of financial crises and economic stagnation. They stress that it is therefore crucial to consider simultaneously the short-run and long-run effects of financial development. For instance, while finance is positively associated with economic growth in a broad cross-section of countries, this relationship does not hold in Latin America, which has been subject to severe and repeated banking crises. Using a panel, Loayza and Ranciere (2001) estimate an encompassing model of long-run and short-run effects. Using the LLB measure of financial intermediary development (Private Credit), they find that a positive long-run relationship between financial development and growth co-exists with a generally negative short-run link.

3. Dynamic panel results and stock market and bank development

Rousseau and Wachtel (2000) and Beck and Levine (2003) extend the LZ study of stock markets, banks, and growth by using panel techniques to examine the relationship between stock markets, banks, and growth. Rousseau and Wachtel (2000) use annual data and the difference estimator. Beck and Levine (2003) use data averaged over five-year periods to focus on longer-run growth factors, use the system estimator to mitigate potential biases associated with the difference estimator, and extend the sample through 1998 (from 1995).¹⁸

Table 5 indicates that the exogenous component of both stock market development and bank development help predict economic growth. Based on Beck and Levine (2003) the paper also present simple OLS regressions. As shown, the coefficient estimates from the two methods are very similar. The panel procedure passes the standard specification tests, which increases confidence in the assumptions underlying the econometric methodology. While not shown, stock market capitalization is not closely associated with growth. Thus, it is not listing per se that is important for growth; rather, it is the ability of agents to exchange ownership claims on an economy's productive technologies that is relevant for economic growth.

The Table 5 estimates are economically meaningful and consistent with magnitudes obtained using different methods. If Mexico's Turnover Ratio had been at the average of the OECD countries (68%) instead of the actual 36% during the period 1996-98, it would have grown 0.6 percentage points faster per year. Similarly, if its Bank Credit had been at the average of all OECD countries (71%) instead of the actual 16%, it would have grown 2.6 percentage points faster per year. These results suggest that the exogenous components of both bank and stock market development have an economically large impact on economic growth.

4. Time series studies

A substantial time-series literature examines the finance-growth relationship using a variety of time-series techniques. These studies frequently use Granger-type causality tests and vector autoregressive (VAR) procedures to examine the nature of the finance-growth relationship (e.g., Arestis and Demetriades, 1997). Some of these studies focus on a few countries and therefore are unconstrained by having to find comparable data for

a large number of countries. Thus, some time-series investigations construct long-run data sets, rather than relying on the post-1960 period, which characterizes broad cross-country studies. Also, some time-series studies, by focusing on a few countries in depth, assemble more detailed, country-specific measures of financial development rather than relying on less precise indicators of financial development that are available for many countries.

In some initial time-series studies, Jung (1986) and Demetriades and Hussein (1996) use measures of financial development such as the ratio of money to GDP. They find the direction of causality frequently runs both ways, especially for developing economies. The positive impact of finance on growth is particularly strong when using measures of the value-added provided by the financial system instead of simple measures of the size of the financial system, as documented by Neusser and Kugler (1998).

Rousseau and Wachtel (1998) conduct time-series tests of financial development and growth for five countries over the past century using more comprehensive measures of financial development. They use measures of financial development that include the assets of both banks and non-banks. They document that the dominant direction of causality runs from financial development to economic growth.

In a broad study of 41 countries over the 1960-1993, Xu (2000) uses a VAR approach that improves upon early work by Jung (1986).¹⁹ The VAR approach permits the identification of the long-term cumulative effects of finance on growth by allowing for dynamic interactions among the explanatory variables. Xu (2000) rejects the hypothesis that finance simply follows growth. Rather, the analyses indicate that financial development is important for long-run growth.

Recently, Christopoulos and Tsionas (2003) use panel unit root tests and panel cointegration analysis to examine the relationship between financial development and economic growth in ten developing countries. They note that many time-series studies yield unreliable results due to the short time spans of typical data sets. Thus, they use time-series tests to yield causality inferences within a panel context that increases sample size. In contrast to Demetriades and Hussein (1996), Christopoulos and Tsionas (2003) find strong evidence in favor of the hypothesis that long-run causality runs from financial development to growth and that there is no evidence of bi-directional causality. Furthermore, they find a unique cointegrating vector between growth and financial development, and emphasize the long-run nature of the relationship between finance and growth.

Rousseau and Sylla (1999) expand Rousseau's (1998) examination of the historical role of finance in U.S. economic growth to include stock markets. They use a set of multivariate time-series models that relate measures of banking and equity market activity to investment, imports, and business incorporations over the 1790-1850 period. Rousseau and Sylla (1999) find strong support for the theory of "finance led growth" in United States. Moving beyond the U.S., Rousseau and Sylla (2001) study seventeen countries over the period 1850-1997. They also find evidence consistent with the view the financial development stimulated economic growth in these economies.

In a study of stock markets, banks, and economic growth, Arestis, Demetriades and Luintel (2000) find additional support for the view the finance stimulates growth but raise some cautions on the size of the relationship. They use quarterly data and apply time series methods to five developed economies and show that while both banking

sector and stock market development explain subsequent growth, the effect of banking sector development is substantially larger than that of stock market development. The sample size, however, is very limited and it is not clear whether the use of quarterly data and a vector error correction model fully abstract from high frequency factors influencing the stock market, bank, and growth nexus to focus on long-run economic growth.

Some time-series studies focus on the experience of a single country. For instance, in a study of the Meiji period in Japan (1868-1884), Rousseau (1999) uses a variety of VAR procedures and concludes that the financial sector was instrumental in promoting Japan's explosive growth prior to the First World War. In a different study, Rousseau (1998) examines the impact of financial innovation in the U.S. on financial depth over the period 1872-1929. Innovation is proxied by reductions in the loan-deposit spread. The impact on the size of the financial intermediary sector is assessed using unobservable components methods. The paper finds that permanent reductions of 1% in the spread of New York banks are associated with increases in financial depth that range from 1.7% to nearly 4%. While not a direct link to growth, these findings develop a direct link running from financial innovation to increases in financial depth, which is commonly associated with economic growth in other studies.

