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Threshold Effect and Financial Intermediation in Economic Development

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Abstract

This paper reformulates the finance-growth nexus in the case of developing countries. Using the Neoclassical growth framework, our contribution is threefold. First, we show that entrepreneurship is a growth-enhancing factor in both financial intermediary equilibrium and financial market equilibrium. Second, we show that agent's saving is one of the determinants of the optimal proportion of long-term investment and hence, we characterize the role of bank as financial intermediary. Third, our model is characterized by the existence of multiple steady states equilibrium with threshold effect that impedes the economy to reach a long-run higher steady state equilibrium. Furthermore, we show that financial intermediary is better than financial market, in order to reduce threshold effect and to ensure the long-run steady state equilibrium of capital stock.

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1. Introduction

During the last two decades, studies on the finance-growth nexus have emerged, but the findings are still currently subject to relevant debate[1]. In the context of developing countries, financial development is often associated with banking sector development, since financial market is relatively underdeveloped. However, at the end of 1990s, the growing importance of stock markets in both developing and developed countries has again opened a new avenue of research into the relationship between financial and growth, which focuses on the effects of stock market development. Using time-series data collected from five developed economies, Arestis et al (2001) examine the relationship between stock market development and economic growth. In particular, their results support the view that banks are more powerful than stock market to promote economic growth. In a similar vein, Rioja and Valev (2004) have found that in the countries with very low levels of financial development, additional improvements in financial markets have an uncertain effect on growth.

In spite of the importance of banking sector to promote economic growth, the literature also suggests that the role of financial market can not be neglected. Levine and Servos (1998) show that stock market liquidity leads to faster rate of growth, productivity improvement, and capital accumulation in both developed and developing countries. Levine (1991) and Bencivenga et al (1995) argue that stock market liquidity facilitates long-term investment, since investors can easily sell their stake in the project if they need liquidity before their project matures. Enhanced liquidity and long-term investment, therefore, increase higher-return projects that boost productivity growth.

In the meantime, it is also well accepted that financial market tends to suffer from asymmetric information and thus, financial liberalization fostering stock market liquidity is often blamed for macroeconomic downturn, as well as banking vulnerability and crisis (Bhide, 1993; Demirgüç-Kunt and Detagriache, 1999). This argument supports the presence of banks as delegated monitor to reduce information asymmetry between lenders and borrowers (Diamond, 1984).

Recently, both empirical and theoretical studies have further questioned the positive link between financial development and economic growth. In the empirical literature, Deidda and Fattouh (2002) report that there is no significant impact of financial development on economic growth in low-income countries, although in high-income countries, there is a positive link between financial development and economic growth. Mihci (2006) also highlights that the relationship between finance and growth is not necessarily positive when substantial variations across different periods and country groups are taken into account. Meslier-Crouzille et al (2011) further indicate the presence of threshold effect on the link between rural bank development and regional growth in the Philippines.

In the theoretical literature, Deidda and Fattouh (2002) theoretically show a non-linear relationship between financial intermediation and endogenous growth. The effect of financial intermediation on economic growth remains ambiguous at low initial levels of banking sector development. This is because risk-averse agents always prefer to incur financial transaction costs even though the expected return on their

[1] In empirical study, see King and Levine (1993a, 1993b), Levine (1998), and Rajan and Zingales (1998) for the country-level study; Fisman and Love (2002) for the industry-level study; or Demirgüç-Kunt and Maksimovic (2002) for the firm-level study. In theoretical study, see Bencivenga and Smith (1991), or recently Hung and Cothren (2002). Levine (2005) provides a comprehensive literature review.

savings is lower than under financial autarky. Such condition holds because financial intermediation can fully perform in risk diversification process. As a result, the economic growth rate under banking sector is lower than under financial autarky. At high levels of the banking sector development, the relationship between banking sector development and economic growth is always positive, where the level of banking sector development depends on the initial level of real per capita income.

Moreover, Aghion et al (2004) and Caballé et al (2006) also develop models where instability occurs at intermediate levels of financial development and, thus, these models provide support to the evidence that emerging markets are quite vulnerable. Similarly, Townsend and Ueda (2006) propose a coherent unified approach to the study of the linkages among economic growth, financial structure, and inequality. In particular, their model displays transitional growth with financial deepening and increasing inequality.

With regards to the particular role of banking as financial intermediary, most of theoretical models depart from the contribution of Diamond and Dybvig (1983) on the liquidity provision function of banks. Through this channel, banks exist to mobilize agents' savings into more profitable long-term investments. Under this framework, Bencivenga and Smith (1991) are the first to show that financial intermediary is better than financial autarky (financial market) in order to spur productive long-term (illiquid) investments rather than short-term (liquid) venture. Consequently, higher long-term investments enhance economic growth. However, the optimal portion of long-term investment in Bencivenga and Smith (1991) is decreasing in the income of long-term investment, although it is increasing in the fraction of entrepreneurs. Hence, although the income of long-term investment is higher than that of short-term ventures, it does not always provide incentives for agents to be entrepreneur. When incentives matter, their model needs to consider the presence of asymmetric information and agency conflicts. Moreover, it is also irrelevant that the optimal portion of long-term investment under the financial intermediary equilibrium is increasing in the income of short-term ventures.

