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Bank-based versus market-based financial systems: A growth-theoretic analysis ☆

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Abstract

We study bank-based and market-based financial systems in an endogenous growth model. Lending to firms is fraught with moral hazard as owner-managers may reduce investment profitability to enjoy private benefits. Bank monitoring partially resolves the agency problem, while market-finance is more 'hands-off'. A bank-based or market-based system emerges from firm-financing choices. Neither system is unequivocally better for growth, which crucially depends on the efficiency of financial and legal institutions. But a bank-based system outperforms a market-based one along other dimensions. Investment and per capita income are higher, and income inequality lower, under a bank-based system. Bank-based systems are also more conducive for broad-based industrialization.

JEL classification: E22; G20; O15; O16

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1. Introduction

This paper is a theoretical analysis of bank-based and market-based financial systems in economic growth and development. We are motivated to study this issue because of a long-standing debate on the relative importance of the two systems. The success of market-based systems in the US and UK have led some observers to tout their virtues, while others have advocated bank-based systems because of their vital role in German and Japanese industrialization. Eastern Europe and Latin America's financial liberalization of the 1990s has revived this debate—market-based systems are being seen as more dependable for growth and development.[1]

We examine this debate in an endogenous growth model where a financial system emerges endogenously from firm-financing choices. We show that two countries with different financial regimes may enjoy similar rates of economic progress; what matters for growth is the efficiency of the country's financial and legal institutions, rather than the type of its financial system. But from the perspective of developing a traditional economy into a modern, industrialized one, a bank-based system outperforms a market-based one.

With the availability of systematic evidence during the past decade, the relevance of finance for development is now widely accepted (Levine, 1997). Concurrently, an extensive theoretical literature on financial institutions has developed. While research in corporate finance has examined firm financing choices, growth theorists have studied the role of finance in capital and knowledge accumulation.

In corporate finance, the organization of financial activities is seen to affect growth through corporate governance and a firm's ability to raise external funds. Financial intermediaries reduce costs of acquiring and processing information about firms and their managers and thereby reduce agency costs by assuming the role of 'delegated monitors' (Boyd and Prescott, 1986; Diamond, 1984). For instance, Holmstrom and Tirole (1997), distinguish between bank- and market-finance according to their information content: bank monitoring resolves moral-hazard problems at the level of the firm. Firms with lower marketable collateral and higher incentive problems borrow from banks, while wealthier firms rely on unintermediated market-finance. Hence, as Boot and Thakor (1997) point out, bank lending is likely to be important when investors face ex post moral hazard problems, with firms of higher observable qualities borrowing from the capital market.

Some authors have also highlighted how market finance creates appropriate incentives for a firm. In Scharfstein (1988), equity markets encourage corporate governance through hostile takeovers of under-performing firms. Rajan and Zingales (1998b, 1999) argue that market-finance transmits price signals which guides firms into making worthwhile investments. Relationship-based bank finance, in contrast, could lead firms facing weak cash flows to undertake misguided investments.

Among contributions on finance and growth, Greenwood and Jovanovic (1990), Bencivenga and Smith (1991) and de la Fuente and Marin (1996) show how financial intermediaries promote growth by pooling risks, providing liquidity and monitoring risky innovations. Greenwood and Smith (1997), on the other hand, analyze how financial markets assist growth through increased specialization. But growth theory has been largely silent on the 'bank versus market' debate, stressing the importance of *either* banks *or*

[1]See Allen and Gale (2000), Holmstrom (1996) and Levine (2002) for details.

financial markets.[2] In recent years, policymakers have been advocating a shift toward financial markets, especially in Latin America and Eastern Europe where financial systems similar to those in the US have been proposed (Allen and Gale, 2000). It is unclear, though, why market-based systems necessarily dominate bank-based ones. As Levine (1997, pp. 702–703) points out, "we do not have adequate theories of why different financial structures emerge or why financial structures change... we need models that elucidate the conditions, if any, under which different financial structures are better at mitigating information and transaction costs." It is precisely here that the contribution of our paper lies.

Finance is relevant for growth and development for two main reasons. Better developed financial systems resolve agency problems better, enabling firms to borrow at cheaper rates and invest more.[3] But finance also plays a role in structural transformation in developing countries where pockets of modern manufacturing activity coexist with widespread peasant farming and cottage-industry production. Transition to manufacturing activities usually requires lumpy investments that may not be forthcoming in the absence of well-developed financial systems.[4]

These complementary roles are built into an *Ak*-type endogenous growth model with overlapping generations of families. A set of agents (entrepreneurs) convert final goods into capital using a modern-sector technology that requires a minimum investment size to cover setup costs. Entrepreneurs who obtain the requisite financing enter the modern-sector and produce capital. Those who do not, engage in traditional activities like peasant farming and household production.

As in the corporate finance literature, we distinguish between bank-finance and market-finance based upon their involvement with investment projects. Banks are typically more engaged in project selection, monitoring firms and identifying promising entrepreneurs, while market-finance (corporate bonds and equities) is an arm's length transaction, with little involvement in a firm's investment decisions. Specifically, we adapt Holmstrom and Tirole's (1997) agency problem: borrowers may deliberately reduce the success probability of investment in order to enjoy private benefits. Outside investors (the market) are too disparate to effectively control a borrower's activities. Financial intermediaries, on the other hand, monitor entrepreneurs and (partially) resolve the agency problem. But since monitoring is costly, bank finance is more expensive than market finance.

A key determinant of financing choices is an entrepreneur's initial wealth. Entrepreneurs with lower wealth have more incentive to be self-serving than wealthier ones. One way to mitigate this incentive gap is to borrow, at a higher rate, from a bank and agree to being monitored. In contrast, wealthier entrepreneurs rely more on market finance as they face less of an information gap. In certain cases, for instance when the fixed cost of modern sector activities are large, even bank monitoring is not a sufficient substitute for entrepreneurial wealth—the poorest entrepreneurs are unable to get *any* type of external finance.[5]

[2]Boyd and Smith (1998) do allow for a simultaneous choice of bank- and market-finance. But they focus on how the mix changes over time.

[3]Rajan and Zingales (1998a) use industry-level data to show that more developed financial regimes promote growth by reducing the cost of borrowing.

[4]Hicks (1969) as well as North (1981) deliberate on the role of finance in overcoming large-scale investment requirements during the Industrial Revolution.

[5]The role of initial wealth for financing choices is particularly relevant in light of evidence that even in developed countries approximately 70% of new investment in physical capital is financed out of retained earnings (Mayer, 1988). See Allen and Gale (2001) for more recent evidence.

A bank-based system, where intermediation plays a key role, or a market-based system, where all lending is unintermediated, evolve endogenously in our model. A bank-based system emerges when monitoring costs are modest and when agency problems are significantly extenuated through monitoring. When agency problems are not particularly severe, or when monitoring is expensive, a market-based system emerges.

The growth rate under either regime is a function of the efficiency of the system—better-functioning legal systems make contracts easier to enforce and reduce monitoring costs as also the cost of direct lending. Investment is higher, as is the growth rate of per capita income. In this, our results square well with the 'legal-based' view espoused more recently by La Porta et al. (1997, 1998) and for which Levine (2002) finds strong cross-country evidence.

