Revista de Análisis Económico, Vol. 8, Nº 1, pp. 113-129 (Junio 1993)

FINANCIAL STRUCTURES AND ECONOMIC DEVELOPMENT

ROSS LEVINE*
The World Bank

Abstract:

This paper examines the relationship between the evolution of financial services and long-run economic growth. Liquidity risk, productivity risk, transactions costs, and information gathering and resource coordination costs create incentives for the emergence of financial contracts and institutions. The level of income per capita, public policies, and legal codes determine the provision of financial services and the types of financial structures that provide these services. The resultant financial structures can alter investment incentives, such that the steady state growth rate of per capita output increases.

Introduction

A large literature documents the relationship between the evolution of financial markets and economic development[1]. Evidence suggests that as real income rises, the distribution of financial assets among financial intermediaries changes, and that rapid economic growth tends to occur in countries where the ratio of financial institutions' assets to GNP is large. These observations suggest that a satisfactory theory of the relationship between financial market evolution and economic growth needs to explain how economic growth elicits the creation and modification of financial arrangements

* The findings, interpretations, and conclusions are only those of the author and should not be attributed to the World Bank, its Board of Directors, its staff, or its member countries. I would like to thank seminar participants at the World Bank, the Federal Reserve Board, Stanford University, New York University, and the University of Maryland. Very influencial suggestions were made by María Carkovic, Mansoor Dailami, William Easterly, Robert King, Eric Leeper, Sergio Rebelo, Paul Romer, Dimitri Vittas, an anonymous referee, and specially David Gordon.

while simultaneously explaining how the evolving financial structure alters the incentives of individuals in ways that change the economy's growth rate. This paper constructs a general equilibrium model to help reconcile theory with the empirical evidence.

Recent theoretical papers by Greenwood and Jovanovic (1990), Bencivenga and Smith (1991) and Levine (1991) have contributed to our understanding of the ties between financial markets and growth[2]. Bencivenga and Smith (1991) construct a bank that by pooling all of an economy's resources invests more efficiently than if individuals make their own investment decisions. Levine (1991) shows how productivity and liquidity risk may induce equity markets to arise and explores how the resultant market allocates risk and alters investment incentives in ways that change steady state growth rates. There is no channel in either of these papers, however, through which economic growth can stimulate changes in financial markets. In Greenwood and Jovanovic (1990), investors can choose to pay a one-time fee to a financial intermediary that in return provides information on the economy's aggregate shock in all subsequent periods which enhances investment decisions and growth. Since more investors find it worthwhile to pay the one-time fee as per capita income rises, economic development helps determine membership in the financial intermediary.

One shortcoming with *all* of these models is that agents are either completely isolated from financial arrangements, or they participate in the totality of financial services available within the context of the specific models. Across countries, however, we see financial markets providing a continuum of services. Apparently, economies choose the types of financial services that they require and can afford given the policies and legal structures of the economy.

This paper takes a step towards resolving this shortcoming of existing models by allowing economies at different levels of development to choose different types of financial arrangements. In the model, various types of financial contracts and institutions arise in response liquidity and productivity risk, information gathering and resource mobilization costs, and financial transactions costs. The emergence and development of financial structures can alter investment decisions and per capita growth rates. Furthermore, the level of per capita income helps determine the *types* of financial services that society chooses to construct and use. Thus, this paper captures the two-way nature of the relationship between financial and economic development as was emphasized by Greenwood and Jovanovic (1990). Also, this paper allows for societies at different levels of economic development and with different policies to choose different financial services.

The model is built on the foundations of both the "endogenous growth" literature, which studies how economic incentives, production opportunities, and policies prompt individuals to make decisions that determine the rate of growth, and the "endogenous financial structures" literature, which studies the emergence of financial services in response to risk and information costs[3]. Per capita output growth only occurs if agents invest a sufficient amount in projects that augment human capital and stimulate technological innovation. The critical inputs into human capital and technology production are physical resources and group interactions.

Human capital augmenting interactions occur in "firms", where groups of agents invent, innovate, and produce together in a two period production process. Furthermore, I assume that physical resources invested in firms are subject to an externality: the average quantity of resources maintained in firms during the two period production process increases the human capital of each worker independently of that individual's

own investment of resources. The externality implies that an individual who prematurely removes his capital after one period slows the rate of human capital accumulation of remaining firm members and, thereby, slows economic growth.

In addition to specifying an environment in which per capita growth may emerge as the result of private investment decisions, the model has characteristics that motivate the creation of commonly observed financial services. Agents may invest in illiquid firms that are subject to productivity shocks, or in liquid but less profitable assets that pay off in one period. The liquid asset does not enhance human capital or technology and, therefore, does not contribute to growth. Firms are termed illiquid because premature removal of one's capital before firms complete production yields a low return. After making investment decisions, some individuals receive privately observed liquidity shocks whereby they discover that they need to consume their wealth before firms complete the two period production process. This liquidity risk along with firm productivity risk may discourage firm investment. Consequently, financial contracts and institutions may arise to enhance firm liquidity and allow investors to diversify against productivity shocks.

Another element of the model that can elicit the creation of financial intermediaries is the cost associated with identifying and exploiting profitable investment opportunities. The model contains an externality associated with physical capital in the creation of human capital and technology. An intermediary that identifies worthy projects and mobilizes resources for a firm could internalize production externalities into investment decisions, improve resource allocation, and accelerate economic growth. I examine a simple cost structure, such that individual investors have to pay a fee each period to purchase financial intermediary services that allow investors to internalize production externalities. This cost structure implies that the level of income per capita helps determine the type of financial services constructed and used by economies.

