Explaining the Trend and the Diversity in the Evolution of the Stock Market

Niloy Bose [a]

Rebecca Neumann [b]

Abstract:

In an overlapping generations economy, lenders fund risky investment projects of firms by drawing up loan contracts in the presence of an informational asymmetry. An optimal contract entails the issue of only debt, only equity, or a mix of the two. The equilibrium choice of contract depends on the state of the economy, which in turn depends on the contracting regime. Based on this analysis, the paper provides a theory of the joint determination of real and financial development. The paper is able to explain the endogenous emergence of the stock market along the path of economic development while capturing the diversity in the mode of financing that often arises among similar countries.

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[a] Department of Economics, University of Wisconsin-Milwaukee, WI 53201, USA**.**

[b] Department of Economics, University of Wisconsin-Milwaukee, WI 53201, USA.
phone: 414-229-4347, fax: 414-229-3860, email: rneumann@uwm.edu

1. Introduction

It has been widely recognised for some time among development experts that financial development is a multi-faceted process that takes place through various distinct stages – from the emergence and expansion of bank-intermediated debt finance to the materialisation of stock markets and the increasing use of equity as an additional instrument by which firms are able to raise funds (e.g., Gurley and Shaw, 1955, 1960; Goldsmith, 1969). In recent years, a substantial volume of empirical research has been directed towards understanding the events that lead an economy to undergo transition from a financial system based wholly or predominantly on the issue of debt to one involving a much greater reliance on the issue of equity. These investigations have yielded a number of important findings that strongly suggest that the development of equity markets is a systematic process that influences and is influenced by the development of the real sector. For example, using data on 47 countries from 1976 through 1993, Levine and Zervos (1998b) conclude that the value of stock trading relative to the size of the financial market and relative to the size of the economy are positively and significantly correlated with current and future rates of economic growth.[1] Extending their analysis using a data set on a cross-section of up to 150 countries, Demirguc-Kunt and Levine (1999) find strong evidence supporting a positive and robust correlation between the levels of GDP per capita and the size, the level of activity, and the efficiency of the stock market.[2]

Despite this, one can identify a non-trivial number of cases where countries with comparable levels of economic development differ significantly in terms of the size and the liquidity of their equity markets (Pagano, 1993).[3] To explain such cases, the existing literature has focused primarily on differences in institutional and regulatory arrangements across countries. For example, La Porta et al. (1998) explain how countries with different legal origins develop distinct laws governing debt and equity contracts. In turn, these country-specific contracting regimes then influence the evolution of banks and security markets. Similarly, differences in accounting standards and in the level of corruption have been viewed as

[1] Antje and Jovanovic (1993) obtain a similar result.
[2] According to their analysis, the correlation between GDP per capita and both the total value traded as a share of GDP and the market turnover ratio are about 0.4 and are significant at the 0.01 level. The correlation between GDP per capita and market capitalisation is almost 0.3 and is significant at the 0.05 level.
[3] For example, in the UK, the ratio of stock market value to GDP is five times larger than in Germany, France, Denmark, and Finland, and six times larger than in Italy and Norway.

responsible for the differences in equity market development among otherwise similar countries (Demirguc-Kunt and Levine, 1999). Despite being valuable in their own right, these explanations are based on factors or events that have remote and often tenuous connection with the process of real development. In this paper, we propose a theory that is capable of capturing the (well evidenced) joint evolution of the equity market and the real sector while contending that the diversity in the mode of financing among similar countries can still be explained by appealing to the two-way interaction between the development of the financial sector and the real sector.

The analysis that we present here is based on a simple growth model in which an informational asymmetry exists between borrowers and lenders. In making a choice between debt financing and equity financing, a representative borrower evaluates the trade-off between two types of costs – bankruptcy costs and dilution costs (e.g., Bolton and Freixas, 2000) – that arise in conjunction with the informational asymmetry. Bankruptcy cost is the loss that a borrower incurs in his current and/or future profit when he is unable to honour a mutually agreed fixed payment that is associated with debt issue. By contrast, an informational dilution cost is the cost incurred by good quality firms that are pooled together with inferior quality firms such that the offered contract falls short of the first best contract (e.g., Myers and Majluf, 1984). In the absence of any pre-committed payment arrangements, there is no bankruptcy cost associated with equity financing. There may be higher dilution costs, however, for a good firm offering equity. This is due to the fact that under the equity contract, the cash flows that a lender receives depend entirely on the type of a borrower. Thus, pooling high quality and inferior quality firms dilutes the optimal contract. By contrast, under debt financing, the dilution costs are lower since the borrower makes fixed payments. However, a firm may be forced into bankruptcy and liquidation when it is unable to honour its commitments, facing higher bankruptcy costs even in the face of lower dilution costs. Our analysis suggests that the trade-off between the two types of costs depends on the level of capital accumulation in the economy. Accordingly, a borrower's choice between debt financing and equity financing relies crucially on the state of the economy. In turn, the economy's rate of return to capital depends on the prevailing mode of financing. Given this mutual dependency, we jointly determine the equilibrium mode of financing along the path of economic development.

The main implication of our analysis is that an economy may find its financial market in any of three distinct types of equilibria contingent upon the level of capital accumulation in the economy. In a low development regime, the financial market is characterised by a unique equilibrium that is associated with a high incidence of debt financing. At the other extreme, at a very high level of the capital stock, there exists a unique equilibrium that is associated with a high incidence of equity financing. Significantly, between these two extremes, the equilibrium mode of financing is not unique and a high incidence of either debt or equity financing may prevail. This account of events is useful in understanding not only the well-evidenced link between the level of real activity and the financing choice of firms, but also the wide diversity in the choice of financing that is more commonly observed among countries that are at an intermediate stage of economic development.