Bekaert, Harvey, Lundblad (2001, 2002) examine the effects of opening equity markets to foreign participation.²⁰ One statistical innovation in their work is the use of over-lapping data. Many time-series studies use annual observations and even quarterly data to maximize the information included their analyses. Bekaert, Harvey, and Lundblad (2002), however, use data averaged over five-year periods to focus on growth rather than higher frequency relationships, but they use over-lapping data to avoid the

lose of information inherent in using non-over-lapping data. Specifically, one observation includes data averaged from 1990-1995 and the next period includes data averaged from 1991-1996. They adjust the standard errors accordingly and conduct an array of sensitivity checks, though the procedure does not formally deal with simultaneity bias. Consistent with Levine and Zervos (1998a), Bekaert, Harvey, and Lundblad (2001, 2002) show that financial liberalization boosts economic growth by improving the allocation of resources and the investment rate

5. Novel case-studies

Jayaratne and Strahan (1996) undertake a fascinating examination of the impact of finance on economic growth. They examine states of the United States, some of which liberalized restrictions on intrastate branching. Since the early 1970s, 35 states relaxed impediments on intrastate branching. Jayaratne and Strahan (1996) estimate the change in economic growth rates after branch reform relative to a control group of states that did not reform. They use a pooled time-series, cross-sectional dataset to assess the impact of liberalizing branching restrictions on state growth.

Jayaratne and Strahan (1996) show that branch reform boosted bank-lending quality and accelerated real per capita growth rates. By comparing states within the United States, the paper eliminates problems associated with country-specific factors. The paper also uses a natural identifying condition, the change in branching restrictions, to trace through the impact of financial development on economic growth. Importantly, the paper finds little evidence that branch reform boosted lending. Rather, branch reform accelerated economic growth by improving the quality of bank loans and the efficiency of capital allocation.²¹ Some issues remain, however. While Jayaratne and Strahan

(1996) control for state investment and tax receipts, it is difficult to control fully for other factors influencing growth in the individual states. Similarly, while the authors show that (i) there is no correlation between the business cycle and the timing of regulation and (ii) deregulation does not forecast a boom in lending, it is difficult to rule out the possibility that states liberalize banking due to expected growth-enhancing structural changes in the economy that do require more lending but better lending. In sum, this innovative study provides empirical support for the view that well-functioning banks improve the allocation of capital and hence economic growth.

Similarly, Guiso, Sapienza, and Zingales (2002b) examine the individual regions of Italy. Using an extraordinary dataset on households and financial services across Italy, they examine the effects of differences in local financial development on economic activity across the regions of Italy. Guiso, Sapienza, and Zingales (2002b) find that local financial development (i) enhances the probability that an individual starts a business, (ii) increases industrial competition, and (iii) promotes the growth of firms. These results are weaker for large firms, which can more easily raise funds outside of the local area. This study ameliorates many of the weaknesses associated with examining growth across countries.

Consider also Haber's (1991, 1997) impressive comparison of industrial and capital market development in Brazil, Mexico, and the United States between 1830 and 1930. Using firm-level data, Haber (1991, 1997) finds that capital market development affected industrial composition and national economic performance. Specifically, Haber shows that when Brazil overthrew the monarchy in 1889 and formed the First Republic, it also dramatically liberalized restrictions on Brazilian financial markets. The

liberalization gave more firms easier access to external finance. Industrial concentration fell and industrial production boomed. While Mexico also liberalized financial sector policies, the liberalization was much more mild under the Diaz dictatorship (1877-1911), which “. . . relied on the financial and political support of a small in-group of powerful financial capitalists.” (p. 561) As a result, the decline in concentration and the increase in economic growth were much weaker in Mexico than it was in Brazil. Haber (1997) concludes that (1) international differences in financial development significantly impacted the rate of industrial expansion and (2) under-developed financial systems that restrict access to institutional sources of capital non-negligible obstacles to industrial expansion in the nineteenth century.

In two classic studies, Cameron, Crisp, Patrick, and Tilly (1967) and McKinnon (1973) study respectively (1) the historical relationships between banking development and the early stages of industrialization for England (1750-1844), Scotland (1750-1845), France (1800-1870), Belgium (1800-1875), Germany (1815-1870), Russia (1860-1914), and Japan (1868-1914) and (2) the relationship between the financial system and economic development in Argentina, Brazil, Chile, Germany, Korea, Indonesia, and Taiwan in the post World War II period. This research does not use formal statistical analysis to resolve causality issues. Instead, the researchers carefully examine the evolution of the political, legal, policy, industrial, and financial systems of the country. The country-case studies document critical interactions among financial intermediaries, financial markets, government policies, and the financing of industrialization. While well-aware of the analytical limitations, these authors bring a wealth of country specific information to bear on the role of finance in economic growth. Cameron (1967b)

concludes that especially in Scotland and Japan, but also in Belgium, Germany, England, and Russia, the banking system played a positive, growth-inducing role.²² McKinnon (1973) interprets the mass of evidence emerging from his country-case studies as suggesting that better functioning financial systems support faster economic growth. Disagreement exists over many of these individual cases, and it is extremely difficult to isolate the importance of any single factor in the process of economic growth. Nonetheless, the body of country-studies suggests that, while the financial system responds to demands from the nonfinancial sector, well-functioning financial systems have, in some cases during some time periods, importantly spurred economic growth.

IV.C. Industry and Firm Level Studies of Finance and Growth

To better understand the relationship between financial development and economic growth, researchers have employed both industry-level and firm-level data across a broad cross-section of countries. These studies seek to resolve causality issues and to document in greater detail the mechanisms, if any, through which finance influences economic growth.

1. Industry level analyses

Consider first the influential study by Rajan and Zingales (henceforth RZ, 1998). They argue that better-developed financial intermediaries and markets help overcome market frictions that drive a wedge between the price of external and internal finance. Lower costs of external finance facilitate firm growth and new firm formation. Therefore, industries that are naturally heavy users of external finance should benefit

disproportionately more from greater financial development than industries that are not naturally heavy users of external finance. From this perspective, if researchers can identify which industries are “naturally heavy users” of external finance – i.e., if they can identify which industries rely heavily on external finance in an economy with few market frictions – then this establishes a natural test: Do industries that are naturally heavy users of external finance grow faster in economies with better developed financial systems? If they do, then this supports the view that financial development spurs growth by facilitating the flow of external finance.

RZ assume that (1) financial markets in the U.S. are relatively frictionless, (2) in a frictionless financial system, technological factors influence the degree to which an industry uses external finance, and (3) the technological factors influencing external finance are constant (or reasonably constant) across countries. They then examine whether industries that are technologically more dependent on external finance – as defined by external use of funds in the U.S. – grow comparatively faster in countries that are more financially developed. This approach allows RZ (1) to study a particular mechanism, external finance, through which finance operates rather than simply assessing links between finance and growth and (2) to exploit within-country differences concerning industries.

RZ develop a new methodology to examine the finance-growth relationship.