The financial structures that may arise in this model –depending on policy, transactions costs, and the level of income per capita– affect growth via two channels. First, financial services can increase the fraction of resources devoted to long-run endeavors that augment human capital and technology. Specifically, financial structures can raise the fraction of resources devoted to firms by reducing the liquidity and productivity risk associated with firms and by allowing investors to internalize firm production externalities. A second channel via which financial arrangements may affect growth is by eliminating the premature liquidation of firm capital. Financial structures can eliminate premature capital liquidation by allowing investors with different liquidity needs to trade either directly through equity markets or indirectly through financial intermediaries, so that investors requiring quick access to their wealth do not liquidate firm capital. This increases the rate of human capital creation for any level of firm investment, and the economy grows faster. Thus, financial services can accelerate growth by improving the allocation of capital and the productivity of firms, while growth can influence the types financial services found in an economy by making the provision of financial services profitable and the purchase of these services affordable.

Although this paper does not focus on policy, imposing different policies on the model generates different financial arrangements and different growth rates. Thus, this paper helps explain a number of empirical regularities that have not been previously reconciled within the context of a single model: (1) there are startling differences in per capita growth rates across countries [Romer 1989]; (2) per capita growth rates are positively correlated with a variety of measures of financial market activity including

the ratio of financial institutions' assets to GNP [King and Levine 1993a]; and (3) the distribution of financial assets among financial intermediaries tends to change in a common pattern as per capita income rises, but countries at similar income levels display noticeable differences in the distribution of assets across specific financial intermediaries [World Bank 1989][4].

The next section describes the endogenous growth model and the incentives for financial services to arise. Section II studies the emergence of financial structures that enhance firm liquidity, allow agents to diversify against productivity risk, and lower financial transactions costs. In addition, the section evaluates the implications of these financial services and public policy on resource allocation and growth. This section emphasizes the role that financial services can play in economic development. It does not focus on the precise institutional forms that may arise in different countries to perform these services. The section does, however, discuss how public policy can shape the types of institutions that provide financial services. Section III examines the emergence of financial intermediaries that research production processes, identify and verify externalities, and mobilize resources to exploit profitable opportunities. The role and implications of policy are also discussed. Section IV concludes.

I. The Model

This section presents an endogenous growth model based on Levine (1991). Liquidity risk, productivity risk, information gathering and resource mobilization costs, and financial transactions costs generate a demand for financial services. In addition, the level of income per capita may affect the affordability and provision of financial services. Later sections study (1) the emergence of financial contracts, markets, and institutions, (2) the resultant effects of financial arrangements on steady state growth, and (3) the manner in which economic growth can affect the emergence of different financial intermediaries.

A. *Preferences and Endowments*

The economy consists of an infinite sequence of agents that live for three periods. There is no population growth; in each period, indexed by $t = 0,1, 2,...$, a continuum of identical agents of measure one is born with the utility function

$$u(c_1, c_2, c_3) = -\frac{[c_2 + \varphi c_3)^{-\gamma}}{\gamma}, \text{ where } \gamma > 0. \tag{1}$$

Consumption at age i is c_i, and the coefficient of relative risk aversion is $\gamma + 1$. Since agents do not value age 1 consumption, they save all age 1 income.

The agent-specific, privately observed random variable φ is revealed at the start of the second period of life, and has the probability distribution

$$\varphi = \begin{cases} 0 \text{ with probability } 1 - \pi \\ 1 \text{ with probability } \pi \end{cases}. \tag{2}$$

The preference and risk structure defined by equations (1) and (2) imply that agents care about the ability to consume their wealth at age 2 because they may receive $\varphi = 0$ and therefore not value age 3 consumption. Consequently, there is a "desire for liquidity". The uncertainty associated with being a "type 0" ($\varphi = 0$) is "liquidity risk". If each individual's type were publicly observable, standard insurance contracts contingent on each agent's type would eliminate liquidity risk. Since types are not publicly verifiable, alternative financial arrangements may arise to mitigate liquidity risk.

Age 1 agents are endowed with one unit of labor that they supply inelastically to firms.

B. *Technology*

Each period, groups of agents –"firms"– produce a commodity that can be used as capital, consumed immediately, or stored and consumed in the next period.

Production is a two-stage process. In the first stage, individuals invent production processes and improve human capital[5]. In the second stage, firms produce commodities.

Formally, an agent born at t works for age 3 entrepreneurs, receives wage w_t, stores (1–q) of her earnings until $t + 1$, and invests the fraction q of age 1 income (qw_t) in a firm. The human capital augmentation function is

$$h_{t+2} = H\underline{W}^{\delta}_{t+2}(qw_t)^{\varepsilon}, \quad 1 < \delta, \varepsilon < 0, \tag{3}$$

where h is human capital, H is a constant, qwt is the quantity of resources invested in the firm by the individual, and $\underline{W}_{t+2}$ is the average quantity of resources per entrepreneur maintained in the firm between t and $t + 2$. Specifically, $\underline{W}_{t+2} = (1- \alpha)(\underline{qw}_t)/\pi$, where α is the average fraction of resources removed from the firm at $t + 1$, $\underline{qw}_t$ are average resources per entrepreneur invested in period t, and π is the fraction of initial members remaining in $t + 2$.