Although neither a bank-based nor a market-based system is specifically better for growth, our model suggests some advantages to having a bank-based system. In particular, since bank monitoring substitutes for entrepreneurial wealth, it enables *all* modern-sector firms to make larger investments than is possible under purely unintermediated finance. It also lowers the minimum entrepreneurial wealth required to obtain external finance so that the traditional sector is smaller under a bank-based system. Hence, even when a bank-based and a market-based economy grow at similar rates and have similar wealth distributions, per capita GDP in the former is permanently higher.

Financial and legal reforms which reduce agency problems make it easier for modern-sector entrepreneurs to borrow. This raises the investment rate, and hence GDP growth, under both types of financial system. However, in a bank-based system, these reforms also have a level effect on per capita income. By lowering the minimum wealth needed to raise external finance, they assist traditional sector entrepreneurs to enter the modern sector faster. This speeds up structural transformation—the traditional sector declines in size and the modern sector expands faster. In contrast, reforms in a market-based system may leave the traditional sector relatively worse-off unless they specifically reduce the costs of bank intermediation.

The paper is organized as follows. We lay out the structure of the economy in Section 2. Sections 3 and 4 discuss financing options that an entrepreneur faces and her optimal investment decision. In Section 5 we characterize the balanced growth path for the economy. We discuss implications of the model and effects of policies in Section 6. Section 7 concludes.

2. The environment

Time is discrete, continues forever and is indexed by $t = 0, 1, 2, \ldots, \infty$. A continuum of two-period lived agents are born every period. These agents are of two types: an exogenous fraction μ of them are working *households*, the remaining are *entrepreneurs*. Without loss of generality, we normalize μ to $\frac{1}{2}$ and the measure of each type to one. There is no population growth, each agent giving birth to one offspring at the end of her youth. Economic activity encompasses a *final goods sector* that produces the unique consumption good, a *cottage industry sector* that produces nonmarketed consumption goods, a *capital goods sector* that supplies inputs to final goods producing firms, and a *financial sector* that channels funds from lenders to borrowers.

2.1. Economic agents

A *household* is born with one unit of labor time in youth which it supplies inelastically to the labor market. A generation-t household's lifetime utility depends only upon second period consumption so that the entire wage income, w_t, is saved. Households are the natural lenders, investing their savings on the financial market and earning a (gross) return R^*.

An *entrepreneur* is also born with one unit of labor time in youth that she uses to operate either of two types of technologies. Using a modern technology she can convert units of the final good into a marketable capital good. Or else, she can engage in non-marketed cottage-industry or household production of the final good.

Entrepreneurs are altruistic, deriving utility from their old-age consumption and bequests made to their offspring. A typical generation-t entrepreneur's preferences are given by the 'warm-glow' (Galor and Zeira, 1993) utility function:

$$U_t^E = (c_{t+1}^E)^{\beta}(b_{t+1})^{1-\beta}, \quad \beta \in (0,1), \tag{1}$$

where b_{t+1} denotes bequests made. Preferences for households and entrepreneurs are posited to be different for a simple reason. We shall shortly identify each entrepreneur with a capital good producing 'firm'. The bequest motive in (1) essentially captures the continuity of each such firm in a dynamic production economy. Altruism among households can be readily incorporated without qualitatively altering any of our basic results.

We index an entrepreneur by $j \in [0,1]$, denoting her initial wealth at date-t by b_t^j. Wealth is distributed among generation-t entrepreneurs according to the cumulative distribution function $G_t(b)$, indicating the proportion of them with wealth less than b. Given Cobb–Douglas preferences, optimal decision rules are linear in entrepreneurial income. In other words, entrepreneur-j leaves to her offspring a constant proportion of her realized old-age income z_{t+1}^j:

$$b_{t+1}^j = (1-\beta)z_{t+1}^j, \tag{2}$$

the remaining β fraction being consumed. These optimal decisions imply that entrepreneurs are risk-neutral since the indirect utility function is linear in income. Eq. (2) tracks the wealth distribution through time, given G_0 and $\{z_{t+1}^j\}_{t=0}^{\infty}$.[6]

2.2. Production technologies

2.2.1. Final goods sector

Competitive firms produce the final consumption good combining raw labor with capital goods. The underlying *private* technology is constant returns in capital and labor inputs

$$Y_t = A_t N_t^{1-\alpha}\left[\int_{j\in E_t} K_t^j \,\mathrm{d}G_t\right]^{\alpha}, \quad 0<\alpha<1.$$

[6]It is sufficient to assume that the initial old generation of entrepreneurs are endowed with capital $\{k_0^j\}$. These entrepreneurs rent out the capital, earning a gross return ρ_0, and leave bequests $b_0^j = (1-\beta)\rho_0 k_0^j$, which then defines the initial distribution of bequests, $G_0(b)$.

Here E_t denotes the set of entrepreneurs who supply capital goods at date-t and A_t denotes the efficiency of technology.

We allow for Arrow–Romer type technological spillovers from private investment to the aggregate technology. In particular, the efficiency of the final goods sector improves with increased capital intensity of production due to learning-by-doing technological progress

$$A_t = Ak_t^{1-\alpha}, \tag{3}$$

where $k_t \equiv K_t/N_t \equiv [\int_{j\in E_t} K_t^j \, \mathrm{d}G_t]/N_t$ denotes aggregate capital per worker. This effectively transforms the *social* per worker production function into

$$y_t = Ak_t, \tag{4}$$

with constant marginal product of capital. Final goods producers operate in competitive output and input markets so that equilibrium rental and wage rates are given by

$$\rho_t = \alpha A, \quad w_t = (1-\alpha)Ak_t. \tag{5}$$

2.2.2. Capital goods sector

Capital goods are produced by entrepreneurs. We shall think of entrepreneur-j, producing K^j, as the jth capital good producing firm. As entrepreneurial generations are interconnected through a bequest motive, firm-j is effectively infinitely lived. At any point in time, the young member of entrepreneurial family-j is the owner-manager of this firm, converting units of the final good into capital with a one-period lag.

The financial sector comes into play in determining how much investment each entrepreneur undertakes. In particular, if the entrepreneur invests $q^j > b^j$, she has to raise the deficit from the financial sector.

All entrepreneurs produce the same type of capital good and are price takers. The common return they earn from renting out their capital is ρ, the marginal product of capital in a competitive equilibrium and given by (5). For simplicity, we assume that capital goods fully depreciate upon use.

2.2.3. Cottage industry production

Entrepreneurs also possess a technology whose output is not marketed and is entirely self-consumed, not appearing in the national income accounts (household production). We identify these entrepreneurs as self-sufficient peasants, cottage industries and informal sector workers.

Low-productivity cottage industry technology enables an entrepreneur to produce, with a one period lag, the same consumption good that the final goods sector manufactures:

$$x_{t+1} = a_t b_t^{\delta}, \tag{6}$$

where $\delta \in (0,1)$ and $\{a_t\}_{t=0}^{\infty}$ is a weakly increasing sequence of positive numbers with $\lim_{t\to\infty} a_t = \overline{a}$. This is similar to Hansen and Prescott's (2002) Malthusian technology. The productivity parameter, a_t, improves exogenously through time due to technology diffusion from the manufacturing sector and human capital accumulation, factors outside the purview of our present analysis. At the same time, this technological progress is bounded above under the plausible assumption that these traditional technologies can be improved only so much (Basu and Weil, 1998).

The entrepreneur's choice of technology depends upon which one gives her a higher income and whether or not she is able to obtain external finance to operate the modern technology. We discuss this in details in the next section.