Consider their formulation.

$$Growth_{i,k} = \sum_j \alpha_j Country_j + \sum_l \beta_l Industry_l + \gamma Share_{i,k} + \delta_1 (External_k * FD_i) + \varepsilon_{i,k}.$$

(6)

$Growth_{i,k}$ is the average annual growth rate of value added or the growth in the number of establishments, in industry k and country i , over the period 1980-90. $Country$ and $Industry$ are country and industry dummies, respectively. $Share_{i,k}$ is the share of industry k in manufacturing in country i in 1980. $External_k$ is the fraction of capital expenditures not financed with internal funds for U.S. firms in the industry k between 1980-90. FD_i is an indicator of financial development for country i . RZ interact the external dependence of an industry ($External$) with financial development (FD), where the estimated coefficient on the interaction, δ_1 , is the focus of their analysis. Thus, if δ_1 is significant and positive, then this implies that an increase in financial development (FD_i) will induce a bigger impact on industrial growth ($Growth_{i,k}$) if this industry relies heavily on external finance ($External_k$) than if this industry is not a naturally heavy user of external finance. They do not include financial development independently because they focus on within-country, within-industry growth rates. The dummy variables for industries and countries correct for country and industry specific characteristics that might determine industry growth patterns. RZ thus isolate the effect that the interaction of external dependence and financial development/structure has on industry growth rates relative to country and industry means. By including the initial share of an industry, this controls for a convergence effect: industries with a large share might grow more slowly, suggesting a negative sign on γ . RZ include the share in manufacturing rather than the level to focus on within-country, within-industry growth rates.

RZ use data on 36 industries across 42 countries, though the U.S is dropped from the analyses since it is used to identify external dependence. To measure financial development, RZ examine (a) total capitalization, which equals the summation of stock

market capitalization and domestic credit as a share of GDP and (b) accounting standards. As RZ discuss, there are problems with these measures. Stock market capitalization does not capture the actual amount of capital raised in equity markets. Indeed, some countries provide tax incentives for firms to list, which artificially boosts stock market capitalization without indicating greater external financing or stock market development. Also, as discussed above, stock market capitalization does not necessarily reflect how well the market facilitates exchange. The accounting standards indicator is a rating of the quality of the annual financial reports issued by companies within a country. The highest value is 90. RZ use the accounting standards measure as a positive signal of the ease with which firms can raise external funds, while noting that it is not a direct measure of the actual amount of external funds that are raised. Beck and Levine (2002) confirm the RZ findings using alternative measures of financial development.

As summarized in Table 6, RZ find that the coefficient estimate for the interaction between external dependence and total capitalization measure, $\text{External}_k * \text{Total Capitalization}_i$, is positive and statistically significant at the one-percent level. This implies that an increase in financial development disproportionately boosts the growth of industries that are naturally heavy users of external finance.

RZ note that the economic magnitude is quite substantial. Compare Machinery, which is an industry at the 75th percentile of dependence (0.45), with Beverages, which has low dependence (0.08) and is at the 25th percentile of dependence. Now, consider Italy, which has high total capitalization (0.98) at the 75th percentile of the sample, and the Philippines, which is at the 25th percentile of total capitalization with a value of 0.46. Due to differences in financial development, the coefficient estimates predict that

Machinery should grow 1.3 percent faster than Beverages in Italy in comparison to the Philippines.²³ The actual difference is 3.4, so the estimated value of 1.3 is quite substantial. Thus, financial development has a substantial impact on industrial growth by influencing the availability of external finance. RZ conduct a large number of robustness checks and show that financial development influences industrial growth both through the expansion of existing establishments and through the formation of new establishments.²⁴

Using a different strategy, Wurgler (2000) also employs industry-level data to examine the relation between financial development and economic growth. Using industry-level data across 65 countries for the period 1963-1995, he computes an investment elasticity that gauges the extent to which a country increases investment in growing industries and decreases investment in declining ones. This is an important contribution because it directly measures the degree to which each country's financial system reallocates the flow of credit. Wurgler (2000) uses standard measures of financial development. He shows that countries with higher levels of financial development both increase investment more in growing industries and decrease investment more in declining industries than financial underdeveloped economies.

2. Firm level analyses of finance and growth

Demirguc-Kunt and Maksimovic (henceforth DM, 1998) examine whether financial development influences the degree to which firms are constrained from investing in profitable growth opportunities. They focus on the use of long-term debt and external equity in funding firm growth. As in RZ, DM focuses on a particular

mechanism through which finance influences growth: does greater financial development remove impediments to the exploitation of profitable growth opportunities. Rather than focusing on the external financing needs of an industry as in RZ, DM estimate the external financing needs of each individual firm in the sample.

DM note that simple correlations between firms' growth and financial development do not control for differences in the amount of external financing needed by firms in the same industry in different countries. These differences may arise because firms in different countries employ different technologies, because profit rates may differ across countries, or because investment opportunities and demand may differ. To control for these differences at the firm-level, DM calculate the rate at which each firm can grow using (1) only its internal funds and (2) only its internal funds and short-term borrowing. They then compute the percentage of firms that grow at rates that exceed each of these two estimated rates. This yields estimates of the proportion of firms in each economy relying on external financing to grow.

The firm-level data consist of accounting data for the largest publicly traded manufacturing firms in 26 countries. Beck, Demirguc-Kunt, Levine, and Maksimovic (2001) confirm the findings using an extended sample. DM estimate a firm's potential growth rate using the textbook "percentage of sales" financial planning model (Higgins 1974). This approach relates a firm's growth rate of sales to its need for investment funds, based on three simplifying assumptions. First, the ratio of assets used in production to sales is constant. Second, the firm's profits per unit of sales are constant. Finally, the economic depreciation rate equals the accounting depreciation rate. Under

these assumptions, the firm's financing need in period t of a firm growing at g_t percent per year is given by

$$EFN_t = g_t * Assets_t - (1 - g_t) * Earnings_t * b_t \quad (5.1)$$

where EFN_t is the external financing need and b_t is the fraction of the firm's earnings that are retained for reinvestment at time t . Earnings are calculated after interest and taxes.

While the first term on the right-hand side of equation (5.1) denotes the required investment for a firm growing at g_t percent, the second term is the internally available funds for investment, taking the firms' dividend payout as given.

The short-term financed growth rate $STFG_t$ is the maximum growth rate that can be obtained if the firm reinvests all its earnings and obtains enough short-term external resources to maintain the ratio of its short-term liabilities to assets. To compute $STFG_t$, we first replace total assets in (5.1) by assets that are not financed by new short-term credit, calculated as total assets times one minus the ratio of short-term liabilities to total assets. $STFG_t$ is then given by

$$SG_t = ROLTC_t / (1 - ROLTC_t) \quad (5.3)$$

where $ROLTC_t$ is the ratio of earnings, after tax and interest, to long-term capital. The definition of $STFG$ thus assumes that the firm does not access any long-term borrowings or sales of equity to finance its growth.²⁵

DM then calculate the proportion of firms whose growth rates exceed the estimate of the maximum growth rate that can be financed by relying only on internal and short-term financing, `PROPORTION_FASTER`.