The remainder of the paper is organised as follows. In Section 2 we present a description of the economic environment. In Section 3 we study an economy's optimal choice of financing in a partial equilibrium setting. Section 4 analyses equilibria in the financial market that are associated with different levels of economic prosperity. In Section 5, we offer some concluding remarks.

2. The Economy

We consider an economy that consists of an infinite sequence of two-period lived overlapping generations. Agents are divided into three groups of market participants – households (lenders), capital-producing firms (borrowers), and output-producing firms. We normalise the size of each group to mass 1. All agents are risk neutral and wish to consume only at the end of the second period. We proceed with our formal description with reference to circumstances facing each type of agent of generation t.

2.1 *Households (Lenders)*

Each young lender is endowed with one unit of labour, which is supplied inelastically to the output producers at the ruling wage rate, w_t. At time t, a young lender decides whether to lend his wage earnings to capital-producing firms in return for capital in $t+1$. Alternatively, we assume that a lender is able to convert his wage earning, w_t, directly into w_t units of $t+1$ capital. In either case, each lender becomes the potential owner of capital during adulthood (in

$t+1$). This capital is then sold to output-producing firms in exchange for output to finance old age consumption.

2.2 *Output-Producing Firms*

These firms are active only during adulthood (period $t+1$) when they gain access to an output production technology. The output is produced by renting capital (from the current generation) and hiring labour (from the young generation) at competitively determined rates. In particular, an adult output-producing firm employing l_{t+1} units of labour and k_{t+1} units of capital, is able to produce y_{t+1} units of output according to

$$y_{t+1} = Ak_{t+1}^{\alpha} l_{t+1}^{1-\alpha}, \quad A > 0; \alpha \in (0,1). \tag{1}$$

In the presence of complete factor mobility, all output-producing firms employ equal amounts of l_{t+1} and k_{t+1} in equilibrium. Since there are an equal number of households and output-producing firms, we obtain a unitary amount of labour per firm, i.e., $l_{t+1} = 1$. Accordingly, the competitively-determined wage rate, w_{t+1}, and the rental rate of capital, ρ_{t+1}, facing each producer of output are given by

$$w_{t+1} = A(1-\alpha)k_{t+1}^{\alpha} \tag{2}$$

and

$$\rho_{t+1} = A\alpha k_{t+1}^{\alpha-1}. \tag{3}$$

2.3 *Capital-Producing Firms (Borrowers)*

Each capital-producing firm begins life with zero resources, except for ξ amount of non-tradable labour and access to a risky investment project from which capital is produced. In order to operate the investment project, a firm must acquire external financing from lenders during the first period. We assume that borrowers differ in terms of their intrinsic characteristics and that the output from the investment project is influenced by such characteristics. To illustrate, we assume that a borrower can be either of two types: type 1 or type 2. The output of an i^{th} investment project at time *t* is jointly determined by three elements: the realisation of a project specific shock, θ_{it}, the type of borrower who is operating the project, and the decision of the

borrower about whether or not to commit non-tradable labour to the project. A borrower does not have any control over the realisation of θ_{it}. In addition, unless the project is commenced, a borrower is unable to observe the realisation of θ_{it} and knows only its probability distribution, which we assume to be identical and independent across the projects. This probability distribution is given by $\theta_{it} = \theta_1$ (indicating a good state) with prior probability p and $\theta_{it} = \theta_2$ (indicating a bad state) with prior probability $(1-p)$. In the good state, when $\theta_{it} = \theta_1$, a type-1 borrower who has decided to commit his non-tradable labour to the project is able to convert 1 unit of time t wage earnings into $Q > 1$ units of time $t+1$ capital. By contrast, under the same circumstances, a type-2 borrower is able to produce only $q < 1 < Q$ units of time $t+1$ capital. In the bad state, when $\theta_{it} = \theta_2$, an investment project fails and yields nothing irrespective of the borrower's type and the commitment of labour to the project.

We assume that each borrower faces a strictly positive opportunity cost of committing the non-tradable labour endowment to the project. By directing the labour endowment into some other venture (e.g. home production), each borrower is able to obtain ε amount of additional output for final consumption. Such action, however, alters the expected output of the investment project. In the event of a success, the project yields $q_0^1 = Q\lambda$ and $q_0^2 = q\lambda$ amount of capital when the project is operated by a type-1 and a type-2 borrower, respectively. We assume $0 < \lambda < 1$.[4] To ensure that loan transactions take place between borrowers and lenders, and to ensure that at least the type-1 borrowers are motivated enough to commit their labour endowment to the project, we assume Q to be sufficiently large. Finally, we assume that a given fraction, $0 < v < 1$, of borrowers are of type 1, and that the distribution of borrower types and the distribution of the project specific random shock are common knowledge.