2.3. The moral hazard problem

We motivate the existence of financial markets and intermediaries by introducing agency problems in firm borrowing. Specifically, following Holmstrom (1996) and Holmstrom and Tirole (1997), we allow an entrepreneur to choose between *three* types of investment projects which differ in their success probability and private benefits they bring to the entrepreneur.

Suppose the entrepreneur raises funds amounting to $q_t^j > b_t^j$ for her investment. When the project succeeds, it realizes a verifiable amount of capital,

$$K_{t+1}^j = q_t^j. \tag{7}$$

But should it fail, it produces nothing. The moral hazard problem arises from the fact that the probability of success depends on an unobserved action taken by the entrepreneur. The unobserved action can be interpreted as her choice on how to spend q_t^j. She can spend it on an efficient technology that results in success for sure, but uses up all of q_t^j. Or, she can spend it on one of two inefficient technologies that may not succeed. One of these technologies, a low moral hazard project, costs $q_t^j - vq_t^j$, leaving vq_t^j for the entrepreneur to appropriate. The other inefficient choice, a high moral-hazard project, costs $q_t^j - Vq_t^j$ which leaves Vq_t^j in private benefits to the entrepreneur. Both inefficient technologies carry the same probability of success, π, but we assume that $0 < v < V < 1$. Hence, the entrepreneur clearly prefers the high moral-hazard project over the low moral-hazard one.[7]

2.4. The financial sector

The financial sector transforms household savings into capital. Two types of agents participate on the supply side—financial intermediaries (banks) and households themselves.

Banks obtain their supply of loanable funds from households. Households have the choice of depositing their savings with banks, or lending directly to firms, or investing it on the international capital market. Direct lending to firms, which we shall refer to as *direct* (or *market*) finance, is made through the purchase of tradeable securities like corporate bonds and equities.

We assume this is a small open economy, facing perfectly mobile capital markets and a constant world (gross) rate of return, R^*. In equilibrium all entrepreneurs will invest in the best project and behave diligently so that investment returns are guaranteed. Hence, households willingly hold both deposits and securities as long as they yield the same return.

[7]While entrepreneurs consume in the second period of life, they invest in the first. We assume that 'illegally' appropriated investment resources cannot be invested on the financial market. Instead, they have to be hidden away for a period. Such storage yields zero net return but is unobservable and cannot be penalized. Hence, although investors know for sure that the entrepreneur was not diligent when an investment project fails, they are unable to seize her stored goods.

That is, R^* is the return that banks promise their depositors and also the return that firms pay on their securities.

Compared to direct finance, *indirect* (or *bank*) finance plays a special role. Banks are endowed with a monitoring technology that allows them to inspect a borrowing firm's cash flows and balance sheet, keep tabs on the owner-manager's activities and ensure the firm conforms to the terms agreed upon in the financial contract (Hellwig, 1991; Holmstrom and Tirole, 1997). Households do not possess this technology, or even if they do, are too disparate to effectively use it. Hence, banks assume the role of delegated monitors (Diamond, 1991).

Monitoring partially resolves the agency problem and reduces the entrepreneur's opportunity cost of being diligent. By monitoring borrowers, banks eliminate the high moral-hazard project but not the low moral-hazard one (Holmstrom, 1996; Holmstrom and Tirole, 1997). For instance, a bank could simply veto the high moral-hazard project when it negotiates a loan contract with the firm. But monitoring is also costly for the bank, costing a nonverifiable amount γ per unit invested. Hence, bank monitoring will be an optimal arrangement only if the gains from resolving agency problems outweigh the monitoring costs.

We should clarify here that while various aspects of bank- and market-finance have been studied in the literature (see Hellwig, 1991; Levine, 1997; Allen and Gale, 2000), we distinguish between the two purely on the basis of their monitoring role. As in Boot and Thakor (1997), what is important for our purpose is that banking institutions exist primarily to resolve certain moral hazard problems that dispersed investors on the financial market are unable to. The Holmstrom–Tirole framework provides a tractable framework to analyze these issues. No claim is being made that these are the only roles that banks and markets perform.

3. Optimal contracts

Whether or not an entrepreneur prefers to be diligent depends upon appropriate incentives and outside monitoring. Consider the financing options a generation-t entrepreneur-j faces when her desired investment, q_t, exceeds her wealth, b_t^j. The entrepreneur may borrow the shortfall from two sources: directly from households and/or from banks. Since banks monitor firms while households do not, we shall refer to the former as *informed* investors. We characterize optimal contracts when borrowing firms behave diligently and undertake successful investments.

3.1. Direct finance

Under direct finance, an optimal contract between the firm and outside investors has a simple structure. An entrepreneur invests her entire internal funds, b_t^j, on her project since she earns a strictly higher return than she would otherwise (see below). Households put up the remainder, $q_t - b_t^j$. Neither party is paid anything if the investment fails. When the project succeeds, the entrepreneur earns an amount $\theta_{t+1}^E > 0$ while uninformed investors are paid $\theta_{t+1}^U > 0$, where $\theta_{t+1}^E + \theta_{t+1}^U = \rho_{t+1} q_t$.

Entrepreneur-j invests q_t in the efficient technology as long as she earns an incentive compatible return, that is, $\theta_{t+1}^E \geqslant [V/(1-\pi)]q_t$. Hence outside investors get paid at most $\theta_{t+1}^U = [\rho_{t+1} - V/(1-\pi)]q_t$. This is the *pledgeable expected income* that firms can

credibly commit to their investors. Households agree to lend as long as this income is commensurate with what they could earn on the international capital market, $R^*[q_t - b_t^j]$. Defining

$$b_t^H(q_t) \equiv \frac{q_t}{R^*}\left[\frac{V}{1-\pi} - (\rho_{t+1} - R^*)\right], \tag{8}$$

we note that only entrepreneurs who are sufficiently asset-rich, with $b_t^j \geqslant b_t^H(q_t)$, are able to obtain direct finance if they want to invest q_t.

Since project returns are observable and verifiable, optimal contracts between direct financiers and capitalists may be interpreted either as debt or as outside equity. For an equity contract, the capitalist sells a share s_t of her project return, $\theta_{t+1}^U = s_t(\rho_{t+1}q_t)$. For a debt contract, the capitalist borrows $q_t - b_t$, promising to repay a return of R^* in case of success. The implicit return on equity has to be R^* for both assets to be held simultaneously, that is, $s_t(\rho_{t+1}q_t) = R^*(q_t - b_t)$. Again, what matters is that neither of these is monitored lending.

3.2. Indirect finance

For indirect or *intermediated* finance, there are three parties to the financial contract: the entrepreneur, the bank and uninformed investors. As before, an optimal contract requires that no party earns anything when the project fails. When it succeeds, the total return, $\rho_{t+1}q_t$, is distributed so that $\theta_{t+1}^E + \theta_{t+1}^U + \theta_{t+1}^B = \rho_{t+1}q_t$, with θ^B denoting the bank's returns.