To analyze whether financial development spurs firm growth, DM run the following cross-country regression regressions

$$PROPORTION_FASTER = \beta_1 FD_{i,t} + \beta_2 CV_{i,t} + \varepsilon_{i,t} \quad (5.4)$$

where *FD* is financial development, *CV* is a set of control variables, and ε is the error term. To measure financial development, DM use (a) the ratio of market capitalization to GDP (Market Capitalization/GDP), (b) Turnover, which equals the total value of shares traded divided by market capitalization, and (c) Bank Assets/GDP, which equals the ratio of domestic assets of deposit banks divided by GDP. Thus, DM include all domestic assets of deposit banks, not just credit to the private sector. As control variables, DM experiment with different combinations of control variables, including economic growth, inflation, the average market to book value of firms in the economy, government subsidies to firms in the economy, the net fixed assets divided by total assets of firms in the economy, the level real per capita GDP, the law and order tradition of the economy.

As summarized in Table 7, DM (1998) find that both banking system development and stock market liquidity are positively associated with the excess growth of firms. Thus, in countries with high Turnover and high Bank Assets/GDP a larger proportion of firms is growing at a level that requires access to external sources of long-term capital, holding other things constant. Note, consistent with LZ, the size of the domestic stock markets is not related to the excess growth of firms. After conducting a wide-array of robustness checks, DM conclude that the proportion of firms that grow at rates exceeding the rate at which each firm can grow with only retained earnings and short-term borrowing is positively associated with stock market liquidity and banking system size.²⁶

Love (2003) also uses firm level data to examine whether financial development eases financing constraints, though she does not explicitly examine economic growth.

Love (2003) uses firm level data from 40 countries. The paper finds that the sensitivity of investment to internal funds is greater in countries with more poorly developed financial system. Greater financial development reduces the link between the availability of internal funds and investment. Thus, the paper is consistent with the findings of DM and RZ. The paper also shows that financial development is particularly effective at easing the constraints of small firms.²⁷ In sum, Love (2003) concludes that financial development will reduce the degree to which firm expansion is constrained by the availability of internally generated funds and that financial development will have a particularly large impact on the ability of small firms to expand.

Claessens and Laeven (2002) not only examine the relationship between financial development and the availability of external funds, they also examine the impact of legal systems that promote financial development on the allocation of external funds. While not directly linked to aggregate growth, they find that countries with legal systems that do comparatively poor job at supporting financial development tend to (a) have less external financing of firms and (b) allocate external financing toward fixed assets.

V. Are bank- or market based systems better? Evidence

As noted earlier, Goldsmith (1969) asked whether (1) financial development influences economic growth and whether (2) financial structure – the mix of financial markets and intermediaries operating in an economy affects economic growth. As we have seen, a growing body of evidence using very different methodologies and datasets find that financial development exerts a first-order impact on economic growth. We now

turn to the empirical analysis of financial structure: Does having a bank-based or market-based financial system matter for economic growth?

Much of the empirical work on financial structure over the last century involves studies of Germany and Japan as bank-based systems and the United States and the United Kingdom as market-based systems.²⁸ As summarized by Allen and Gale (2000) and Stulz (2001), this research has produced illuminating insights into the functioning of *these* financial systems. Nonetheless, it is difficult to draw broad conclusions about the long-run growth effects of bank-based and market-based financial systems based on only four countries, especially four countries that have very similar long-run growth rates. Indeed, given the similarity of their long-run growth rates, many observers may conclude that differences in financial structure obviously did not matter much. Broadening the analysis to a wider array of national experiences is important for garnering greater information on the bank-based versus market-based debate. A recent set of papers takes this step (Demirguc-Kunt and Levine, 2001).

Recently, research has expanded the study of financial structure to a much broader set of countries. Beck, Demirguc-Kunt, and Levine (2001) construct a large cross-country, time-series database on financial structure for up to 150 countries from 1960-1995 data permitting. Demirguc-Kunt and Levine (2001b) use these data to classify countries according to the degree to which they are bank-based or market-based. They also examine the evolution of financial structure across time and countries. They find that banks, nonbank financial intermediaries (insurance companies, pension funds, finance companies, mutual funds, etc.) and stock markets are larger, more active, and more efficient in richer countries and as countries become richer over time. Also, as

countries become richer, stock markets become more active and efficient relative to banks. There is a tendency, not without exceptions, for national financial systems to become more market-based as they become richer.

Turning to economic growth, recent research on financial structure and growth uses the methodologies employed by the financial development and growth literature. Based on Demirguc-Kunt and Levine's (2001b) measures of the degree to which countries are bank-based or market-based, this literature has (1) used cross-country regressions, including instrumental variables regressions, (2) industry-level studies that employ the Rajan and Zingales (1998) methodology discussed above, and (3) firm-level investigations that exploit the Demirguc-Kunt and Maksimovic (1998) procedure. Beck, Demirguc-Kunt, Levine, and Maksimovic (2001) summarize the results from these investigations in detail.

Since we have already reviewed the methodologies, we can succinctly discuss the findings on financial structure and growth. Using very different econometric methodologies, the literature finds astonishingly consistent results. First, countries do not grow faster in either market-based or bank-based financial systems. Levine (2003) shows that after controlling for the overall level of financial development, information on financial structure does not help in explaining cross-country differences in financial development. These results hold when using instrumental variables to control for simultaneity bias. Levine (2003) also assesses whether bank-based systems are better at promoting growth in poor countries or countries with poor legal systems or otherwise weak institutions. Allowing for these possibilities, however, did not alter the conclusion: after controlling for overall financial development, cross-country comparisons do not

suggest that distinguishing between bank-based and market-based financial systems is a first-order concern in understanding the process of economic growth. In an extension of this line of work, however, Tadesse (2002) finds that while market-based systems outperform bank-based systems among countries with developed financial sectors, bank-based systems fare better among countries with underdeveloped financial sectors.

Second, financially dependent industries do not expand at higher rates in bank-based or market-based financial systems. Beck and Levine (2002) use the Rajan and Zingales (1998) methodology. They confirm that greater financial development accelerates the growth of financially dependent industries, but financial structure does not help explain the differential growth rates of financial dependent industries across countries.

Third, firms' access to external finance is not easier, and firms do not grow faster in either market-based or bank-based financial systems. Demirguc-Kunt and Maksimovic (2002) extend their earlier study and show that overall financial development helps explain the excess growth of firms across countries, i.e., the proportion of firms that grow at rates exceeding the rate at which each firm can grow with only retained earnings and short-term borrowing is positively associated with overall financial development. However, the degree to which countries are bank-based or market-based does not help explain excess growth.