In addition to producing capital, each borrower acquires skills whenever he operates an investment project. Specifically, a young borrower of either type is able to acquire valuable experience that enables him to develop entrepreneurial skills that can be used productively during adulthood. In practice, such entrepreneurial skills are rewarded in the market and the extent of the reward is determined, among other things, by the state of the economy. To keep our model tractable, we do not explicitly include this entrepreneurial input into the production

function. Instead, we capture the flavour by assuming that each adult borrower is endowed with 's' units of skilled labour, which entitles him to $B(k_{t+1})s$ units of additional consumption in $t+1$. The function B denotes the rate of return of the borrower's skilled labour endowment, which depends on the time $t+1$ capital stock per firm, k_{t+1}. The reliance of the function B on the capital stock per firm captures the extent to which the reward for entrepreneurial skills depends on the state of the economy.

2.4 *The Structure of Information*

While the distribution of borrower types is common knowledge, we assume that a lender is unable to distinguish *ex-ante* between a type-1 and a type-2 borrower because a borrower's type is private information. This informational asymmetry is crucial in shaping the financial contract between borrowers and lenders – an issue that we discuss in detail in the following section.

3. The Credit Market

The precise functioning of the credit market is as follows. At each period, young households and young capital-producing firms are united in randomly matched pairs.[5] To keep our exposition transparent, in this section we assume that, at the beginning of period t, the terms of the financial contracts are determined while taking the capital stock, k_t, the wage rate, w_t, and the rental rate of capital for period $t+1$, ρ_{t+1}, as given. Subsequently, in Section 4, we demonstrate how the optimal financial contract is influenced by the evolution of these state variables along the growth path. We assume that the terms of contracts offered in the market are public knowledge and can take one of two possible forms: a bond (debt) issue or an equity issue. The debt issue specifies a fixed repayment, R, to bondholders at a specified date. In the event of

[4] To benefit the reader, we summarize the conditional outcomes of the project in Table A1 of the Appendix.
[5] The assumption of one-to-one matching between borrowers and lenders is not uncommon in the literature (e.g., Bencivenga and Smith, 1993; Bose and Cothren, 1996) and is made in the present context largely to save on notation. As will become apparent, if a lender were to be approached by more than one borrower (each of whom is identical *ex ante*), the lender would either divide her loanable funds equally between borrowers, or lend only to a single borrower. Given that there are equal numbers of lenders and borrowers, the equilibrium outcome in each case would be equivalent to one-to-one matching.

default, the lender appropriates the project output as a residual claimant. In addition, if a borrower is compelled to declare bankruptcy, he incurs a bankruptcy cost that lowers his second period earning.[6] In particular, we assume that a borrower incurs a bankruptcy cost that is a fraction, σ, of his second period labour earnings. By contrast, an equity issue does not involve any such bankruptcy costs as it specifies a share, $\delta \in [0,1]$, of the produced capital to which outside shareholders are entitled.

We assume that the lenders operate in a competitive framework. Accordingly, any contract that makes extra economic profit for the lenders is not sustainable since the lenders compete with each other to win borrowers by offering any extra economic profits to the borrowers. This amounts to saying that competition drives the lenders to maximize the utility of the borrowers subject to their own zero profit constraint. Hence, in practice, the borrowers' preferences determine the optimal contracting form.[7] Further, the outside opportunities of the lenders entail that the gross (net) expected rate of return from lending must be greater than or equal to one (zero). Below, we pin down the optimal contracting form by making use of a set of lemmas and propositions.

Lemma 1:

(i) Given $\varepsilon > 0$, a type-2 borrower prefers not to commit his labour endowment to the project under a debt contract.

(ii) If ε is sufficiently small such that $(1-\delta)(q-q_0^2)\rho_{t+1} > \varepsilon$, a type-2 borrower commits his labour endowment to the project under an equity contract, which specifies a share, $\delta \in [0,1]$, of the produced capital to which outside shareholders are entitled.

Proof: (i) As $q < 1$, a type-2 borrower faces bankruptcy with certainty under the contract even if he decides to commit his labour endowment to the project. Accordingly, he receives zero payoff from the project and his life-time income is simply the second period income net of the bankruptcy cost. Here, his only incentive to participate in the project is to acquire the

[6] The effects of bankruptcy on the future earnings may arise due to various reasons. For example, bankruptcy may cause adverse reputational effects. In addition, bankruptcy proceedings are usually lengthy and time consuming. Accordingly, a borrower is likely to expend some of his second period labour endowment to deal with such cumbersome legal proceedings. This, along with the reputational effects, is likely to lower his future earning.

entrepreneurial skills that can be employed productively during adulthood. By utilizing his first period labour endowment in ventures other than the investment project, a type-2 borrower can improve his life-time income by the amount $\varepsilon > 0$ without compromising the acquisition of skills. Accordingly, it is optimal for the type-2 borrower to abstain from committing his labour endowment to the project under a debt contract.

(ii) Under the equity contract, a type-2 borrower owes nothing to the lenders in a bad state ($\theta_{it} = \theta_2$). In a good state ($\theta_{it} = \theta_1$), which occurs with probability p, a type-2 borrower is able to retain $(1-\delta)qw_t$ or $(1-\delta)q_0^2 w_t$ amount of capital as profit depending upon whether he commits his labour to the project or not. Thus, the corresponding amount of expected output a type-2 borrower is entitled to at the end of the second period is $p(1-\delta)\rho_{t+1}qw_t$ or $p(1-\delta)\rho_{t+1}q_0^2 w_t + \varepsilon$ depending on the labour input. Given $p(1-\delta)(q-q_0^2)w_t\rho_{t+1} > \varepsilon$, a straightforward comparison of the payoffs ensures that a type-2 borrower prefers to commit his labour endowment to the project.□

To obtain funding, a type–2 borrower must always mimic any preferences revealed by a type-1 borrower.[8] As a result, we determine the optimal contracting form by exclusively focusing on the preferences revealed by the type-1 borrower. Let W_E and W_D denote the expected amount of capital that a type-1 borrower is able to retain from the project under the equity and debt contracts, respectively. Recall that *Q* is assumed to be sufficiently large so that the type-1 borrower always commits his non-tradable labour endowment to the investment project.