Human capital acquisition requires that agents interact for two periods [Prescott and Boyd 1987]. The *rate* of human capital acquisition for an individual depends positively on (1) the amount of resources invested by the individual [King and Rebelo 1990] and (2) the average amount of physical resources maintained in the firm for two periods [Levine 1991]. This last input states that the average amount of resources in the firm positively affects the human capital of each individual member independently of that individual's own investment. This physical resource externality may be the result of a number of effects: (1) there may be a public good externality associated with resources within a firm; (2) a member who benefits from his own investment will, via interactions with other members, influence the human capital of others; (3) resources invested by one individual may allow that individual to interact more with other firm members. The externality implies that investment is socially sub-optimal. If a financial intermediary could coordinate investment, it would internalize the production externality and increase firm investment.

In the second stage of firm production, age 3 firm members with human capital –"entrepreneurs"– hire age 1 workers to produce consumption goods (y):

$$y_{t+2} = \eta_{t+2} h^{1-\theta}_{t+2} L_{t+2}, \quad 0 < \theta < 1, \tag{4}$$

where L_{t+2} is age 1 labor units hired per entrepreneur in t + 2 and η_{t+2} is a firm specific shock with an expected value of one[6]. The level of human capital per entrepreneur at t + 2 is h_{t+2}. In relation to the standard neoclassical growth model, h_{t+2} is technology, but in this paper, the evolution of technology is the result of the decisions of maximizing agents.

Only age 3 agents receive firm profits because production requires two periods. Removal of one's capital after one period yields a low gross return of x consumption goods per initial investment good, where x is less than the return from the storage technology (i.e., x < 1). Thus, firm investment is illiquid.

The labor market is competitive, so that labor is paid its expected marginal product,

$$w_{t+2} = (1-\theta)\, h_{t+2}\, L_{t+2}^{-\theta}. \tag{5}$$

The return to each entrepreneur in firm j is

$$r^j_{t+2} = [\tilde{\eta}^j_{t+2} + \theta - 1]\, h_{t+2}\, L_{t+2}^{1-\theta}. \tag{6}$$

Thus, human capital positively influences production, wages, and the return to capital.

C. *Information and Transactions Costs*

Four characteristics motivate the creation of financial structures. First, individuals face uncertain liquidity needs. Consequently, financial contracts and institutions may arise that allow individuals to reduce liquidity risk. Second, firm specific productivity shocks create an incentive for financial structures that help agents diversify against productivity risk. Third, there are costs associated with financial transactions. Thus, intermediaries may arise that reduce the number of transactions. For simplicity, I assume that agents can conduct two free asset transactions; additional transactions cost τ per trip. As will become clear, allowing two free transactions is unimportant for the results.

A fourth element of the model's informational structure that can elicit the creation of financial intermediaries is the cost associated with identifying and exploiting profitable investment opportunities. The model contains an externality associated with physical capital in the creation of human capital and technology. The externality implies that firm investment is socially sub-optimal. An intermediary that identifies profitable opportunities and coordinates investment for a firm could internalize the production externality and improve resource allocation. This activity, however, is costly.

I examine a cost structure that creates an important link between financial structure and growth. I assume that there is a cost (Z) each period associated with researching firms and identifying externalities. Any individual or agency can acquire this information about all of the productive processes in the economy for Z. An intermediary that collects information for a large number of investors can reduce the research costs per investor by spreading the fixed costs over many investors. Thus, there is an incentive for intermediaries to perform researching activities for many individuals. In addition, there are costs associated with mobilizing resources from many individuals and coordinating financing to exploit profitable projects[7]. Specifically, mobilization costs equal a constant amount (ζ) per investor from whom the

intermediary collects funds, or put differently, each investor must pay ζ to receive researcher/mobilizer services in a competitive equilibrium. Thus, researcher/mobilizer services cost less in richer countries in per capita income terms. Consequently, the level of economic development helps determine the type of financial structures constructed and used by an economy.

D. *Trading under Financial Autarky*

This section examines the model without financial services. Consider an agent born at time t. In the first period of life, she supplies time to a firm, receives wage wt, and makes an investment decision: she invests the proportion q of her wages in an illiquid firm and stores the remainder. The initial firm investment is one asset transaction.

At age 2, agents learn their types (φ). The fraction $1-\pi$ of the generation receives $\varphi = 0$ and therefore does not value period 3 consumption. These type 0 agents regret having invested in the firm. They consume their wealth at age 2: stored good $[(1-q)w_t]$ plus the premature "liquidation" value of the capital they invested in the firm $[xqw_t]$. This liquidation is counted as a second asset transaction. Since all type 0's liquidate firm capital, the fraction of resources removed from firms (α) equals the fraction of the population that are type 0 ($1-\pi$). Thus, the average quantity of resources maintained in firms for two periods (W_{t+2}) is lower than it would be if capital were not removed from firms prematurely. Because of the externality, type 0 agents unintentionally reduce the rate of human capital accumulation of remaining members.

Type 1 agents value age 3 consumption and regret having stored goods at age 1 because firms have a higher expected rate of return than storage. They do not prematurely liquidate capital and consume only their stored goods at age 2: $[(1-q)wt]$. At age three, type 1 agents complete stage one of firm production, having developed skills and patents. They hire age 1 labor, produce goods subject to a productivity shock, pay labor, and distribute any profits to remaining partners based on their initial investments. Thus, type 1 agents consume r^j_{t+2} at age 3. The distribution of profits is a second asset transaction.

Note that at age 2, $(1-\pi)$ of the population regrets having invested in the firm [type 0 agents], and π of the population regrets having stored goods [type 1 agents]. Thus, there is a role for markets that allow these two types to trade directly or indirectly.