The Beck and Levine (2002), Demirguc-Kunt and Maksimovic (2002), and Levine (2003) papers, however, share a common weakness: they use aggregate, cross-country indicators to measure the degree to which countries are bank-based or market-based. These measures may not sufficiently capture the comparative roles of banks and

markets. They may not be sufficiently country-specific to gauge accurately national financial structure. Thus, the conclusion from these studies that financial structure is not a particularly useful indicator of the degree to which a financial system promotes growth must be viewed cautiously (Demirguc-Kunt and Levine, 2001a).

Finally, Carlin and Mayer (2003) extend the recent work on financial structure and economic growth by examining the relationship between the structure of the financial system and types of activities conducted in different countries. They find a positive association between information disclosure (as measured by the effectiveness of the accounting system), the fragmentation of the banking system (as measured by low bank concentration), and the growth of equity finance and skill-intensive industries. This is consistent with models by Allen and Gale (2000) and Boyd and Smith (1998) that emphasize that high technology firms require financial systems that allow for diverse views, such as equity markets rather than banks which provided more standardized monitoring. This result is also consistent with models by Dewatripont and Maskin (1995) that focus on renegotiations, where fragmented banking systems tend to impose short-term, tighter budget constraints. This may be more appropriate for new, higher-risk firms where the threat of bankruptcy must be credibly imposed. In contrast, concentrated banks with long-run relationships with firms can more easily renegotiate constructs and will have a correspondingly more difficult time credibly committing to not renegotiate. Thus, concentrated banks will tend to be associated with more mature, less risk firms. While not directly linked to aggregate economic growth, this sector-based work improves our understanding of the relationship between financial structure and the types of activities occurring in different economies.

VI. Conclusions

This paper reviewed theoretical and empirical work on the relationship between financial development and economic growth. Theory illuminates many of the channels through which the emergence of financial instruments, markets and institutions affect -- and are affected by -- economic development. A growing body of empirical analyses, including firm-level studies, industry-level studies, individual country-studies, time-series studies, panel-investigations, and broad cross-country comparisons, demonstrate a strong positive link between the functioning of the financial system and long-run economic growth. The econometric evidence suggests that both financial intermediaries and markets matter for growth and that reverse causality alone is not driving this relationship. Furthermore, the microeconomic-based evidence is consistent with the view that better developed financial systems ease external financing constraints facing firms, which illuminates one mechanism through which financial development influences economic growth. While admittedly subject to ample qualifications, theory and evidence currently make it difficult to conclude that the financial system merely -- and automatically -- responds to economic activity, or that financial development is an inconsequential addendum to the process of economic growth.

In the remainder of the Conclusion, I will discuss broad areas needing additional research. In terms of theory, Section II raised several issues associated with modeling finance and growth. Here I simply make one broad observation. Our understanding of finance and growth will be substantively advanced by the further integration of models that explicitly motivate the emergence of financial arrangements from information and

transactions costs with general equilibrium macroeconomic models. In this way, we will gain greater insights into the dynamic interactions between the evolution of the financial system and economic growth (Smith, 2002). Existing work suggests that it is not just finance following industry. Yet, there is no reason to believe that it is just industry following finance. Thus, we need additional thought on the co-evolution of finance and growth. Technology shocks, for instance, may only foster growth in the presence of a financial system that can evolve effectively to help the economy exploit new conditions. Furthermore, technological innovation itself may substantively affect the operation of financial systems. Moreover, the financial system may provide different services at different stages of economic development, so that the financial system needs to evolve if growth is to continue. These are merely conjectures, which are easy to make, but which I hope foster more careful thinking.

In terms of empirical work, this paper continuously emphasized that all methods have their problems but that one problem plaguing the entire study of finance and growth pertains to the proxies for financial development. Theory suggests that financial systems influence growth by easing information and transactions costs and thereby improving the allocation of capital, corporate governance, risk management, resource mobilization, and financial exchanges. The empirical measures of financial development, however, generally do not directly measure these financial functions.

Much more research needs to be conducted on the determinants of financial development. To the extent that financial systems exert a first-order impact on economic growth, we need a fuller understanding of what determines financial development. There are at least two levels of analysis. There is a growing body of research that examines the

direct laws, regulations, and macroeconomic policies shaping financial sector operations. There is a second research agenda that studies the political, cultural, and even geographic context shaping financial development.

Some research examines the impact of laws, regulations, and macroeconomic policies on financial development. LLSV (1997, 1998) show that laws and enforcement mechanisms that protect the rights of outside investors tend to foster financial development. Beck, Demirguc-Kunt, and Levine (2003b) show that legal system adaptability is crucial. The financial needs of the economy are continuously changing, so that more flexible legal systems do a correspondingly better job at promoting financial development than more rigid systems. Barth, Caprio, and Levine (2003) show that bank regulations and supervisory practices that force accurate information disclosure but do not grant regulators excessive power boost the overall level of banking sector development.²⁹ Monetary and fiscal policies may also affect the taxation of financial intermediaries and the provision of financial services (Bencivenga and Smith, 1992; Huybens and Smith, 1999; Roubini and Sala-i-Martin, 1992, 1995). Indeed, Boyd, Levine, and Smith (2001) show that inflation has a large – albeit non-linear – impact on both stock market and bank development.

At a more primitive level, some research studies the forces shaping the laws, regulations, and institutions underlying financial development. LLSV (1998) stress that legal tradition, shaped by historically determined factors (Glaeser and Shleifer, 2002), shape laws governing financial transactions. Haber (2003), Pagano and Volpin (2001), and Rajan and Zingales (2003) focus on how political economy forces shape national policies toward financial development. Guiso, Sapienza, and Zingales (2001a) examine

the role of social capital in shaping financial systems, while Stulz and Williamson (2003) stress the role of religion in influencing national approaches to financial development. Finally, some scholars stress the role of geographical endowments on the formation of long-lasting institutions that shape financial systems (Engerman and Sokoloff, 1997, 2002; Acemoglu, Johnson, and Robinson, 2001; Beck, Demirguc-Kunt, and Levine, 2003a; Easterly and Levine 2003). This broad spectrum of work suggests that finance maybe influenced by political, legal, cultural, and even geographical factors and that much work is required to better understand the role of financial factors in the process of economic growth.