Proposition 1: $W_D > W_E$ *when* $\lambda > \delta$.

Proof: An equity contract specifies a share $\delta \in [0,1]$ to which the lenders are entitled. Since competition drives lenders' profits to zero, the value of δ must be consistent with the zero profit

[7] This approach is common in the existing literature. Examples include Bencivenga and Smith (1991, 1993) and Azariadis and Smith (1993), among others.

[8] As in Bolton and Freixas (2000), we do not consider the possibility where type-1 borrowers could attempt to partially reveal themselves by offering a menu of contracts. Such a separating equilibrium can only be supported by ad-hoc beliefs.

constraint of the lender. For a given amount of loanable wage earnings, w_t, the zero profit constraint of the lender is given by $w_t = \delta p[vQ + (1-v)q]w_t$. This, in turn, implies $\delta = \dfrac{1}{p[vQ + (1-v)q]}$. When offering a debt contract, a borrower promises a fixed repayment, R, that must also satisfy the zero profit constraint of the lender, i.e., $vpR + (1-v)pq\lambda w_t = w_t$. Accordingly, $R = \dfrac{w_t - (1-v)pq\lambda w_t}{vp}$. Given these observations, we obtain

$$W_E = pQw_t(1-\delta) = \left[pQ\frac{p[vQ + (1-v)q] - 1}{p[vQ + (1-v)q]} \right] w_t \equiv \mathrm{X}_1 w_t \qquad (4)$$

and

$$W_D = p[Qw_t - R] = \left[\frac{Qvp - 1 + (1-v)pq\lambda}{v} \right] w_t \equiv \mathrm{X}_2 w_t . \qquad (5)$$

A straightforward comparison of equations (4) and (5) indicates that $W_D > W_E$ when the relation $\lambda > \delta$ holds. In turn, the relation $\lambda > \delta$ is true for a sufficiently large value of Q, which we assume to hold for the remainder of our analysis.□

Intuition underlying the above proposition is easy to obtain. Consider a scenario in which a debt contract has been offered. A type-2 borrower facing the prospect of bankruptcy with certainty will not commit his labour endowment to the project. Under such circumstance, the lender, being the residual claimant, is able to appropriate $\lambda q w_t$ amount of produced capital. However, under an equity contract, the type-2 borrower produces qw_t amount of capital and the lender is able to obtain a fraction δ of this project output. Accordingly, when $\lambda > \delta$, and when a lender offers a contract by pooling the two types of borrowers, an equity contract gets more diluted (i.e., falls short of the first best contract) than a debt contract, causing $W_D > W_E$.

The result obtained in Proposition 1 implies that in the absence of any other costs, a type-1 borrower would always prefer to raise funds through an issue of debt, thus minimizing the dilution costs. In reality, however, a firm's decision to raise funds through the issue of debt is significantly influenced by the consideration of bankruptcy costs – the loss that a borrower

typically incurs in his current and/or future profit when he is unable to honour a mutually agreed fixed payment (e.g. Bolton and Freixas, 1998, 2000).[9] In our case, a type-1 borrower encounters this possibility when $\theta_{it} = \theta_2$ and the project yields nothing. Under such circumstance, a type-1 borrower is compelled to declare bankruptcy and incurs a bankruptcy cost that is a fraction, σ, of his second period labour earnings. Thus, under debt financing, while the dilution costs are lower, a firm may be forced into bankruptcy and incur the costs associated with bankruptcy. By contrast, in the absence of any pre-committed payment arrangements, there is no bankruptcy cost associated with equity financing. However, there may be higher dilution costs for a type-1 firm offering equity. Below, we exploit this trade-off between the two costs in determining the optimal financing choice for the economy.

Proposition 2: An equity (debt) contract is the preferred mode of financing from the point of view of a type-1 borrower when $\dfrac{(1-p)\sigma B(k_{t+1})s}{(W_D - W_E)} \equiv \Omega(k_{t+1}) > (<) \rho_{t+1}$.

Proof: During adulthood, a type-1 borrower rents out any capital at his disposal at a competitively determined rental rate ρ_{t+1}. At the same time, when operating under an equity contract, a type-1 borrower is able to earn $B(k_{t+1})s$ amount of adult income from his skilled labour endowment in the absence of any bankruptcy costs. Accordingly, we write the expression for the expected life-time utility of a borrower under an equity contract as

$$U_E = \rho_{t+1} W_E + B(k_{t+1})s \qquad (6)$$

where W_E is given by equation (4). In a similar vein, we express the life-time expected utility of a type-1 borrower under a debt contract as

$$U_D = \rho_{t+1} W_D + pB(k_{t+1})s + (1-p)(1-\sigma)B(k_{t+1})s, \qquad (7)$$

where W_D is given by equation (5). The first term represents a type-1 borrower's expected project earnings (in terms of output) under a debt contract. The second and third terms together represent a type-1 borrower's expected earnings from his skilled labour endowment during the second period in the presence of a probable bankruptcy. A straightforward comparison of equations (6) and (7) establishes the result.□

[9] See Altman (1984) for estimates of the size and importance of bankruptcy costs.