E. *Equilibrium under Financial Autarky*

A representative agent born at t chooses q to solve the problem

$$\max E - \frac{(1-\pi)\,[qw_t x + (1-q)\,w_t]^{-\gamma}}{\gamma} - \frac{\pi[(1-q)w_t + (\tilde{\eta}^j_{t+2} + \theta - 1)\, H\underline{W}^{\delta}_{t+2}\,(qw)^{\varepsilon}_t\, L^{1-\theta}_{t+2}]^{-\gamma}}{\gamma}, \tag{7}$$

where E is the expected value operator. Since π of a generation become entrepreneurs and L_t is age 1 labor per entrepreneur, $L_t = 1/\pi$. Under financial autarky, all type 0 agents prematurely remove firm capital, so that $\alpha = 1-\pi$. Thus, in equilibrium

$$L_t^{1-\theta} = \pi^{\theta-1} = \psi, \underline{W}_{t+2} = (1-\alpha)(\underline{qw})/\pi = w_t q. \tag{8}$$

After substituting (8) into the first order condition and assuming $\varepsilon + \delta = 1$ is[8]

$$\frac{(1-\pi)[x-1]}{[xq+(1-q)]^{1+\gamma}} + \pi E_{\tilde{\eta}} \left\{ \frac{[(\eta+\theta-1)\varepsilon H\psi - 1]}{[(\tilde{\eta}+\theta-1)H\psi q+(1-q)]^{1+\gamma}} \right\} = 0. \tag{9}$$

The first term in (9) is the increment to utility if q is marginally increased given that the agent is type 0. The second term is the expected increment to utility if q is marginally increased given that the agent is type 1[9].

Re-write (9)

$$\frac{(1-\pi)[x-1]}{[xq+(1-q)]^{1+\gamma}} + \pi \frac{[\varepsilon\theta H\psi - 1]}{[\theta H\psi q+(1-q)]^{1+\gamma}} + \pi \mathrm{Cov}\left\{ [\tilde{\eta}+\theta-1]\varepsilon H\psi - 1], \frac{1}{[(\tilde{\eta}+\theta-1)H\psi q+(1-q)]^{1+\gamma}} \right\} = 0. \tag{10}$$

Contingent on the agent being type 1, the last term is the covariance between the expected return to marginally increasing firm investment and the marginal utility of consumption. This covariance is always negative.

The first result is that financial contracts or institutions that allow investors to hold diversified portfolios will induce individuals to invest more in firms. To see this, note that the summation of the first two terms in (10) varies inversely with q. Since the covariance is negative and becomes more negative as the variance of the productivity shock increases, q –the fraction of income devoted to firm investment– must fall as the variance of the productivity shock increases. The economic intuition is that the variance of the productivity shock discourages risk averse investors from investing in firms. Consequently, financial structures that allow investors to diversify against productivity shocks will induce more firm investment.

F. *Investment and Growth under Financial Autarky*

Having established the influence of productivity risk on investment, let the variance of the productivity shock equal zero. Solving (10) yields

$$q = \frac{\lambda - 1}{(R-1)+\lambda(1-x)}, \text{ where } \lambda = \left\{ \frac{\pi(\varepsilon R-1)}{(1-\pi)(1-x)} \right\}^{\frac{1}{1+\gamma}}, \quad R = H\theta\psi. \tag{11}$$

The fraction of resources allocated to firms depends positively on the share of output going to entrepreneurs (θ), the rate of human capital accumulation (H), labor per entrepreneur (ψ), the liquidation value of firm investment (x), the probability of being type 1 (π), and the fraction of returns internalized by individuals (ε). Also, more risk aversion (γ) implies less firm investment because liquidity risk is associated with firm investment.

The two period growth rate is

$$g_y = y_{t+2}/yt = h_{t+2}/ht = \frac{H\underline{W}_{t+2}^{\delta}(qw_t)^{\varepsilon}}{h_t}. \tag{12}$$

Substituting equilibrium values and letting $A = H(1-\theta)\pi^{\theta}$,

$$g_y = Aq = A\left[\frac{1(\lambda-1)}{(R-1)+\lambda(1-x)} \right]. \tag{13}$$

Per capita growth is tied to human capital accumulation: the faster the rate of human capital accumulation, the faster is the growth rate of per capita output.

G. *Discussion*

The larger the fraction of resources devoted to firms, the higher is the economy's growth rate. Thus, incentives for firm investment increase growth; disincentives discourage it. Productivity risk discourages firm investment and thereby lowers growth. Financial contracts and institutions that allow agents to hold diversified portfolios reduce productivity risk, encourage firm investment, and expedite per capita growth. Similarly, financial arrangements that ameliorate liquidity risk can stimulate firm investment and economic growth. Furthermore, financial intermediaries that allow investors to internalize production externalities would further raise the fraction of resources allocated to firms, augmenting the rate of human capital creation and accelerating per capita income growth.

In addition to the fraction of resources allocated to firms being an important determinant of growth, the economy's growth rate is also a function of firm productivity. The fraction $1-\pi$ of the population removes its capital from firms after one period. Because of the production externality, premature capital liquidation reduces the rate of human capital accumulation of remaining firm members and slows economic growth. An institution or market that minimizes premature capital liquidation would increase economic growth for any firm investment rate by improving productive efficiency.

II. Risk and Transactions Costs: Equity Markets and Simple Financial Intermediaries

This section examines the emergence of equity markets and simple financial intermediaries that mitigate liquidity and productivity risk. The incentives for equity markets and financial intermediaries to form are straightforward: agents would like to hold diversified portfolios that eliminate their exposure to idiosyncratic productivity risk; and investors would like to hold assets that are liquid, so that they do not receive a low return when they require early access to their wealth. While reducing liquidity risk, equity markets and simple financial intermediaries eliminate the premature withdrawal of resources from firms. This increases firm efficiency and accelerates growth.