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Table 1: Growth and Financial Intermediary Development, 1960-89

Dependent Variable	Depth	Bank	Privy
Real per Capita GDP Growth	2.4** (0.007)	3.2** (0.005)	3.2** (0.002)
R ²	0.50	0.50	0.52
Real per Capita Capital Growth	2.2** (0.006)	2.2** (0.008)	2.5** (0.007)
R ²	0.65	0.62	0.64
Productivity Growth	1.8** (0.026)	2.6** (0.010)	2.5** (0.006)
R ²	0.42	0.43	0.44

Source: King and Levine (1993b), Table VII

* significant at the 0.10 level, ** significant at the 0.05 level

(p-values in parentheses)

Observations: 77

Variable definitions:

DEPTH = Liquid Liabilities/GDP

BANK = Deposit bank domestic credit/[deposit bank domestic credit + central bank domestic credit

PRIVY = Gross claims on the private sector / GDP

Productivity Growth = Real per capita GDP growth - (0.3)*(Real per capita Capital growth)

Other explanatory variables included in each of the nine regression results reported above:

logarithm of initial income, logarithm of initial secondary school enrollment, ratio of government consumption expenditures to GDP, inflation rate, and ratio of exports plus imports to GDP.

Notes: King and Levine (1993b) define 2 percent growth as 0.02. For comparability with subsequent tables, we have redefined 2 percent growth as 2.00 and adjusted the coefficients by a factor of 100.

Table 2: Growth and Initial Financial Depth, 1960-89

Dependent Variable	Depth in 1960
Real per Capita GDP Growth, 1960-89	2.8** (0.001)
R ²	0.61
Real per Capita Capital Growth, 1960-89	1.9** (0.001)
R ²	0.63
Productivity Growth, 1960-89	2.2** (0.001)
R ²	0.58

Sources: King and Levine (1993b), Table VIII; and Levine (1997), Table 3

* significant at the 0.10 level, ** significant at the 0.05 level

(p-values in parentheses). Observations: 57

Variable definitions:

DEPTH = Liquid Liabilities/GDP

Productivity Growth = Real per capita GDP growth - (0.3)*(Real per capita Capital growth)

Other explanatory variables included in each of the regression results reported above:

logarithm of initial income, logarithm of initial secondary school enrollment, ratio of government consumption expenditure to GDP, inflation rate, and ratio of exports plus imports to GDP.

Notes: King and Levine (1993b) and Levine (1997) define 2 percent growth as 0.02. For comparability with subsequent tables, we have redefined 2 percent growth as 2.00 and adjusted the coefficients by a factor of 100.

Table 3: Stock Market and Bank Development Predict Growth, 1976-1993

<u>Dependent Variable (1976-93)</u>	<u>Independent Variables (1976)</u>		
	Bank Credit	Turnover	R ²
Real per Capita GDP Growth	1.31** (0.022)	2.69** (0.005)	0.50
Real per Capita Capital Growth	1.48** (0.025)	2.22** (0.024)	0.51
Productivity Growth	1.11** (0.020)	2.01** (0.029)	0.40

Source: Levine and Zervos (1998), Table 3.

* significant at the 0.10 level, ** significant at the 0.05 level. (p-values in parentheses)

Observations: 42 for the real per capita GDP growth regression and 41 for the others.

Variable definitions:

Bank Credit = Bank credit to the private sector / GDP in 1976 or the closest date with data.

Turnover = Value of the trades of domestic shares on domestic exchanges as a share of market capitalization of domestic shares in 1976 or the closest date with data.

Productivity Growth = Real per capita GDP growth - (0.3)*(Real per capita Capital growth)

Other explanatory variables included in each of regression results reported above:

logarithm of initial income, logarithm of initial secondary school enrollment, ratio of government consumption expenditures to GDP, inflation rate, black market exchange rate premium, and frequency of revolutions and coups.

Notes: Levine and Zervos define 2 percent growth as 0.02. For comparability with subsequent tables, we have redefined 2 percent growth as 2.00 and adjusted the coefficients by a factor of 100.

Table 4: Growth, Productivity Growth, and Capital Accumulation, Panel GMM and OLS, 1960-1995

1. Dependent Variable: Real per Capita GDP Growth						
Estimation Procedure	Private Credit	Countries	Obs.	OIR-test ¹	Sargan test ² (p-value)	Serial correlation test ³ (p-value)
IV-Cross-Country	2.22** (0.003)	63	63	0.577		
GMM-Panel	2.40** (0.001)	77	365		0.183	0.516
2. Dependent Variable: Productivity Growth						
Estimation Procedure	Private Credit	Countries	Obs.	OIR-test ¹	Sargan test ² (p-value)	Serial correlation test ³ (p-value)
IV-Cross-Country	1.50** (0.004)	63	63	2.036		
GMM-Panel	1.33** (0.001)	77	365		0.205	0.772
3. Dependent Variable: Capital per Capita Growth						
Estimation Procedure	Private Credit	Countries	Obs.	OIR-test ¹	Sargan test ² (p-value)	Serial correlation test ³ (p-value)
IV-Cross-Country	2.83** (0.006)	63	63	6.750		
GMM-Panel	3.44** (0.001)	77	365		0.166	0.014

Source: Beck, Levine, and Loayza (2000)

¹ The null hypothesis is that the instruments used are not correlated with the residuals from the respective regression

Critical values for OIR-Test (2 d.f.): 10%= 4.61; 5%= 5.99

² The null hypothesis is that the instruments used are not correlated with the residuals from the respective regression

³ The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation

* significant at the 0.10 level, ** significant at the 0.05 level (p-values in parentheses)

IV-Cross-Country: Cross-country instrumental variables with legal origin as instruments, estimated using GMM

GMM-Panel: Dynamic panel (5-year averages) generalized method of moments using system estimator

Other explanatory variables: logarithm of initial income per capita, average years of schooling

PRIVATE CREDIT: Logarithm (credit by deposit money banks and other financial institutions to the private sector divided by GDP.)

Table 5: Stock Markets, Banks, and Growth: Panel GMM and OLS, 1975-1998

Dependent Variable: Real per Capita GDP Growth						
Estimation Procedure	Bank Credit	Turnover	Countries	Obs.	Sargan test ¹ (p-value)	Serial correlation test ² (p-value)
OLS-Cross-Country	1.47** (0.001)	0.79** (0.025)	40			
GMM-Panel	1.76** (0.001)	0.96** (0.001)	40	146	0.488	0.60

Source: Beck and Levine (2002), Tables 2 and 3

* significant at the 0.10 level, ** significant at the 0.05 level. (p-values in parentheses)

OLS: Ordinary Least Squares with heteroskedasticity consistent standard errors.

GMM: Dynamic panel Generalized Method of Moments using system estimator.

¹ The null hypothesis is that the instruments used are not correlated with the residuals.

² The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

Bank Credit = logarithm (credit by deposit money banks to the private sector as a share of GDP.)

Turnover = logarithm (Value of the trades of domestic shares on domestic exchanges as a share of market capitalization of domestic shares)

Other explanatory variables included in each of the regression results reported above:

logarithm of initial income and logarithm of initial secondary school enrollment.