Besides the incentive compatibility constraint of the capitalist and the participation constraint of the uninformed investors, we have to take into account an additional incentive compatibility constraint, that for bank monitoring. At the same time the loan size has to be chosen optimally so as to maximize bank profits subject to the capitalist's incentive constraint and the bank's incentive and resource constraints. Moreover, in a competitive equilibrium, the banking sector earns zero profits. Together these have the following implications[8]: (i) bank finance is relatively more expensive than direct finance (due to monitoring costs), that is, the (gross) loan rate charged by the bank, R_{t+1}^L, is greater than R^*

$$R_{t+1}^L = \frac{R^*}{\pi} > R^*, \tag{9}$$

and (ii) capitalists with wealth $b_t^H(q_t) > b_t^i \geqslant b_t^L(q_t)$, where

$$b_t^L(q_t) \equiv \frac{q_t}{R^*}\left[\frac{v}{1-\pi} - [\rho_{t+1} - (1+\gamma)R^*]\right], \tag{10}$$

are able to convince uninformed investors to supply the remaining funds for the investment project only after the bank lends an amount (and agrees to monitor)[9]

$$L_t^j = \gamma\left(\frac{\pi}{1-\pi}\right)q_t. \tag{11}$$

[8]A complete analysis of indirect finance is contained in the working paper version available at http://econpapers.hhs.se/paper/oreuoecwp/2003-6.htm

[9]In order that the loan size does not exceed investment size, we restrict monitoring costs to $\gamma \leqslant (1-\pi)/\pi$. For there to be any demand for monitoring, it is also natural to assume that $b_t^H(q_t) \geqslant b_t^L(q_t)$. This is true as long as the expected gain from monitoring exceeds its cost, $(V - v)/(1-\pi) \geqslant \gamma R^*$.

Bank finance entails monitoring that partially eliminates the incentive problem; perceiving this, direct lenders are willing to lend. Costly monitoring makes bank finance a more expensive, but necessary, alternative to market finance. Evidently capitalists willing to invest q_t but with wealth level below $b_t^L(q_t)$ cannot obtain any external finance, direct or indirect.

3.3. Entrepreneurial income under optimal contracts

Denote entrepreneur-j's second period income by z_{t+1}^j and consider the case where her internal funds are insufficient, $b_t^j < b_t^L(q_t)$, to obtain *any* external financing. She can either invest her assets on the financial market or utilize them in household production. She prefers to engage in the latter as long as $a_t b_t^{\delta} \geqslant R^* b_t$, that is, $b_t \leqslant \widehat{b}_t \equiv [a_t/R^*]^{1/(1-\delta)}$. This will be true under appropriate parametric restrictions (see footnote 12 below) and her income given by $z_{t+1}^j = a_t (b_t^j)^{\delta}$.

For entrepreneurs who borrow both from banks and the market, $b_t^j \in [b_t^L(q_t), b_t^H(q_t))$. Equations (9) and (11) imply that $z_{t+1}^j = [\rho_{t+1} - (1+\gamma)R^*]q_t + R^* b_t^j$. Note that since $\rho_{t+1} \geqslant (1+\gamma)R^*$,[10] these entrepreneurs earn a return strictly greater than they would earn by investing on the international capital market. Similarly, entrepreneurs with adequate internal funds, $b_t^j \geqslant b_t^H(q_t)$, borrow only from the market, earning $z_{t+1}^j = (\rho_{t+1} - R^*)q_t + R^* b_t^j$, which again exceeds the opportunity cost of internal funds.

Given an investment of size q_t, entrepreneurial earnings are thus summarized by

$$z_{t+1}^j(b_t^j \mid q_t) = \begin{cases} a_t (b_t^j)^{\delta} & \text{if } b_t^j \in [0, b_t^L(q_t)), \\ [\rho_{t+1} - (1+\gamma)R^*]q_t + R^* b_t^j & \text{if } b_t^j \in [b_t^L(q_t), b_t^H(q_t)), \\ (\rho_{t+1} - R^*)q_t + R^* b_t^j & \text{if } b_t^j \in [b_t^H(q_t), \infty). \end{cases} \tag{12}$$

4. Investment choice and financial structure

Having characterized financial contracts and returns from an arbitrary investment of q_t, we turn to the entrepreneur's investment decision. Recall that entrepreneurs operate either a modern or a traditional technology. A distinguishing feature of developing countries is their dualistic structure, the coexistence of a labor-intensive low-productivity sector with a high-productivity modern sector specializing in factory goods.

A number of commentators have suggested that entry into such modern-sector activities require large setup costs.[11] These include fixed capital requirements and costs of adapting newer types of technologies. The efficacy of a financial system lies in the degree to which it allows entrepreneurs to surmount such lumpy investment requirements. To capture this notion, we impose a minimum investment size of q^* on any entrepreneur wishing to produce capital goods. We allow entrepreneurs to choose as much as they want to invest as long as they invest this minimum amount.

[10] Since $\rho_{t+1} q_t \geqslant R_{t+1}^L L_t^j = [\gamma/(1-\pi)]R^* q_t$, we have $\rho_{t+1} \geqslant \pi\rho_{t+1} + \gamma R^*$. But, for an entrepreneur to accept a bank loan, we must have $\rho_{t+1} \geqslant R_{t+1}^L$. Hence, $\rho_{t+1} \geqslant R^*(1+\gamma)$.

[11] The industrial revolution was possible, according to Hicks (1969) and North (1981), because financial markets enabled England to implement newer technologies. In many cases, these technologies were invented early on but large-scale investment requirements hampered their implementation.

4.1. Minimum investment size

The minimum investment size q^* defines the minimum wealth (internal funds), b_t^*, required to raise external finance. From (5) and (10), this constraint is given by

$$b_t^* = \frac{q^*}{R^*}\left[\frac{v}{1-\pi} - [\alpha A - (1+\gamma)R^*]\right] \equiv b_L^*. \tag{13}$$

Credit-rationed entrepreneurs, with $b_t^j < b_L^*$, operate the cottage-industry technology,[12] and accumulate assets according to

$$b_{t+1}^j = (1-\beta)a_t(b_t^j)^\delta.$$

Evidently b_L^* and the wealth distribution determine the size of the informal sector at any point in time. Following our notation, $G_0(b_L^*)$ indicates the fraction of generation-0 entrepreneurs with assets less than b_L^*, and hence, the initial size of the informal sector. More efficient the banking system, the lower will be b_L^*, and thus, greater the extent of economic activities devoted to high-productivity manufacturing.

Recall that cottage-industry production is subject to exogenous productivity improvements. To rule out perpetual stagnation in the informal sector, we allow $\bar{a}$ to be large enough so that $b_{t+1}^j(\bar{a}) > b_L^*$. This means entrepreneurial families who do not obtain external financing initially would ultimately accumulate enough wealth to enter the manufacturing sector. But how long they remain in the informal sector depends on the efficiency of the banking system and on the pace of technical progress which may be very slow.

4.2. Optimal investment decision

Entrepreneurs whose initial wealth exceeds the cutoff level b_L^* qualify for outside financing. We illustrate their investment decisions using Figs. 1 and 2.

Given optimal contracts and financing arrangements for any investment q_t, the optimal investment size is chosen by an entrepreneur to maximize her income. For an investment of q_t, the minimum amount of internal funds required to qualify for indirect and direct finance are $b^L(q_t)$ and $b^H(q_t)$, respectively.[13] These cut-off wealth levels are shown as two rays passing through the origin in Figs. 1 and 2. The intersection points of these rays with q^* are labeled b_H^* and b_L^*, respectively.