There are, however, transactions costs associated with equity transactions. The fraction $[1-\pi]$ of the population goes to the market twice, while the fraction π goes three times. Thus, expected transactions costs at age 1 are $\pi\tau$. The intermediaries introduced in this section reduce transactions costs. The intermediaries are termed "simple" because they do not improve the informational content manifest in society's investment decisions.

It should also be emphasized that this paper focuses on the provision of financial services, not on explicitly characterizing the institutions that provide financial services. Thus, while the presentation is done in the context of equity markets and deposit taking financial intermediaries, this paper says little about the precise form of contracts and institutions. I do, however, discuss how different looking institutional structures could provide similar financial services and also describe how public policy may shape the existence and form of financial institutions.

A. *Trading and the Emergence of Equity Markets*

Financial trades occur in the first part of each period and other activities occur in the second part. During age 1, agents create firms and distribute shares. At age 2, agents learn their types. The resulting heterogeneity creates an incentive for financial transactions.

At age 2, agents know the amount of claims each has on period three consumption goods and the quantity of consumption goods stored from period 1. Let P equal the period 2 price of claims to period 3 goods, i.e., how many stored goods one has to pay for a claim to a period 3 good. Type 0 agents will sell their claims to period 3 consumption goods as long as they receive a return at least equal to the liquidation value of their firm investment, x. Type 1 agents will purchase period three consumption goods with their stored goods as long as the price of period three consumption goods in terms of stored consumption goods (P) is less than one.

The solution is greatly simplified by noting that as long as the expected return from firm investment ($\varepsilon\pi R^*$, where $R^* = R\pi^{-\delta}$) is greater than the storage return (1) which is in turn larger than the liquidation return (x), no resources will be prematurely liquidated and all stored goods are consumed by agents that do not value period 3 consumption[10].

Thus, no firm capital is prematurely liquidated: $(1-\alpha) = 1$, and $W_{t+2} = w_t q^*/\pi$. This implies that the rate of human capital accumulation will be higher for any given investment rate than in the financially autarkic economy.

Assuming agents hold diversified portfolios, agents choose q^* to maximize expected utility, where the superscript "*" designates the investment decision with equity markets:

$$\max \; -\left[\frac{1-\pi}{\gamma}\right]\left[(1-q^*)w_t + P\pi\theta\psi H\underline{W}^{\delta}_{t+2}(q^*w_t)^{\varepsilon}\right]^{-\gamma} \qquad (14)$$

$$-\left[\frac{\pi}{\gamma}\right]\left[\pi\theta\psi H\underline{W}^{\delta}_{t+2}(q^*w_t)^{\varepsilon} + \frac{(1-q^*)w_t}{P} - \tau\right]^{-\gamma}.$$

If transactions costs are sufficiently large, agents will choose not to use equity markets; the economy will resort to the equilibrium studied in Section I. Thus, public policies

that raise transactions costs could inhibit the formation and functioning of capital markets[11].

B. *The Investment Decision and Growth with Equity Markets*

Taking the first condition of (14) and simplifying yields

$$\varepsilon\pi R^*P = 1. \qquad (15)$$

To solve for q^* conjecture that

$$P = \frac{(1-q^*)}{(1-\pi)R^*q^*}, \qquad (16)$$

substitute (16) into (15) to obtain q^*

$$q^* = \frac{\varepsilon\pi}{1-\pi+\varepsilon\pi}. \qquad (17)$$

Equation (17) specifies the fraction of resources devoted to firm investment when society chooses to create equity markets. In comparing the investment decision in the presence of equity markets (17) with the investment decision in the absence of equity markets (11), note that there are parameterizations of the model such that without equity markets no firm investment occurs, but the emergence of equity markets alone changes incentives sufficiently, so that individuals invest in firms and the economy grows. Thus, policies that stymie the evolution of capital markets may retard technological innovation, human capital augmentation, and economic growth.

The per capita growth rate of the economy is

$$\begin{aligned} g_y^* &= A\pi^{-\delta}q^* \\ &= A^*q^* \\ &= A^*\frac{\varepsilon\pi}{1-\pi+\varepsilon\pi}. \end{aligned} \qquad (18)$$

Equations (17) and (18) demonstrate the two channels through which the emergence of equity markets can stimulate growth. The first channel is enhanced productive efficiency. By allowing agents to manage liquidity risk, equity markets eliminate the premature removal of capital from firms. The maintenance of more resources in firms increases the rate of human capital accumulation because of the physical resource externality in human capital production. The faster rate of human capital augmentation enhances firm productivity and the rate of per capita income growth. Thus, even if $q = q^*$, the growth rate with equity markets is greater than under financial autarky, i.e., $A^* > A$ by $\pi^{-\delta}$.

The second channel through which equity markets can affect growth is the allocation channel. By reducing the liquidity and productivity risk associated with firm

investment, equity markets can increase the fraction of resources devoted to firms over the financially autarkic allocation which increases growth.

Equity markets do not, however, allow investors to internalize production externalities into their investment decisions. Furthermore, equity markets require more transactions than in financial autarky.