Table 6: Industry Growth and Financial Development

Dependent Variable: Growth of value added of industry k in country i, 1980-1990

Share i,k of industry k in country i in 1980	External $_k$ * Total Capitalization $_i$	External $_k$ * Accounting Standards $_i$	R ²	Observations
-0.912 (0.246)	0.069 (0.023)		0.29	1217
-0.643 (0.204)		0.155 (0.034)	0.35	1067

Notes:

Source: Rajan and Zingales (1998), Table 4.

The table above reports the results from the regression:

$$Growth_{i,k} = \sum_j \alpha_j Country_j + \sum_l \beta_l Industry_l + \gamma Share_{i,k} + \delta_l (External_k * FD_i) + \varepsilon_{i,k}$$

Two regressions are reported corresponding to two values of FD_i , Total Capitalization and Accounting Standards respectively.

(Heteroskedasticity robust standard errors are reported in parentheses.)

External $_k$ is the fraction of capital expenditures not financed with internal funds for U.S. firms in industry k between 1980-90.

Total Capitalization is stock market capitalization plus domestic credit.

Accounting Standards is an index of the quality of corporate financial reports.

Table 7: Excess Growth of Firms and External Financing

Dependent Variable: Proportion of firms that grow faster than their predicted growth rate¹

Market Capitalization/GDP	Turnover	Bank Assets/GDP	Adj. R ²	Countries
-0.106 (0.058)	0.311*** (0.072)	0.162*** (0.050)	0.48	26

Notes:

Source: Demirguc-Kunt and Maksimovic (1998), Table V

(White's heteroskedasticity consistent standard errors in parentheses)

*** indicates statistical significance at the 1 percent level.

1. The proportion of firms whose growth rates exceed the estimate of the maximum growth rate that can be financed by relying only on internal and short-term financing.

Market Capitalization/GDP: The value of domestic equities listed on domestic exchanges as a share of GDP.

Turnover: The total value of trades of domestic shares on domestic exchanges as a share of market capitalization.

Other regressors: rate of inflation, the law and order tradition of the economy, i.e., the extent to which citizens utilize existing legal system to mediate disputes and enforce contracts, growth rate of real GDP per capita, real GDP per capita, government subsidies to private industries and public enterprises as a share of GDP, and net fixed assets divided by total assets.

Time period: The dependent variable is averaged over the 1986-1991 period. All regressors are averaged over the 1980-1985 period, data permitting.

Endnotes

¹ See King and Levine (1994), Jorgenson (1995), and Easterly and Levine (2001).

² In the case of the United States, Roe (1994) argues that the corporate structure of the firms has been heavily influenced by politics and therefore is not primarily an outcome of market forces.

³ Note that Calomiris and Kahn (1991), Flannery (1994), and Diamond and Rajan (2001) develop models in which the fragile structure of banks, i.e., liquid deposits and illiquid assets, serves as an effective commitment device that keeps banks from assuming excessive risks or from shirking on collecting payment from firms. Put succinctly, the sequential service constraint on bank deposits creates a collective action problem among depositors that induces depositors to run if they acquire information that the bank is not monitoring firms and managing risk appropriately. See Gorton and Winton (2000) for an excellent discussion of theories of financial intermediation.

⁴ Bank-based system may also impede the flow of information about firms (Morck et al 2000) and the responsiveness of the economy to market signals (Hoshi, Kashyap, and Scharfstein, 1991; Peek and Rosengren, 1998).

⁵ Also, Rajan and Zingales (2002) argue that in response to adverse stock that affects the economy unevenly, market-based systems will more effectively identify, isolate, and bankrupt truly distressed firms and prevent them from hurting the overall economy than a bank-based system. In a bank-based system (a relationship-based system), the pain is likely to be shared. While this may smooth temporary shocks, it may also impede the efficient adjustment to structural change.

⁶ These measures build on Demirguc-Kunt and Levine (1996a,b).

⁷ Note, King and Levine's (1993) PRIVY measures total credit flowing to the private sector, while Levine and Zervos's (1998) Bank Credit measures credit by banks to the private sector.

⁸ LZ examine three additional measures of liquidity. First, the value traded ratio equals the total value of domestic stocks traded on domestic exchanges as a share of GDP. This measures trading relative to the size of the economy. The next two measures of liquidity measure trading relative to stock price movements: (1) the value traded ratio divided by stock return volatility, and (2) the turnover ratio divided by stock return volatility.

⁹ Levine and Schmukler (2003) find that international cross-listing by emerging market firms can hurt the operation of the emerging market itself with potentially adverse implications for economic development according to the conclusions in Guiso, Sapienza, and Zingales (2002). In terms of international banking, Levine (2003c) finds that regulatory restrictions on foreign bank entry hurt the efficiency of domestic banking sector operations.

¹⁰ The null hypothesis is that the overidentifying restrictions are valid, that is, the instrumental variables are not correlated with the error term. The test statistic is simply the sample size times the value attained for the objective function at the GMM estimate (called the *J-statistic*).

Hansen's (1982) test statistic is distributed as χ^2 with degrees of freedom equal to the number of moment conditions minus the number of parameters to be estimated.

¹¹ LLB (2000) improves upon past measures of financial intermediary development by more accurately deflating nominal measures of financial intermediary liabilities and assets.

Specifically, while financial intermediary balance sheet items are measured at the end of the year, GDP is measured over the year. LLB deflate end-of-year financial balance sheet items by end of year consumer price indices (CPI) and deflate the GDP series by the annual CPI. Then,

they compute the average of the real financial balance sheet item in year t and $t-1$ and divide this average by real GDP measured in year t .

¹² To get this, note that LLB take logarithms of the financial intermediary indicators to reduce the effect of outliers, so that the change in financial development is $\ln(25) - \ln(19.5) = 0.25$.

Then, use their smallest parameter estimate on Private Credit from their Table 3, which equals 2.5. Thus, the acceleration in growth is given by $2.5*(0.25) = 0.63$.

¹³ Specifically, the within-country standard deviation of Private Credit is 15%, which in the panel estimation is added to the between-country standard deviation of 28%. Similarly, for real per capita GDP growth, the within-country standard deviation is 2.4% and the between-country standard deviation is 1.7%. The within-country standard deviation is calculated using the deviations from country averages, whereas the between-country standard deviation is calculated from the country averages.

¹⁴ This method, however, does not control for full endogeneity. It assumes that the explanatory variables are only “weakly exogenous,” which means that they can be affected by current and past realizations of the growth rate but must be uncorrelated with future realizations of the error term. Thus, the weak exogeneity assumption implies that future *innovations* of the growth rate (i.e., unanticipated shocks to future growth) do not affect current financial development. This assumption is not particularly stringent conceptually and its validity is tested statistically.