The above proposition shows that the equilibrium mode of financing at period t depends not only on the current state variable, w_t (through W_D and W_E), but is also influenced by the variables k_{t+1} and ρ_{t+1} that characterise the future state of the economy. As we demonstrate in the following section, this relationship is instrumental in explaining why countries with similar economic environments often differ in their use of debt and equity financing.

4. Capital Dynamics and the Financing Choice

The foregoing analysis (Proposition 2) sets out the condition based upon which a type-1 borrower makes a decision about whether to use debt or equity as the preferred mode of raising funds. The analysis reveals that the debt-equity decision depends upon economy-wide variables. We begin our discussion in this section by considering how these economy-wide variables, in turn, are affected by the mode of raising funds in the financial market. This two-way causal relationship between the behaviour in the financial market and the state of the economy lies at the core of our analysis that is to follow.

First, consider a situation in which $\Omega(k_{t+1}) > \rho_{t+1}$ holds (from Proposition 2) and equity financing is the preferred means of raising funds at time *t*. Under such circumstance, each type-2 borrower commits his labour endowment to the project. The ownership of the capital that enters the time $t+1$ output production is distributed among three groups of individuals – the households, the type-1 borrowers, and the type-2 borrowers. By exploiting the law of large numbers and by recalling that there is unity measure of output-producing firms, we express the time $t+1$ capital stock per firm as

$$k_{t+1}^{E} = p[vQ + (1-v)q]w_t = A(1-\alpha)\,p[vQ + (1-v)q]k_t^{\alpha}. \qquad (8)$$

At the other extreme, consider the case where debt financing is the preferred choice of raising funds at time t. In such a case, each type-2 borrower decides not to commit his labour endowment to the project. Accordingly, λq amount of capital is produced in the event of a success. The ownership of the capital that enters the time $t+1$ output production is distributed among the lenders and the type-1 borrowers. Accordingly, the time $t+1$ capital stock per firm is given by

$$k_{t+1}^{D} = p[vQ + (1-v)\lambda q]w_t = A(1-\alpha)\,p[vQ + (1-v)\lambda q]k_t^{\alpha}. \qquad (9)$$

In Diagram 1, we denote these two capital accumulation paths by Path E and Path D and their corresponding steady states by k_{ss}^{E} and k_{ss}^{D}, respectively. Given $\lambda < 1$, Path E lies above Path D and $k_{ss}^{E} > k_{ss}^{D}$. In this way, we ensure that the existence of a stock market, should it ever emerge, is conducive to real economic development, as suggested by the empirical evidence. For example, among the references cited earlier, Levine and Zervos (1998b) report significant positive correlations between various indicators of stock market activity and the current and future rates of capital accumulation and productivity growth.

At this stage, it is imperative to specify a functional form for $B(k_{t+1})$ – the rate of return to the borrower's skilled labour endowment. We assume that $B(.) = bk_{t+1}, \quad b > 0$, implying that the return to entrepreneurial skills is proportional to the level of prosperity of the economy as measured by the capital stock per firm.[10] Making use of Proposition 2, we define two variables $\Omega^{E} \equiv \Omega(k_{t+1}^{E})$ and $\Omega^{D} \equiv \Omega(k_{t+1}^{D})$ in accordance with the fact that k_{t+1} takes values k_{t+1}^{E} and k_{t+1}^{D} respectively in the cases of equity and debt financing. Substituting the expressions for W_E, W_D, k_{t+1}^{E} and k_{t+1}^{D} from equations (4), (5), (8) and (9) respectively, we obtain

$$\Omega^{E} = \frac{p[vQ + (1-v)q](1-p)\sigma bs}{(\mathrm{X}_2 - \mathrm{X}_1)} \tag{10}$$

and

$$\Omega^{D} = \frac{p[vQ + (1-v)\lambda q](1-p)\sigma bs}{(\mathrm{X}_2 - \mathrm{X}_1)}. \tag{11}$$

Since $\lambda < 1$, casual inspection reveals that $\Omega^{E} > \Omega^{D}$.

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[10] It is possible to derive such a proportional relationship from first principles. For illustration, consider an output production function, $y_{t+1} = \bar{k}_{t+1}^{\beta} k_{t+1}^{\alpha} l_{t+1}^{1-\alpha} + \bar{k}_{t+1}^{\gamma} k_{t+1}^{\alpha} s_{t+1}^{1-\alpha}$; β, α, γ $\in (0,1)$, where the entrepreneurial input, s_{t+1}, enhances the productivity of capital. Here, $\bar{k}_{t+1}$ represents the 'average per firm capital stock,' implying an externality in production of the type considered by Shell (1966), Romer (1986), or Prescott and Boyd (1987a,b). For a given value of $s_{t+1} = s$ (as in our case), and under the assumption, $\gamma = 1-\alpha, \alpha + \beta < 1$, this production function takes a form that is similar to the one considered by Jones and Manuelli (1990). Under such specification, the rate of return to entrepreneurial input, $B(k_{t+1}) = (1-\alpha)s^{-\alpha}k_{t+1}$, is proportional to k_{t+1}. Further, w_{t+1} and ρ_{t+1} depend on k_{t+1} in the same fashion as given by equations (2) and (3), respectively, preserving the essence of our model (please see Bose (2005) for details). We have assumed such relationships at the outset to avoid notational clutter and to make the analysis transparent for the reader.