Suppressing the j-superscript, consider a generation-t entrepreneur with inherited bequest level $b_t > b_L^*$. In Figs. 1 and 2, $q_{I,t}$ and $q_{U,t}$ are given by the points of intersection of $b^L(q_t)$ and $b^H(q_t)$ with the entrepreneur's wealth, b_t. Observe that $b_t < b^L(q_t)$ for any $q_t > q_{I,t}$. Such an entrepreneur desiring to invest more than $q_{I,t}$ cannot convince uninformed investors to supply enough funds for her project, and is completely rationed from the credit market. She can only resort to household production in that case and earn an income $z_{t+1} = a_t b_t^\delta$ (from (12)). This earning is given by the horizontal line PQ in Figs. 1 and 2. Similarly, $b^L(q_t) \leqslant b_t < b^H(q_t)$ for any $q_{U,t} < q_t \leqslant q_{I,t}$. If this entrepreneur chooses an investment size in this range, she can convince uninformed investors to fund her project only if she simultaneously borrows from the bank. Her earning,

[12]We assume that $b_L^* < \widehat{b}_0 \equiv [a_0/R^*]^{1/(1-\delta)}$.

[13]Assumptions in footnote 17 guarantee that $b^L(q_t) > 0$ and $b^H(q_t) > 0$ for any q_t.

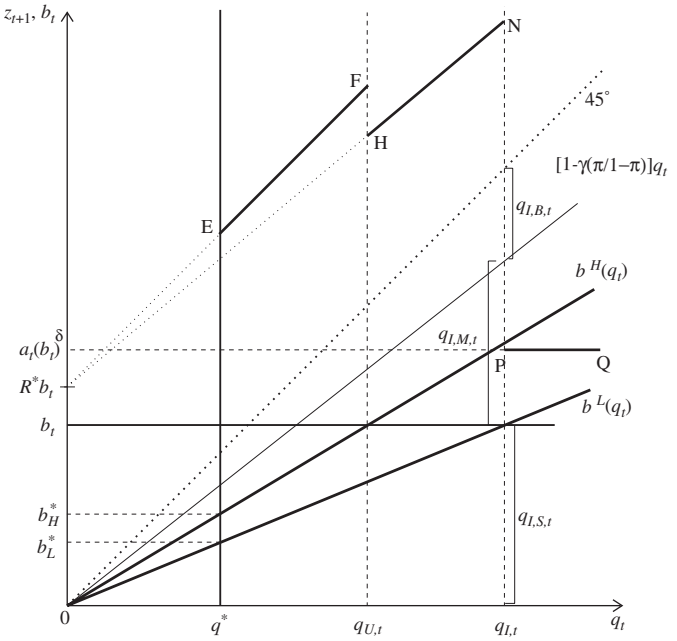

Fig. 1. Investment choice in a bank-based system.

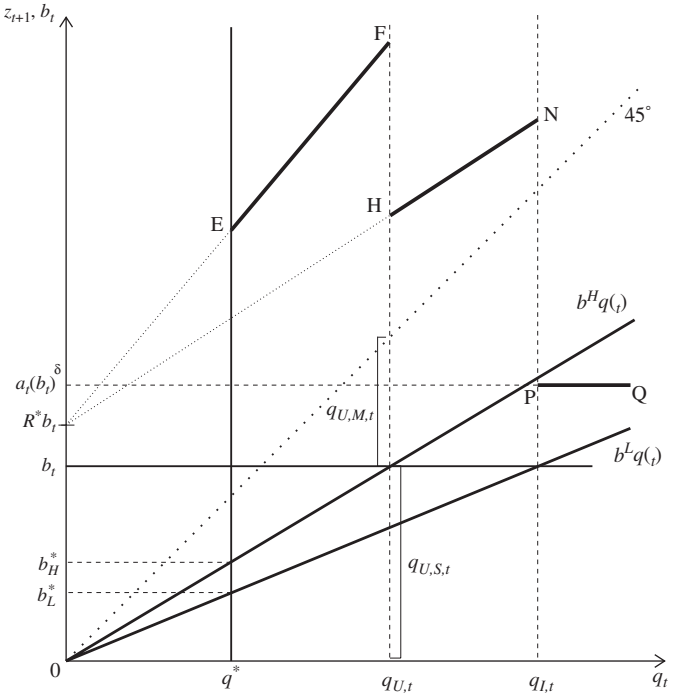

Fig. 2. Investment choice in a market-based system.

$z_{t+1} = R^* b_t + [\alpha A - (1+\gamma)R^*]q_t$, is shown by the flatter line HN with intercept $R^* b_t$. Finally, for any $q^* \leqslant q_t \leqslant q_{U,t}$, $b_t \geqslant b^H(q_t)$. An entrepreneur can fund an investment in this range by raising funds directly from the market without requiring any bank finance. Her earning, $z_{t+1} = R^* b_t + [\alpha A - R^*]q_t$, is the steeper line EF with intercept $R^* b_t$.

An entrepreneur chooses q_t so as to maximize $z_{t+1}(q_t)$. In the figures, $z_{t+1}(q_t)$ is given by the piecewise linear schedule EF, HN and PQ. Two possibilities arise: $q_{I,t}$ is the investment choice when the height of the point N is greater than that of the point F (Fig. 1), whereas $q_{U,t}$ is chosen when the opposite holds (Fig. 2).[14] Closed-form solutions for these investment levels can be obtained using (10) and (8):

$$q_{I,t} = \left[\frac{R^*}{v/(1-\pi) - [\alpha A - (1+\gamma)R^*]}\right] b_t, \quad q_{U,t} = \left[\frac{R^*}{V/(1-\pi) - [\alpha A - R^*]}\right] b_t. \tag{14}$$

Since $z_{t+1}(q_t)$ is strictly increasing in the range $q_t \in [q^*, q_{U,t}]$, maximal earning occurs at $q_t = q_{U,t}$ and is given by

$$z_{t+1}(q_{U,t}) = \left[\frac{[V/(1-\pi)]R^*}{V/(1-\pi) - (\alpha A - R^*)}\right] b_t. \tag{15}$$

Likewise, the maximum earning for $q_t \in (q_{U,t}, q_{I,t}]$ occurs at $q_t = q_{I,t}$, and is given by

$$z_{t+1}(q_{I,t}) = \left[\frac{[v/(1-\pi)]R^*}{v/(1-\pi) - [\alpha A - (1+\gamma)R^*]}\right] b_t. \tag{16}$$

It follows that an entrepreneur chooses $q_{I,t}$ over $q_{U,t}$ *iff* $z_{t+1}(q_{I,t}) \geqslant z_{t+1}(q_{U,t})$ that is,

$$1 - \frac{\gamma R^*}{\alpha A - R^*} \geqslant \frac{v}{V}, \tag{17}$$

a condition that does not depend upon borrower characteristics, that is, on b_t.[15]

4.3. Implications for the financial system

Consider now the financial system resulting from firm-financing decisions. As long as (17) holds (Fig. 1), except for the fraction $G_t(b_L^*)$ of entrepreneurs who are credit-constrained, all capital goods producers finance their investment through a mix of intermediated and unintermediated finance. We label this a *bank-based financial system*.

On the other hand, if (17) does not hold (Fig. 2), unconstrained entrepreneurs earn a higher income with purely unintermediated finance. Despite this, one group of entrepreneurial families have to rely upon bank-finance, at least in the short-run. To see this, consider entrepreneurs with $b_L^* \leqslant b_t < b_H^*$. If we were to redraw $q_{U,t}$ and $q_{I,t}$ for such an entrepreneur, we would have $q_{U,t} < q^* < q_{I,t}$. Since (17) is not satisfied, this entrepreneur's earning would be maximized for investment level $q_{U,t}$. But that level of investment would not be permissible since $q_{U,t} < q^*$. Under the circumstances, this entrepreneur will have to choose an investment $q_{I,t}$. Thus, all entrepreneurs in the range $b_t \in [b_L^*, b_H^*)$ have to rely upon mixed finance, whereas those who are wealthy enough ($b_t \geqslant b_H^*$) use only market finance.