¹⁵ Using these moment conditions, Arellano and Bond (1991) develop – and LLB and BLL employ -- a two-step GMM estimator. In the first step the error terms are assumed to be independent and homoskedastic across countries and over time. In the second step, the residuals obtained in the first step are used to construct a consistent estimate of the variance-covariance matrix, thus relaxing the assumptions of independence and homoskedasticity.

¹⁶ As with the *difference estimator*, the model is estimated in a two-step GMM procedure generating consistent and efficient coefficient estimates. The consistency of the GMM estimator depends on (1) the assumption that ε does not exhibit serial correlation and (2) the validity of the instruments. Arellano and Bond (1991) develop two tests. The first is a Sargan test of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation procedure. Under the null-hypothesis of the validity of the instruments this test is distributed χ^2 with $(J-K)$ degrees of freedom, where J is the number of instruments and K the number of regressors. The second test examines the assumption of no second-order serial correlation. Under the null-hypothesis of no second-order serial correlation, this test is distributed standard-normal. Failure to reject the null hypotheses of both tests gives support to our model.

¹⁷ This results follows from $\text{Ln}(27.5) - \text{Ln}(22.9) = 0.18$ and $0.18 * 2.4 = 0.43$, where 2.4 is the parameter estimate from the panel regression.

¹⁸ There are additional econometric problems created when studying stock markets, banks, and economic growth. There many fewer countries and years when incorporating stock markets, which can lead to over-fitting of the data and potential mis-leading inferences. Beck and Levine (2003) describe and use variants of the dynamic panel estimator to reduce the likelihood that over-fitting is driving the results.

¹⁹ In a narrower study, Luintel and Khan (1999) find some evidence of bi-directional causality between finance and growth in VAR analysis of developing countries.

²⁰ For further analyses on the dating of international financial liberalization and its growth effects impact, see Bekaert, Harvey, and Lunsdaine (2003), Bekaert and Harvey (2000), Henry (2000),

Levine and Zervos (1998b), Edison, et al (2002), and Klein and Olivei (2002) and the references therein.

²¹ Note, Jayaratne and Strahan (1998) show that with bank deregulation, better-managed, lower costs banks expand at the expense of inefficient banks. On an international level, Demirguc-Kunt, Laeven, and Levine (2003) show that regulatory restrictions reduce banking sector efficiency and Beck, Demirguc-Kunt, and Levine (2003d) find that regulatory restrictions on bank competition tends to increase the fragility of banks.

²² A valuable debate exists concerning the case of Scotland between 1750 and 1845. Scotland began the period with per capita income of less than one-half of England's. By 1845, however, per capita income was about the same. While recognizing that the "... dominant political event affecting Scotland's potentialities for economic development was the Union of 1707, which made Scotland an integral part of the United Kingdom" (Cameron, 1967a, p. 60), Cameron argues that Scotland's superior banking system is one of the few noteworthy features that can help explain its comparatively rapid growth. Some researchers, however, suggest that England did not suffer from a dearth of financial services because nonfinancial enterprises provided financial services in England that Cameron's (1967a) measures of formal financial intermediation omit. Others argue that Scotland had rich natural resources, a well-educated work force, access to British colonial markets, and started from a much lower level of income per capita than England. Consequently, it is not surprising that Scotland enjoyed a period of rapid convergence. Finally, still others disagree with the premise that Scotland had a well-functioning financial system and emphasize the deficiencies in the Scottish system (Sidney Pollard and Dieter Ziegler, 1992).

²³ More specifically, let I indicate Italy, P indicate the Philippines, M indicate machinery, B indicate beverages, and g represent the growth of an industry in a country, then the differential

growth rate of machinery and beverages in Italy from the difference in growth rate of machinery and beverages in the Philippines is as follows: $[\{g(I,M)\} - \{g(P,M)\}] - [\{g(I,B)\} - \{g(P,B)\}]$.

Now, inserting estimates one obtains 1.3 =

$$[\{0.069*0.45*0.98\} - \{0.069*0.45*0.46\}] - [\{0.069*0.08*0.98\} - \{0.069*0.08*0.46\}].$$

²⁴ Cetorelli and Gambera (2001) use the RZ methodology to examine how banking system concentration influences the structure of industrial growth. Beck (2002) extends the work by RZ to examine the linkages between financial development and trade patterns. He develops a model in which higher levels of financial development produce a comparative advantage in industries that require external finance. Using cross-industry and cross-country data on trade flows, Beck (2002) finds that countries with more developed financial systems tend to be net exporters in industries that are heavy users of external finance. The results are consistent with the view that financial development influences the structure of trade patterns across countries.

²⁵ The estimates of internally financed growth (*IFG*) and short-term financed growth (*STFG*) are conservative. First, they assume that a firm utilizes the unconstrained sources of finance- trade credit in the case IFG and trade credit and short-term borrowing in the case of STFG - no more intensively than it is currently doing. Second, firms with spare capacities do not need to invest and may grow at a faster rate than predicted without accessing external resources. Third, the financial planning model abstracts from technical advances that reduce the requirements for investment capital. Thus, it may overstate the costs of growth and underestimate the maximum growth rate attainable using unconstrained sources of financing.

²⁶ Dyck and Zingales (2003, JF forthcoming) examine the private benefits of control over the period 1990-2000. They estimate the value of control in 393 control transactions across 39 countries. They find that the benefits of control are greater when financial markets are less

developed. They examine which institutions are most important in curbing the private benefits of control. They find that standard institutions are important, such as the statutory protection of minority shareholder rights and the efficiency of the legal system. Dyck and Zingales (2003) also find, however, that non-standard institutions are very important, such as the effectiveness of the media. Dyck and Zingales (2002) go on to further stress the role of the media in influencing corporate managers. This work extends our conception of the institutions involved in exerting corporate control over firms.

²⁷ Kumar, Rajan, and Zingales (2001) show that financial development is associated with larger firms, suggesting that low levels of financial development constraint firm growth.

²⁸ See Goldsmith (1969), Hoshi, Kashyap, and Scharfstein (1990), Allen and Gale (1995), Levine (1997), Mork and Nakkamura (1999), Weinstein and Yafeh (1998) and Wenger and Kaserer (1998).

²⁹ Beck, Demirguc-Kunt, and Levine (2003c) go on to show that bank supervisory practices that force accurate information disclosure ease external financing constraints facing firms, while countries that grant substantial power to government controlled regulators actually make external financing constraints more severe. Caprio, Laeven, and Levine (2003) show that legal protection of shareholders is more effective at boosting the valuation of banks than strong official bank regulation and supervision. In terms of securities markets, La Porta et al (2003) find that securities market regulations that empower private monitoring of corporations promote stock market development; while securities market regulations that rely on official oversight of markets only promote equity market development in countries with efficient government bureaucracies.