Similary, we define ρ_{t+1}^D and ρ_{t+1}^E as the time $t+1$ rates of return to capital when debt and equity contracts respectively prevail in the financial market at time t.

Lemma 2: ρ_{t+1}^D *and* ρ_{t+1}^E *are decreasing in* k_t *and* $\rho_{t+1}^D > \rho_{t+1}^E$.

Proof: Since $\lambda < 1$, equations (8) and (9) imply $k_{t+1}^E > k_{t+1}^D$. This, together with equation (3), readily establishes the claim.□

Lemma 3: Let k_1^c *and* k_2^c *represent the time* t *capital stock per firm at which* $\Omega^E = \rho_{t+1}^E$ *and* $\Omega^D = \rho_{t+1}^D$, *respectively. Then* $k_2^c > k_1^c$.

Proof: Lemma 2, together with the fact that $\Omega^E > \Omega^D$, establishes the claim. For convenience, we illustrate the scenario in Diagram 2.□

The foregoing analysis demonstrates that the time $t+1$ state variables are influenced by the time t financing choice. This, together with the results obtained in Section 3, then predicts a relationship between the financing choice and the state of the economy that is fundamentally two-way causal. The following propositions show that in such an environment, the time t equilibrium financing choice is determined by the relation of k_t with respect to the values of k_1^c and k_2^c.

Proposition 3: If $k_t < k_1^c < k_2^c$ *holds for a low value of* k_t *then there exists a unique equilibrium at time* t *where debt financing is used to raise funds in the credit market. If* $k_1^c < k_2^c < k_t$ *holds for a high value of* k_t *then the time* t *credit market is uniquely characterized by equity financing.*

Proof: Suppose $k_t < k_1^c < k_2^c$ and all funds are raised by debt contracts at time t so that $\Omega = \Omega^D$, $k_{t+1} = k_{t+1}^D$ and $\rho_{t+1} = \rho_{t+1}^D$. Given that ρ_{t+1}^D is decreasing in k_t, $k_t < k_2^c \Leftrightarrow \rho_{t+1}^D > \Omega^D$. Accordingly, (by use of Proposition 2) no borrower has an incentive to deviate and raise funds through an equity contract when all other borrowers are raising funds through debt contracts. Debt financing is therefore the equilibrium financing choice in the market. To see that this is a

unique equilibrium in such an environment, suppose that all funds are raised through equity financing. As a result, $\Omega = \Omega^E$, $k_{t+1} = k_{t+1}^E$, and $\rho_{t+1} = \rho_{t+1}^E$. Since $k_t < k_1^c$ implies $\rho_{t+1}^E > \Omega^E$, the optimal behaviour of an individual borrower is to deviate and raise funds through a debt contract. Therefore, equity financing cannot exist as an equilibrium financing choice. By a similar line of argument it is easy to see that equity finance is the unique equilibrium choice of borrowers when $k_1^c < k_2^c < k_t$.□

Corollary 1: If $k_1^c < k_t < k_2^c$ holds for an intermediate value of capital stock per firm, then equity and debt are equally likely candidates for the equilibrium mode of financing at time period t.

Proof: $k_1^c < k_t < k_2^c$ implies that the relations $\rho_{t+1}^D > \Omega^D$ and $\rho_{t+1}^E < \Omega^E$ hold at the same time (see Diagram 2). The use of Proposition 3 then readily proves the above claim.□

Based on the foregoing analysis, we are led to distinguish between three types of development regimes for an economy as illustrated in Diagram 1. The first – a low development regime – is one in which debt financing is the dominant mode of raising funds in the credit market for any given level of capital stock below the threshold level k_1^c. In this case, the capital stock accumulates along Path D, which is consistent with debt financing. The second – a high development regime – is one in which firms primarily rely on equity financing to raise funds in the market for any given level of capital stock per firm above the upper threshold level k_2^c. This chain of events outlines a process of transition from low to high economic development in which the stock market becomes an increasingly important source of funding for borrowers. Finally, we identify a third development regime in which the market equilibrium is characterized by a situation where either debt or equity could emerge as a preferred mode of financing for a capital stock between the two thresholds k_1^c and k_2^c.[11] Therefore, in the interval $k_t \in (k_1^c, k_2^c)$ two

[11] In addition to these pure equilibria, there may also exist equilibria in mixed strategy in the intermediate development regime. Denote $\widetilde{k}_{t+1}$ as the time $t+1$ capital stock per firm when $\mu_t \in (0,1)$ fraction of borrowers offer equity financing and the rest, $(1-\mu_t)$, offer debt financing. As before, we define $\widetilde{\Omega} = \Omega(\widetilde{k}_{t+1})$ and

countries with a similar level of development may experience very different levels of equity market development. In support of this result, we list the variances of the ratios of market capitalisation to GDP and the total value traded to GDP across different income groups in Table A2 of the appendix.[12] The picture that emerges is one of much wider diversity in the size of equity markets (as measured by the market capitalisation ratio) and in the level of equity market activity (as measured by the ratio of total value traded to GDP) for those countries that are at an intermediate stage of development (i.e., the upper middle-income and lower high-income countries) than for any other income group. For example, the variance of the market capitalisation ratio for the lower high-income group is 4.2 times that of the highest income group. The variance of the same variable for the upper middle-income group is 9.5 times that of the lower middle-income group and 67.8 times that of the lowest income group. A similar pattern emerges when one compares the ratio of total value traded to GDP.[13]

We conclude this section by noting the possibility that the transition from one development regime to another may not occur in a smooth fashion as depicted in Diagram 1. For example, an economy may remain trapped in a low steady state with an underdeveloped equity market if the relation $k_1^c > k_{ss}^D$ holds for a set of parameter values. Given the specific objective of the paper we have chosen not to discuss such cases in greater detail.