[14] In Fig. 1, $q_{I,B}$ denotes bank borrowing, $q_{I,M}$ denotes market borrowing and $q_{I,S}$ denotes self-financing in a bank-based system. Similarly for a market-based system in Fig. 2.

[15] Note that incentive constraints of all modern-sector entrepreneurs are binding, since $q_{I,t}$ ($q_{U,t}$) is given by the intersection of b_t with $b^L(q_t)$ [$b^H(q_t)$].

This reliance on mixed finance is, however, temporary. Since the wealth of these entrepreneurial families grow at the rate of g_I, they eventually cross b_H^*. Thereafter, they too choose only market finance, growing at the rate g_U. In the long-run, all entrepreneurs with $b_t \geqslant b_L^*$ use only unintermediated finance in Fig. 2. We call this a *market-based system*.

Depending on parameter values, both bank-based and market-based financial systems may thus emerge. The following proposition summarizes this important result:

Proposition 1. *The financial structure of an economy is* bank-based *if and only if* (17) *holds. It is otherwise* market-based *without any dependence on intermediated finance in the long-run. In the short-run, some entrepreneurs with low wealth rely upon intermediated finance even in a market-based system.*

Intuitively, the financial structure is likely to be bank-based whenever the cost of monitoring (γ) is low and whenever the residual moral hazard problem under bank monitoring (v) is low relative to the moral hazard problem in the absence of external monitoring (V).

We should clarify here that a market-based system does not preclude banks. Since the only role banks perform is of monitoring, all it means is that even when banks participate in the loanable funds market, they do not engage in monitoring activities. Based upon their informational content, bank- and market-finance become indistinguishable in that case.

5. Dynamic equilibria

Long-run equilibria in an overlapping generations economy with Ak technology are known to be balanced growth paths where per capita quantities grow at the same constant rate. This economy too is characterized by such a balanced growth path in the long-run.

In the short-run, a constant flow of entrepreneurs move from traditional to modern activities by accumulating wealth beyond b_L^*. Capital accumulation is thereby faster than the growth of entrepreneurial wealth. Secondly, in a market-based financial system, medium-wealth entrepreneurs use mixed finance in the short-run and accumulate wealth at a rate different than those using purely market finance. It is therefore difficult to fully characterize the short-term dynamics without further information relating to the wealth distribution and the pace of exogenous productivity improvements in traditional activities.

In the long-run, all entrepreneurs access credit markets and use only one type of financial contract in either financial system. Thus long-run dynamic equilibria are characterized by constant growth rates of GDP (GNP), capital and consumption per capita. But during the transition process, the economy may exhibit a Kuznets curve type (inverted U) relationship. Initially, inequality increases as informal sector entrepreneurs get left behind (households and modern sector entrepreneurs grow at the same, and faster, rate); as they gradually join the modern sector, they enjoy similar rates of economic progress, and inequality starts declining.

5.1. Wealth accumulation

To see this, consider a bank-based system. For entrepreneur-j who is not credit-constrained ($b_t^j \geqslant b_L^*$), (2) and (16) give us

$$b_{t+1}^j = (1 + g_I) b_t^j, \tag{18}$$

where the rate of growth, g_I, is defined by

$$1 + g_I \equiv (1-\beta)\left[\frac{\{v/(1-\pi)\}R^*}{\{v/(1-\pi)\} - \{\alpha A - (1+\gamma)R^*\}}\right]. \tag{19}$$

Likewise, in a market-based regime, for entrepreneur-j using market finance,[16] we have

$$b^j_{t+1} = (1+g_U)b^j_t, \tag{20}$$

where[17]

$$1 + g_U \equiv (1-\beta)\left[\frac{\{V/(1-\pi)\}R^*}{\{V/(1-\pi)\} - (\alpha A - R^*)}\right]. \tag{21}$$

5.2. Capital accumulation

Optimal investment choices are linear in entrepreneurial wealth as (14) shows. The aggregate stock of capital in $t+1$ depends on investment undertaken in t. Define

$$\overline{q}_{I,t} \equiv \int_{b^*_L}^{\infty} q^j_{I,t}\,\mathrm{d}G_t, \quad \overline{b}_t \equiv \int_{b^*_L}^{\infty} b^j_t\,\mathrm{d}G_t.$$

Since optimal loan contracts ensure that all entrepreneurs behave diligently, aggregate (and per capita) capital produced in a bank-based system is

$$k_{I,t+1} = \overline{q}_{I,t} = \left[\frac{R^*}{\{v/(1-\pi)\} - [\alpha A - (1+\gamma)R^*]}\right]\overline{b}_t,$$

using (7). Using (18) we obtain that $k_{I,t+1} = (1+g_I)k_{I,t}$, so that capital per capita grows at the same rate as entrepreneurial wealth.

Similarly, when unintermediated finance is chosen by all entrepreneurs (in the long-run), per capita capital grows at the rate g_U: $k_{U,t+1} = (1+g_U)k_{U,t}$.

5.3. GDP, GNP and consumption growth

The aggregate production function being linear in capital, growth of GDP mimics that of capital. In other words, for a country that chooses a bank-based financial system, $y_{I,t+1} = (1+g_I)y_{I,t}$, whereas for market-based system, $y_{U,t+1} = (1+g_U)y_{U,t}$.

However, given our small open-economy assumption with perfect capital mobility, a more appropriate measure of income is GNP. Suppose that households supply their savings to the domestic financial sector first, and then invest any excess on the international capital market. Similarly, the domestic financial sector first relies on the domestic loanable funds market before approaching the international capital market. Since banks and entrepreneurs pay the world rate of return, R^*, the loan market always clears.

Consider first a bank-based system. Demand for loanable funds comes from banks seeking deposits (D_t) and from entrepreneurs seeking direct finance (M_t) and is given by, $D_t + M_t = L_t/\pi + M_t = (1+\gamma)k_{I,t+1} - \overline{b}_t$. Supply of loanable funds, on the other hand,

[16]In the short-run, wealth of entrepreneurs using mixed finance grow at the rate g_I which is less than g_U by Proposition 1 above.

[17]To ensure $g_I > 0$ we assume $[\alpha A - R^*(1+\gamma)] \leqslant v/(1-\pi) \leqslant [\alpha A - R^*(1+\gamma)]/[1-(1-\beta)R^*]$. Likewise, assuming $(\alpha A - R^*) \leqslant V/(1-\pi) \leqslant [\alpha A - R^*]/[1-(1-\beta)R^*]$ implies that $g_U > 0$.

comes from household savings, $S_t = w_t = (1-\alpha)Ak_{I,t}$. Net lending abroad (NLA) by households, is then simply, $NLA_{I,t} = S_t - D_t - M_t = (1-\alpha)Ak_{I,t} + \overline{b}_t - (1+\gamma)k_{I,t+1}$.[18] Thus, after financing new investments and spending resources in bank monitoring, the remainder of investable resources (household savings plus entrepreneurial wealth) is invested on the international capital market. Current loans made abroad yield a flow of net interest income from abroad (NIA) the following period. This income is given by $NIA_{I,t+1} = R^* NLA_{I,t}$ which clearly grows at the rate g_I. GNP being the sum of GDP and NIA also grows at g_I. Similar results follow under a market-based system.