C. *"Simple" Financial Intermediaries*

This section shows how financial intermediaries can reduce transactions costs. Intermediaries may take deposits from age 1 individuals and invest directly in the storage technology and a diversified portfolio of firms[12]. A demand deposit is defined as contract that requires an initial investment at age 1 and promises a return of r^1 at age 2 or r^2 at age 3 at the discretion of the depositor. Let intermediaries offer depositors

$$r^1 = \frac{1}{1-\pi+\varepsilon\pi}; \qquad r^2 = \frac{R\,\varepsilon\pi}{1-\pi+\varepsilon\pi}. \tag{19}$$

These return are equal to the equilibrium returns in the presence of equity markets except that r^2 is greater in this banking economy by τ because transactions costs are lower. Each agent only conducts two transactions: deposit and withdrawal. In the equity market equilibrium π percent of the population transact three times.

Since simple financial intermediaries choose the same allocation of resources as with equity markets, no firm capital is prematurely liquidated, and reduced productivity and liquidity risk enhance firm investment. Transactions costs with banks are lower, however.

Different public policies may play an important role in determining the types of institutions that perform financial services across economies. Directed credit policies, interest rate controls, and taxes on financial intermediaries could impede the ability of intermediaries to invest optimally and thereby discourage development of financial institutions. In this case, equity markets may play a more prominent role in allowing investors to pool and trade risk. Similarly, taxes on equity transactions or capital gains could restrict participation in stock markets. Under these conditions, banks, mutual funds, informal finance houses, and even the financial divisions of large corporations may play key roles in providing financial services. Thus, policy will not only help in determining whether or not financial services are provided, public policies may importantly shape the type of financial structures that arise to allocate risk and reduce transactions costs.

III. Financial Intermediaries: Researcher/Mobilizer

Individuals would invest more in firms if they could internalize firm externalities into their decisions, but there are costs associated with researching projects, identifying externalities, publicly certifying "good" projects and conveying this information to investors, and then mobilizing resources from individual investors. Although it would

be prohibitively costly for each individual to perform these activities, financial intermediaries may form to research production processes and mobilize resources to take full advantage of profitable production opportunities. These research, certification, mobilization, and coordination functions are similar to the types of activities conducted by investment banks, venture capitalists, and commercial banks[13].

A. *Costs, Trading, and Equilibrium*

As described in Section I, the cost of researching firms and identifying externalities is Z. Therefore, an intermediary that collects funds from many investors can effectively reduce the research costs to zero *per investor*. In addition, there are costs associated with mobilizing resources and coordinating financing to exploit profitable projects. Specifically, it costs the researcher/mobilizer ζ per investor. Since I assume the market for financial services is competitive, the profits from financial intermediation must be zero in equilibrium. Thus, financial intermediaries charge ζ per investor in equilibrium. Individuals, however, may not find it worthwhile to purchase researcher/mobilizer services. If the extra return generated by these services does not sufficiently compensate for the cost of these services, agents will not purchase the services offered by researcher/mobilizers.

I examine the situation in which financial structures already exist that allow agents to both diversify portfolios and manage liquidity risk such that there is no premature capital liquidation. In this case, investors have the choice of whether to use or not use researcher/mobilizer intermediaries. Formally, investors can choose to forgo researcher/mobilizer services, so that utility equals

$$V^* = \max -\left[\frac{1-\pi}{\gamma}\right]\left[(1-q)w_t + P\pi\theta\psi H\underline{W}^{\delta}_{t+2}(qw_t)^{\varepsilon}\right]^{-\gamma} - \left[\frac{\pi}{\gamma}\right]\left[\pi\theta\psi H\underline{W}^{\delta}_{t+2}(qw_t)^{\varepsilon} + \frac{(1-q)w_t}{P}\right]^{-\gamma}. \tag{20}$$

Or, investors can purchase researcher/mobilizer services and obtain a higher returns. In this case, agents maximize expected utility

$$V^{**} = \max -\left(\frac{1-\pi}{\gamma}\right)\left[(1-q)w_t + P\pi R^* qw_t - \zeta\right]^{-\gamma} - \left(\frac{\pi}{\gamma}\right)\left[\pi R^* qw_t + \frac{(1-q)w_t}{P} - \zeta\right]^{-\gamma}, \tag{21}$$

where the superscript "**" designates values for an economy that chooses to create research/mobilizer financial intermediaries.

Before characterizing the equilibrium, Proposition 1 will simplify the analysis.

Proposition 1:

For a given purchase price of researcher/mobilizer activities, ζ, there is a threshold level of income, $\hat{w}$, such that when income is above the threshold level, $w > \hat{w}$, agents choose to purchase researcher/mobilizer activities because $V^{**} > V^{*}$.

Proof:

Since (i) $V^{**} > V^{*}$ when $\zeta = 0$; and (ii) $V^{**} - V^{*}$ is continuous and increasing in w, then for any constant $\zeta > 0$, there is a $\hat{w}$ where $V^{**}(w) = V^{*}(\hat{w})$, so that for $w > \hat{w}$, $V^{**}(w) > V^{*}(w)$.

Proposition 2 establishes that the level of per capita income can help in determining the types of financial services provided by financial intermediaries. If per capita income is sufficiently high, agents choose to purchase services that involve researching firms, certifying the existence of worthy projects, and mobilizing resources to exploit fully investment opportunities. If per capita income is not sufficiently high, agents find that the additional returns generated by these financial services are not worth the cost.

It should also be pointed out that public policies may affect the cost of financial intermediation. If public policies directly or indirectly raise the cost of evaluating firms, this could retard financial development. Thus, the model predicts that restrictive financial policies can lower productive efficiency and the rate of economic growth.