5. Discussion and Conclusions

In recent years, a number of cross-country studies have suggested that strong equity market activity is typically associated with high levels of economic development. At the same time, researchers have highlighted the existence of notable diversity in the mode of financing

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$\widetilde{\rho}_{t+1} = \rho(\widetilde{k}_{t+1})$. It is easy to verify that $k_{t+1}^E > \widetilde{k}_{t+1} > k_{t+1}^D$. Accordingly, $\rho_{t+1}^D > \widetilde{\rho} > \rho_{t+1}^E$ and $\Omega_{t+1}^E > \widetilde{\Omega} > \Omega_{t+1}^D$. In such a circumstance, any μ_t for which $\widetilde{\Omega} = \widetilde{\rho}$ holds then supports an equilibrium in which $\mu_t \in (0,1)$ fraction of borrowers utilize equity financing and the remaining $(1-\mu_t)$ fraction of borrowers utilize debt financing.

[12] In the construction of Table A2, we employ the same set of countries and data as in Demirguc-Kunt and Levine (1999). Countries are first classified according to their 1995 GNP per capita as defined in the 1997 World Development Indicators. Low income is \$765 or less; lower middle income is \$766-\$3035; upper middle income is \$3036-\$9385; high income is \$9,386 or more. We then classify the high-income countries into upper high income and lower high income according to (average 1990-95) GDP per capita.

among countries that belong to the same income group – implying that the sizes of the economies are insufficient to explain the differences in the levels of equity market activity. Against this backdrop, our paper provides a theory of joint determination of real and financial development with the ability to explain the emergence of the stock market along the path of economic development while making room for the possibility that countries with similar levels of economic development may display diversity in the mode of financing.

The approach adopted in this paper is strikingly different from existing research that has a similar objective of modelling the process of transition from one stage of financial development to another. Among the existing research, the notable contributions by Boyd and Smith (1996, 1998) propose a framework in which producers of capital choose between two different technologies that are financed in two different ways. The output arising from the first type of technology is publicly observable and is financed by means of equity at no expense. The output of the second type of technology is not directly observable by lenders and is financed by means of debt due to a standard costly verification problem (e.g. Townsend, 1979; Diamond, 1984). Assuming plausible parameter values, it is shown that there is a critical level of per capita income below which only a debt market exists. As capital accumulation takes place, however, the cost of state verification increases due to a fall in the relative price of capital. Eventually (i.e., once the critical level of income is reached), a stock market emerges as firms begin to make more use of the observable technology and less use of the unobservable technology, implying an increase in the amount of equity finance relative to debt finance.

In contrast to the above, the linchpin of our analysis is the trade-off between bankruptcy costs, associated with debt issues, and information dilution costs, associated with equity issues, that agents must resolve in deciding the optimal contracting form along the path of economic development. Our approach is similar to that used by Bose (2005), who analyses the co-evolution of the real and financial sectors. The model in Bose (2005), however, is unable to explain the diversity of financing among countries with similar levels of real development. Significantly, our analysis shows that the relationship between the optimal financing choice and the economy-wide state variables is two-way causal. Given this mutual dependency, we jointly

[13] The variance in the total value traded for the lower high-income group is approximately double that of the highest income group. The variance for the upper middle-income group is almost 8 times that of the lower middle-income group and 135 times that of the lowest income group.

determine the equilibrium mode of financing along the path of economic development. Our analysis produces results that are consistent with the stylized facts. In particular we show that a transition from low to high economic development is associated with more reliance on equity financing. During an intermediate stage of development, however, the equilibrium mode of financing could be characterized by either debt financing, or equity financing, or a mixture of the two. Thus, the present paper exploits the well-evidenced financial development–economic development nexus in explaining why countries with similar levels of economic development often experience remarkably different levels of equity market activity and why such diversity is more common among countries in the intermediate stages of development.

The model that we develop here may prove to be useful in explaining some of the other stylized facts that relate to the development of equity markets. In recent years, a number of studies (e.g. Levine and Zervos, 1998a, 1998b; Demirguc-Kunt and Levine, 1996; Chinn and Ito, 2002) have explored the effects of liberalization of capital controls on the development and functioning of equity markets in developing and middle-income countries. Evidence strongly suggests that, in most cases, liberalization of capital controls has given rise to increases in the liquidity (as measured by the value of the trades of domestic shares on domestic exchanges divided by GDP) and volatility of stock markets. The effect of capital control liberalization on the size (as measured by the value of listed domestic shares on domestic exchanges divided by GDP) of stock markets, however, is mixed. For example, Levine and Zervos (1998a) identify 14 countries that significantly reduced barriers to international capital and dividend flows in the 1980s. Among these, only five countries have experienced an increase in the size of their stock markets following liberalization. Our model may be helpful in explaining these mixed effects. Suppose, as a result of capital inflows, the rental rate to capital falls. In our model, this can be seen as a decline in ρ. Consequently, the economy's position in Diagram 2 is changed. For instance, as a result of capital inflows, a country may make a transition from a low development regime to an intermediate development regime. As elucidated in our model, due to the presence of multiple equilibria, such a transition is likely to produce a mixed rather than a unidirectional effect on the size of the stock market for a pool of countries as some countries rely more predominately on equity while others rely more predominately on debt financing.