Consider now consumption paths for workers and entrepreneurs. The equilibrium wage rate is linear in capital, from (5), while second-period consumption of households is equal to $R^* w_t$. Hence, per capita household consumption grows at the rate of growth of the capital stock. It is equal to, g_I or g_U, depending upon the prevailing financial structure. For entrepreneurs, all of them access credit markets and borrow using the same type of external finance in the long-run. Their consumption is linear in wealth and hence grows at the same rate as workers' consumption and GDP.

6. Discussion and policy considerations

Our analysis has a number of implications for the "banks versus market" debate, as also for the efficacy of credit markets in transforming traditional economies into modern manufacturing ones.

6.1. Growth rates and the quality of institutions

A key result we obtain shows how an economy's growth rate depends upon the quality of its institutions entrusted with resolving agency problems. As in the financial and legal services views (see Merton and Bodie, 1995; Levine, 1997; La Porta et al., 1998), financial contracts, markets and intermediaries arise in our model to ameliorate market imperfections. These arrangements are defined by, and their effectiveness determined according to, legal rights and enforcement mechanisms.

We view the moral hazard problem (v, V), and the cost of controlling it (γ), as primarily institutional. These parameters capture environments in which markets and intermediaries operate and how effective they are. Expressions for growth rates in (19) and (21) imply that $\partial g_I/\partial\gamma < 0$, $\partial g_I/\partial v < 0$, and $\partial g_U/\partial V < 0$. Faster growth results, therefore, when γ or v is lower in a bank-based system, and when V is lower in a market-based one. Even with identical technologies (α, A), countries using similar financial institutions need not experience identical growth rates.

But what explains cross-national differences in these parameters? The answer must partly lie in the quality of legal and financial institutions. To see why, it may help to consider some empirical counterparts for v and V, parameters which denote a borrower's opportunity costs of being diligent with and without monitoring. Based on La Porta et al's (henceforth LLSV) extensive work, we can think of at least three empirical measures of V: "accounting" (LLSV, 1998, Table 5), consisting of ratings on accounting standards, "rule of law" (LLSV, 1998, Table 5; LLSV, 1997, Table 2) assessing a country's ability to enforce law and order, and "shareholder rights" (LLSV, 1998, especially "antidirector

[18]Assume, without loss of generality, that this amount is positive.

rights'' in Table 2). Better accounting standards, better protection of shareholder rights and strong enforcement of the rule of law naturally reduce a manager's private benefits from negligent behavior even in the absence of monitoring in our model.

Similarly, an empirical measure of v would be ''creditor rights'' reported in LLSV (1998, Table 4; 1997, Table 2). As a monitor, banks can better enforce and protect the rights of creditors. Indeed, in line with our Proposition 1 above, Demirguc-Kunt and Levine (2001) show that countries with strong shareholder rights relative to creditor rights and strong accounting systems (that is, low V relative to v) tend to have more market-based financial systems. Bankruptcy costs, book-keeping procedures and the ease with which banks are able to inspect firms' cash-flows, similarly affect γ as they determine how easy it is for firms to obfuscate their activities.

The quality of services that a financial system provides is, thus, a fundamental determinant of growth. This 'legal-based' view has been recently espoused by La Porta et al. (1997, 1998) in their study of legal rules that protect corporate shareholders and creditors. Its relevance in explaining the cross-country growth experience is confirmed by Levine's (2002) study of 48 countries.

6.2. Banks versus markets

Our analysis sheds light on the long-standing debate whether bank-based or market-based systems are better for growth. It suggests that such an 'either-or' question is, in fact, ill-posed: the growth rate is a function not so much of the financial regime as of the quality of services it delivers.

It is, indeed, possible for two countries to have different financial systems but enjoy similar growth rates. Consider two countries characterized by the vectors $(v_\ell, \gamma_\ell, V_\ell)$, $\ell = 1, 2$. Suppose also that country 1 has a bank-based regime while country 2 has a market-based one. Following Proposition 1, these financial regimes will be in place as long as these hold

$$\frac{\alpha A - R^*(1+\gamma_1)}{v_1} \geqslant \frac{\alpha A - R^*}{V_1} \quad \text{and} \quad \frac{\alpha A - R^*(1+\gamma_2)}{v_2} \leqslant \frac{\alpha A - R^*}{V_2}.$$

These conditions, on their own, imply little about growth rates in one country versus another. Given the same (α, A, R^*), if cost parameters (v_1, γ_1, V_2) are such that

$$\left[\alpha A - R^*(1+\gamma_1)\right]/v_1 = (\alpha A - R^*)/V_2,$$

growth rates in the two countries will be similar, $g_1 = g_2$.[19] If, on the other hand,

$$[\alpha A - R^*(1+\gamma_1)]/v_1 < (\alpha A - R^*)/V_2,$$

country 1 will grow at a slower rate, $g_1 < g_2$. This happens not because the country uses a bank-based system, but rather because its banking sector is inefficient in allocating resources. It is not possible, then, to attribute faster growth in one country over another purely to its choice of financial regime without explicitly taking into account the efficiency of that financial regime. This squares well with Levine's (2002) cross-country findings that the type of financial system does not seem to matter much for economic growth.

[19]From Eqs. (19) and (21), $g_1 \gtreqless g_2$ whenever $[\alpha A - R^*(1+\gamma_1)]/v_1 \gtreqless (\alpha A - R^*)/V_2$.

Note, moreover, that endogenously evolved financial systems are also *growth maximizing* here. Recall that a bank-based system is preferred over a market-based one only if entrepreneurs prefer mixed-finance over purely market-finance, that is, if condition (17) holds. Under a bank-based system, the country grows at the rate given by (19). Had a market-based system prevailed instead, the growth rate would have been given by (21).

When an economy endogenously chooses a bank-based system, condition (17) guarantees that $g_I \geqslant g_U$. That is, a particular country that chooses a bank-based system grows faster than it would under the alternative system. Therefore, a policy of promoting one type of financial arrangement over another, say a market-based system over an existing bank-based one, may be misplaced and fail to raise economic growth.

6.3. Level effects of bank-based systems

Despite neither system being especially better for faster growth, bank-based systems have an edge over market-based ones along other dimensions. In particular, a bank-based economy undertakes a higher *level* of investment than a market-based one with *similar* growth rate. The initial size of the modern-sector is also larger in a bank-based system.

Consider our previous example of countries 1 and 2 and suppose both are growing at identical rates, $g_1 = g_2$. Appendix A.1 shows that with identical wealth distributions in the two countries, investment size for all modern-sector entrepreneurs is strictly greater under a bank-based regime, that is, in country 1. The implication is that country 1 will permanently enjoy a higher level of per capita GDP than country 2 as long as both economies start out with the same wealth distribution.

Similarly, in Appendix A.2 we show that the minimum wealth, b_L^*, that entrepreneurs require to engage in manufacturing activities is smaller in country 1. Given identical wealth distributions in the two economies, the initial size of the traditional sector is then smaller in country 1. In transition, more entrepreneurs supply capital in this economy, so that GDP per capita is again higher than in country 2. A bank-based system is hence more conducive, at least in the short-run, for the process of industrialization which shifts production from traditional activities to ones involving manufacturing and marketed output.