We can now solve for the equilibrium investment allocation decision and per capita growth rate in an economy that chooses to create and use financial intermediaries that provide researcher/mobilizer services. Let $w > \hat{w}$, so that agents maximize the problem in equation (21). The investment decision is

$$q^{**} = \pi, \tag{22}$$

and growth is

$$\begin{aligned} g_y^{**} &= A^{*}q^{**} \\ &= A^{*}\pi. \end{aligned} \tag{23}$$

B. *Discussion*

The economy where a financial intermediary arises that substantially augments the informational content of investment decisions grows faster than economies where these "complex" financial intermediaries do not arise. This occurs because researcher/mobilizer intermediaries induce a larger fraction of resources to be invested in human capital augmenting firms, i.e., $q^{**} > q^{*}$ and $q^{**} > q$. By internalizing externalities, the financial intermediary encourages investment in firms that enhance technology and improve human capital. Since the analysis of this "complex" financial intermediary was assumed to occur in the presence of financial structures that minimize liquidity and productivity risk, no firm capital is prematurely liquidated and productivity risk does not discourage firm investment.

Financial development can be a function of the level of income per capita. Thus, this model captures the two-sided nature of the relationship between finance and growth: the emergence and development of financial contracts and institutions alters investment incentives and firm production processes in ways that change per capita growth rates; and the level of economic development helps in determining the types of financial arrangements that society chooses to construct and use[14]. One empirical prediction that emerges from the analysis is that economies that pass a threshold level of income per capita will choose more sophisticated financial arrangements and therefore grow faster.

The model also predicts that per capita growth rates are related to the types of financial services provided by the financial sector: financial structures that manage liquidity and productivity risk, reduce transactions costs, and augment the information content of investment decisions increase the efficient allocation of resource, the productivity of firms, and economic growth. Thus, common empirical measures of the overall size of the financial system may not appropriately capture fundamental features of financial development. This paper suggests that empirical work should focus on developing indicators of the provision of financial services, not simply measuring the size of the financial system or any particular financial institution.

IV. Conclusion

An important challenge to economists is to explain how financial contracts and institutions affect economic growth while simultaneously explaining how economic growth elicits the creation and modification of financial arrangements. This paper examines the relationship between the evolution of financial services and long-run economic growth. Liquidity risk, productivity risk, transactions costs, and information gathering and resource coordination costs create incentives for the emergence of financial contracts and institutions. The level of income per capita, public policies, and legal codes determine the provision of financial services and the types of financial structures that provide these services. The resultant financial structures can alter investment incentives, such that the steady state growth rate of per capita output increases. In addition, the model formally demonstrates that the purchase and use of financial services is not necessarily "all-or-nothing". From the broad spectrum of available financial services, economies choose to construct and use financial contracts and institutions given the level of income per capita, public policies, and legal structures.

Taking policies toward financial markets as given exogenously, this paper can help explain a number of empirical regularities that have not been previously reconciled within the context of a single optimizing model. In this model, different policies toward financial activities can yield different steady-state growth rates; these policy differences can explain the positive correlation between per capita output growth and various measures of financial market activity; and different financial market policies can simultaneously explain why economies will tend to choose more sophisticated financial services as per capita income rises, but why policy and legal differences may cause the form of the financial institutions providing those services to differ across countries with similar per capita incomes. The focus on financial services in this paper suggests a new emphasis for empirical investigations. The analysis predicts that it is the provision of specific financial services that will be related to long-run growth, not necessarily the size of the financial system or of any particular financial institution.

Notes

1 See Goldsmith (1969), King and Levine (1993a), and the World Bank (1989).

2 Also, see De Gregorio and Giudotti (1992), Saint-Paul (1992), and King and Levine (1993b).

3 The endogenous growth literature is most closely associated with the work of Romer (1986, 1990), Lucas (1988), Rebelo (1991), Grossman and Helpman (1991), and Ahion and Howitt (1992). On the endogenous financial structures literature see Townsend (1978, 1979), Diamond and Dybvig (1983), Diamond (1984), and the review by Gertler (1988).

4 Central banks typically compose a smaller percent of financial intermediation as income per capita rises; deposit banks grow in importance over an initial range of income; and then, other financial structures such as pension funds, investment banks, and mutual funds holding long-term debt and equities surge in importance. However, important differences exist. For example, the assets of deposit banks composed 56% of financial system assets in France in 1985, while the comparable number in the United Kingdom was 35%. The assets of contractual savings institutions composed 26% of total financial system assets in the United Kingdom, while in France the figure was only 7% in 1985.

5 Human capital is a non-tradable factor of production representing the knowledge and skills embodied in individuals. Although Romer (1990) distinguishes technology –the instructions for combining raw materials into goods– from human capital –the ability to follow instructions and create new instructions, this distinction is unimportant in this paper because I assume that legal or technical restrictions imply that invented technologies are only useful to the firms that create those plans. Using Romer's terminology, firm-created technology is perfectly excludable and therefore economically indistinguishable from rival goods such as human capital. Thus, I will use the terms human capital and technology interchangeably.

6 For each firm η is drawn from a distribution function on a compact interval, such that min $\{\eta\} > 1 - \theta$, and the expected value of η equals 1.

7 As discussed by Townsend (1983), these costs may be associated with setting up organizations, communicating with clients, keeping accounts, and writing and enforcing contracts. In addition, Booth and Smith (1986) argue that financial intermediaries certify the viability and profitability of relatively unknown firms. The costs involved in obtaining this information and effectively communicating this information to investors could be substantial.

8 This makes it easy to solve for a closed form solution.

9 Since I assumed that the expected return from firm investment is greater than that of storage which is greater than the premature liquidation value of firm capital ($\pi\varepsilon\theta H\psi > 1 > \chi > 0$), there is a solution to (9) where $0 \leq q \leq 1$.