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Appendix:

Table A1: Conditional Outcome of the Project

		Investment project output (units of time *t*+1 capital)	
		Commit labour to investment project	Use labour elsewhere
Good State $\theta_{it} = \theta_1$	Type-1 borrower	$Q>1$	$q_0^1 = Q\lambda$ with $0 < \lambda < 1$
	Type-2 borrower	$q<1<Q$	$q_0^2 = q\lambda$ with $0 < \lambda < 1$
Bad State $\theta_{it} = \theta_2$	Type-1 borrower	0	0
	Type-2 borrower	0	0

Table A2: Equity Market Development and GDP

	GDP per capita (1990-95)	Market capitalisation/GDP	Total value traded/GDP
Total (63 countries)			
Variance		0.1948	0.0610
Min	194.31	0.01	0
Max	20134.81	2.01	1.14
Upper High Income (12 countries)			
Variance		0.0741	0.0495
Min	14481.78	0.11	0.01
Max	20134.81	0.98	0.76
Lower High Income (13 countries)			
Variance		0.3099	0.0894
Min	3908.74	0.12	0.05
Max	14313.95	1.96	1.08
Upper Middle Income (13 countries)			
Variance		0.4204	0.0945
Min	2124.69	0.01	0
Max	6588.45	2.01	1.14
Lower Middle Income (14 countries)			
Variance		0.0443	0.0119
Min	609.76	0.02	0
Max	2951.55	0.65	0.4
Low Income (11 countries)			
Variance		0.0062	0.0007
Min	194.31	0.04	0
Max	1042.35	0.28	0.08

We use the same set of countries and data as in Demirguc-Kunt and Levine (1999). Market capitalisation to GDP is a measure of market size, defined as the ratio of the value of domestic equities (traded on domestic exchanges) to GDP. Total value traded to GDP is a measure of market activity, defined as the value of trades of domestic equities on domestic exchanges divided by GDP.

Countries are initially classified according to their 1995 GNP per capita as defined in the 1997 World Development Indicators. Low income is $765 or less; lower middle income is $766-$3035; upper middle income is $3036-$9385; high income is $9,386 or more. We then classify the high-income countries into upper high income and lower high income according to GDP per capita (1990-95).

Diagram 1

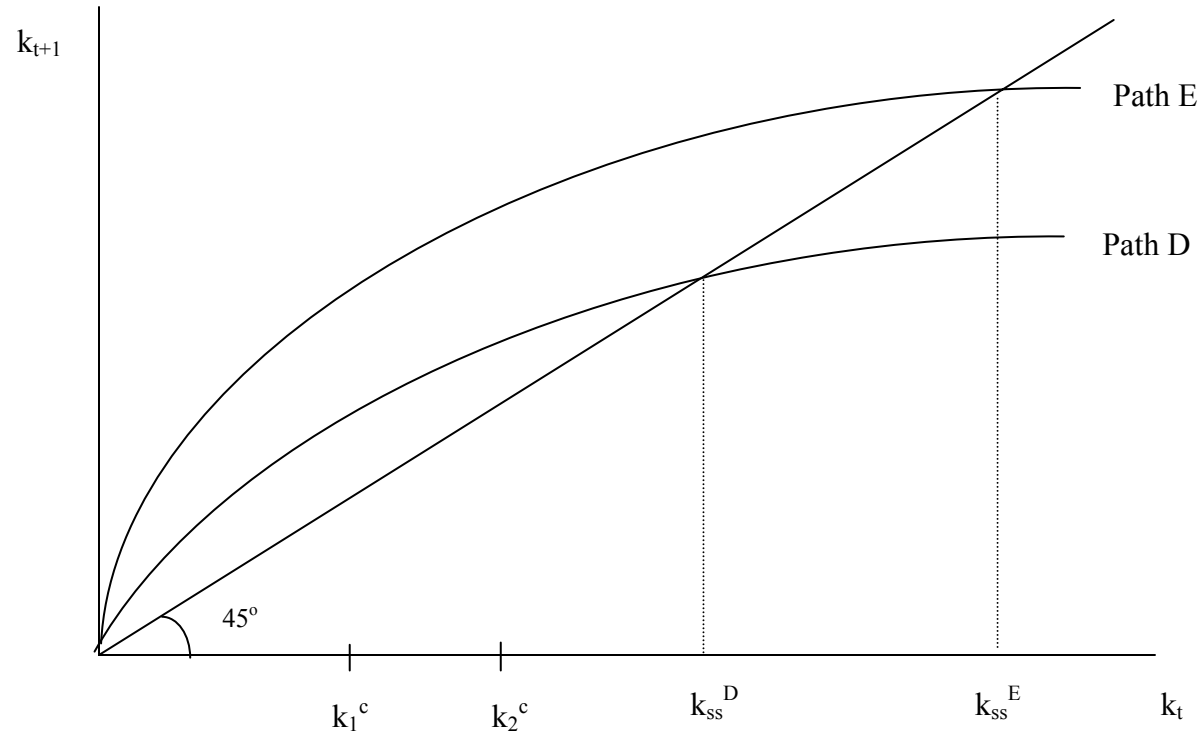

Diagram 2