Both these level effects of a bank-based system result because banks monitor firms and reduce incentive problems, while markets are more 'hands-off' in their lending activities. Bank monitoring effectively substitutes for entrepreneurial wealth, but cannot do so entirely since monitoring does not completely eliminate the agency problem. But market finance need not play such a passive role. As Allen and Gale (2000) and Scharfstein (1988) argue, for some types of market finance, especially equity, aggressive shareholder rights (especially in the US) may substitute for the monitoring role played by financial intermediaries. Since we do not take into account possible monitoring by shareholders, our analysis is better-suited for securities that are essentially arms length lending. While this is evidently true for corporate bonds, even for equity markets there are often limits on how effectively shareholders can discipline poorly-performing managers.

6.4. Effect of institutional reforms

While policy interventions in either type of financial regime affect growth rates, these have to be targeted towards improving the quality of services that the *existing system* uses.

But bank-based and market-based systems react somewhat differently to such interventions.

Consider the effect of reducing the monitoring cost, γ (analysis same for v), on a bank-based economy, perhaps through better contract enforcements. Lower γ would lead to greater borrowing and higher investment by all entrepreneurs (by (14)). Since the investment rate has a growth effect in the Ak-model, lower monitoring costs increase the growth rate. But this lower monitoring cost also results in a *level effect* by increasing the level of per capita GDP when the policy is implemented. This follows by noting that a lower γ reduces the minimum wealth that entrepreneurs need to enter the modern sector.[20] Since per capita GDP is proportional to the fraction of entrepreneurs in the modern sector, relaxing the credit-constraint raises GDP. Institutional reforms in a bank-based system, thus, encourage traditional sector entrepreneurs to enter the modern sector, improving the entrepreneurial income distribution and speeding up structural transformation.

A policy that lowers agency costs in a market-based system (V), on the other hand, leads to faster growth but worse wealth distribution. In particular, a lower agency cost results in higher investment (by (14)) and faster growth for entrepreneurs who have access to external finance. However, the minimum wealth required to borrow, b_L^*, is independent of V. So a lower V has no impact on the size of the traditional sector at any point of time. At the same time, by speeding up wealth accumulation among modern-sector entrepreneurs, it leads to rising entrepreneurial wealth inequality during the transition to the balanced growth path.

Interestingly, lowering γ or v would raise GDP and improve the wealth distribution even in a market-based system since these b_L^* is also the relevant cutoff for constrained entrepreneurs in a market-based system. The only difference is that some of the constrained entrepreneurs rely at first on mixed finance, but eventually grow out of monitoring needs.

These results suggest that developing countries may benefit more from bank-based systems in situations where setup costs are large relative to average wealth and when a more equitable income distribution is of particular concern.

On balance, we conclude that although there may not be distinct growth advantages to either type of financial regime, bank-based systems have an edge along other dimensions. Intermediated finance confers a level effect on per capita income and leads to a faster structural transformation. Financial sector reforms yield higher economic payoffs when they focus on banking institutions and in bank-based financial systems. Our analysis is, thus, complementary to some recent contributions, notably Rajan and Zingales (1998b, 1999) and Tadesse (2002), which make a strong case for bank-based systems in developing countries.

7. Conclusion

The chief contribution of this paper has been to shed light on the ongoing debate about the relative merits of bank-based and market-based financial systems for growth and development. Many developing countries have been moving towards market-based systems in recent years without a clear consensus that such systems are necessarily better.

[20]From Eq. (13), we have $\partial b_L^*/\partial\gamma > 0$ and $\partial b_L^*/\partial v > 0$.

Hence, it is important that growth theory addresses this debate to better inform policy-making.

From a growth perspective, we do not find that one type of system is invariably better than the other. Indeed, it is quite possible for two types of systems in two different countries to deliver similar growth rates of per capita GDP. Moreover, and consistent with recent cross-country evidence, we show that the quality of a country's financial and legal institutions are more important for its growth.

But bank-based systems have some advantages over those that are market-based. For one, levels of investment and per capita GDP are higher under a bank-based system. Bank monitoring resolves some of the agency problems and enable firms to borrow more. Arms-length market finance plays no such role and results in a lower amount of external finance available to all firms. Secondly, bank-based systems allow greater participation in manufacturing activities, by providing external finance to a larger number of entrepreneurs. The implication is that the traditional sector is smaller and wealth distribution better under such a system.

Appendix A

A.1. Investment size in bank-based and market-based systems

Take two countries, 1 and 2 where 1 uses mixed finance and 2 uses market finance. Suppose both have the same growth rate so that

$$\frac{V_2 - v_1}{1-\pi} = \frac{V_2/(1-\pi)}{\gamma_1 R^*/(\alpha A - R^*)}. \tag{A.1.1}$$

Now compare the amount of investment a particular entrepreneur with internal funds b^j undertakes in each of these countries. We have,

$$q_1^j \gtrless q_2^j \Leftrightarrow \frac{V_2 - v_1}{1-\pi} \gtrless \gamma_1 R^*. \tag{A.1.2}$$

Substituting (A.1.1) into (A.1.2) gives us $V_2/(1-\pi) \gtrless \alpha A - R^*$. From the entrepreneur's participation constraint in country 2, her income is $z^j = (\alpha A - R^*)q_2^j + R^* b^j = [V_2/(1-\pi)]q_2^j$. Clearly we must have $[V_2/(1-\pi)]q_2^j > \alpha A - R^*$ as long as $b^j > 0$. Hence, investment size in country 2 is smaller for every entrepreneur in the modern-sector, i.e., $q_1^j > q_2^j$. Consequently, per capita GDP in country 1 is greater, that is, $y_1 > y_2$.

A.2. b_L^* in Bank-based and market-based systems

Once again consider country 1 with a bank-based system and country 2 with a market-based one and $g_1 = g_2$. We show that $b_{L,1}^* < b_{L,2}^*$. From Proposition 1, we have

$$\frac{\alpha A - R^*(1+\gamma_1)}{v_1/(1-\pi)} > \frac{\alpha A - R^*}{V_1/(1-\pi)} \quad \text{and} \quad \frac{\alpha A - R^*(1+\gamma_2)}{v_2/(1-\pi)} < \frac{\alpha A - R^*}{V_2/(1-\pi)}.$$

Also, $g_1 = g_2$ implies that

$$\frac{\alpha A - R^*(1+\gamma_1)}{v_1/(1-\pi)} = \frac{\alpha A - R^*}{V_2/(1-\pi)}.$$

Combining these three relations we obtain the following inequality:

$$\frac{v_2 - v_1}{1-\pi} > \frac{v_1}{1-\pi}\left[\frac{R^*(\gamma_1 - \gamma_2)}{\alpha A - R^*(1+\gamma_1)}\right]. \tag{A.2.1}$$

Now, from entrepreneur-j's incentive constraint in country 1, we have $z_1^j = [\alpha A - (1+\gamma_1)R^*]q_1^j + R^* b^j = [v_1/(1-\pi)]q_1^j$. For any $b^j > 0$, this implies that $[v_1/(1-\pi)] > \alpha A - (1+\gamma_1)R^*$. Using this in (A.2.1) above, we get $(v_2 - v_1)/(1-\pi) > R^*(\gamma_1 - \gamma_2)$ which ensures that $b^*_{L,1} < b^*_{L,2}$ from (13) above.

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