10 For a proof of this proposition see Levine (1992).

11 Levine (1991) studies the implications of income taxes, corporate taxes, capital gains taxes, and consumption taxes on the provision of financial services and the rate of per capita output growth.

12 The storage technology may be viewed as "reserves" and investment in firms may be in the form of loans.

13 On the certification role that financial intermediaries may play when relatively unknown firms try to raise capital in a world with asymmetric information see Booth and Smith (1986) and Megginson and Weiss (1991). On the monitoring role of financial intermediaries see Diamond (1984).

14 Different costs structures for acquiring information and mobilizing resources would produce different results. For example, let the cost of identifying externalities and coordinating resources be proportional to per capita income, $Z\underline{w}_t$. The justification might be that in richer, more complicated economies, the total costs of identifying and mobilizing resources are larger. Thus, at a cost of $Z\underline{w}_t$ an individual or agency can identify externalities and collect resources from individuals to exploit these externalities in period t. By sharing the cost of performing researcher/mobilizer activities among many investors, these agencies allow society to identify and exploit fully the most profitable projects. Under this cost structure, the formation of delegated researcher/mobilizers is independent of income per capita.

References

AGHION, P. and P. HOWITT, (1992), "A Model of Growth through Creative Destruction", *Econometrica* 60: 323-51.

BENCIVENGA, V.R. and B.D. SMITH (1991), "Financial Intermediation and Endogenous Growth", *Review of Economic Studies* 58, 195-209.

BOOTH, J. and R. SMITH (1986), "Capital Raising, Underwriting and the Certification Hypothesis", *Journal of Financial Economics* 15: 261-281.

DE GREGORIO, J. and P.E. GIUDOTTI (1992), "Financial Development and Economic Growth" International Monetary Fund, mimeo.

DIAMOND, D. (1984), "Financial Intermediation and Delegated Monitoring", *Review of Economic Studies* 51, 393-414.

—— and P. DYBVIG (1983), "Bank Runs, Insurance and Liquidity", *Journal of Political Economy* 85, 191-206.

GERTLER, M. (1988), "Financial Structure and Aggregate Economic Activity: An Overview", *Journal of Money, Credit, and Banking* 20, 559-588.

GOLDSMITH, R.W. (1969), *Financial Structure and Development* (Yale University Press, New Haven).

GREENWOOD, J. and B. JOVANOVIC (1990), "Financial Development, Growth, and the Distribution of Income", *Journal of Political Economy* 98, 1076-1107.

GROSSMAN, G. and E. HELPMAN (1991), "Quality Ladders in the Theory of Economic Growth", *Review of Economic Studies* 63: 43-61.

JACKLIN, C. (1987), "Demand Deposits, Trading Restrictions and Risk Sharing" in E.D. Prescott and N. Wallace, eds.: *Contractual Arrangements for Intertemporal Trade* (University of Minnesota Press, Minneapolis).

KING, R. and S. REBELO (1990), "Public Policy and Economic Growth: Developing Neoclassical Implications", *Journal of Political Economy* 98, S126-S150.

KING, R and R. LEVINE (1993a), "Finance and Growth: Schumpeter Might Be Right", *Quarterly Journal of Economics*, forthcoming.

—— and —— (1993b), "Finance, Entrepreneurship, and Growth: Theory and Evidence", World Bank mimeo.

LEVINE, R. (1991) "Stock Markets, Growth, and Tax Policy", *Journal of Finance* 46, 1445-65.

LEVINE, R. and D. RENELT (1992), "A Sensitivity Analysis of Cross Country Growth Regressions", *American Economic Review* 82, 942-63.

LUCAS, R.J. (1988), "On the Mechanics of Economic Development", *Journal of Monetary Economics* 22, 3-42.

MEGGINSON, W.L. and K.A. WEISS (1991), "Venture Capitalist Certification in Initial Public Offerings", *Journal of Finance* 46: 879-903.

PRESCOTT, E.C. and J.H. BOYD, "Dynamic Coalitions, Growth, and the Firm" in E.D. Prescott and N. Wallace, eds.: *Contractual Arrangements for Intertemporal Trade* (University of Minnesota Press, Minneapolis).

REBELO, S. (1991), "Long Run Policy Analysis and Long Run Growth", *Journal of Political Economy* 99: 500-521.

ROMER, P. (1986) "Increasing Returns and Long Run Growth", *Journal of Political Economy* 94, 1002-1037.

—— (1989), "Capital Accumulation in the Theory of Long Run Growth" in R.J. Barro, ed.: *Modern Business Cycle Theory* (Harvard University Press, Cambridge)

—— (1990), "Endogenous Technological Change", *Journal of Political Economy* 98, S71-S102.

SAINT-PAUL, G. (1992), "Technological Change, Financial Markets and Economic Growth", *European Economic Review* 36, 763-81.

SEWARD, J.K. (1990) "Corporate Financial Policy and the Theory of Financial Intermediation", *Journal of Finance*, 45, 351-377.

TOWNSEND, R.M. (1983), "Theories of Intermediated Structures", *Carnegie-Rochester Conference Series on Public Policy*. 18 (Spring): 221-272.

—— (1979), "Optimal Contracts and Competitive Markets with Costly State Verification", *Journal of Economic Theory* 21, 265-293.

—— (1978), "Intermediation with Costly Bilateral Exchange", *Review of Economic Studies*, 45:417-425.

WORLD BANK (1989), *World Bank Development Report* (World Bank, Washington, D.C.)