As Bencivenga and Smith (1991) is one of the major literatures on financial intermediation, the aim of this paper is thus to reevaluate their finance-growth nexus. We modify several hypotheses used by Bencivenga and Smith (1991). First, since our motivation is to set up an appropriate model for developing countries, we consider that externalities changes due to technological innovation may be less likely to play a significant role in boosting economic growth. Thus, we use the Neo-classical growth hypothesis without externalities in an overlapping generation (OLG) model with three periods instead of drawing endogenous growth model, as used by Bencivenga and Smith (1991), or Deidda and Fattouh (2002). Second, we distinguish the behaviour *vis-à-vis* of risk between non-entrepreneur and entrepreneur. More precisely, entrepreneurs are supposed to be risk neutral[2]. This hypothesis allows us to consider that entrepreneurs' behaviour may be the source of costly overinvestment which reduces long-term economic growth. Likewise, Baumol (1990) emphasizes that entrepreneurship activity may be unproductive or even destructive. In this regard, entrepreneurial activities can be riskier than the non-entrepreneurial activities.

Using these stylized facts, our contribution is threefold. First, we show that entrepreneurship is always growth enhancing in both financial intermediary equilibrium and financial market equilibrium[3]. Second, we acknowledge that agents'

[2] Azariadis and Smith (1998) also use such hypothesis for a different framework of model.
[3] The optimal portion of long-term investment is increasing in the fraction of entrepreneurs, the income of long-term investment, and the agent's savings rate.

saving is a determinant of the optimal proportion of long-term investment, where in Bencivenga and Smith (1991), financial intermediary does not consider agents' saving as input and thus, it is somehow irrelevant. In our model, we characterize the traditional role of bank as financial intermediary (deposits and investments). Third, our model is characterized by the existence of multiple steady states equilibrium with threshold effect. In this regard, financial intermediary is better than financial market, as the threshold level of financial intermediary equilibrium is lower than that of financial market equilibrium. As well, financial intermediary yields a higher transition of capital stock than financial autarky.

The rest of this paper is organized as follows. Section 2 describes the model set-up. Section 3 constructs the financial market equilibrium. Section 4 lays out the financial intermediary equilibrium. Section 5 compares the dynamic path of capital stock and threshold effect under both financial market and financial intermediary. Section 6 concludes.

2. The Set-Up

The framework we use is one of overlapping generations (OLG) model with three periods and a unique good. As in Bencivenga and Smith (1991), we also consider a bank without liquidity risk that invests more efficiently by pooling all economic resources. On the contrary, we modify two aspects in the Bencivenga-Smith's economy. First, we assume that the entrepreneurs are risk neutral following Azariadis and Smith (1998). Second, we consider the existence of a technology in developing countries but without the types of externality considered by Romer (1986).

We assume that there is no population growth in the economy and each generation consists of a continuum of agents with size $N_t = N$. Each agent may live for two or three periods. Let *t* be the time index, where the young and middle-age generations are endowed with an initial per firm capital stock of k_0 units at *t* = 0 and k_1 units at *t* = 1, respectively. Moreover, each young agent supplies inelastically one unit of labour in the first period.

In the first period, all agents of a generation are identical. At the beginning of the second period, the agents learn whether they will be either non-entrepreneurs (two-period-lived agents) or entrepreneurs (three-period-lived agents) with probability $(1-\pi)$ and π, respectively. Thus, there are $(1-\pi)N$ agents who will be non-entrepreneur in the second period and πN agents who will be entrepreneur in the third period. All young agents save entirely their labour income in the first period.

Non-entrepreneurs consume their second-period incomes, c_{1t}, while entrepreneurs only consume the profit of production realized in the third period, c_{2t}. Thus, agents have different liquidity needs in which non-entrepreneurs have higher liquidity need than entrepreneurs, since non-entrepreneurs only live for two periods. Meanwhile, the young agents have incentive to be entrepreneur if the profit of long-term investment is relatively higher than the return of non-entrepreneurs' saving.

As entrepreneurs are risk-neutral, we can define the agent's preferences at time *t* by the following expected utility function.

$$U(c_{1t}, c_{2t}) = \frac{(1-\pi)}{-\gamma}(c_{1t})^{-\gamma} + \pi\phi c_{2t}, \text{ where } c_{0t} = 0. \quad (1)$$

We define c_{it} as the period *i* consumption of an agent who is born at time *t*. The constant relative risk aversion is denoted by $\gamma > -1$. The variable ϕ stands for the individual specific random variable realized at the beginning of period 2. Thus, the value of ϕ is equal to 0 with probability $1-\pi$, or 1 with probability π.

To build a link between saving and economic growth, we characterize the production function in the third period. Specifically, the entrepreneur's production y_t is realized by physical capital k_t and units of labour L_t. In this regard, we follow the Cobb-Douglas production function as following

$$y_t = Ak_t^{\theta} L_t^{1-\theta}. \quad (2)$$

where $\theta \in [0,1]$ is the part of production that uses k_t and *A* is an arbitrary coefficient. For simplification, we assume that capital depreciates completely at the end of period. Furthermore, there is no endowment of capital at period $t > 0$ except for the initial young generation and middle-age generation. For entrepreneurs (the old generation), they do not need endowment, as they already have resources to realize production that generates profit.

The entrepreneur's profit Π_t is the difference between the production and the cost of quantity units of labour defined as $\Pi_t(k_t, L_t) = Ak_t^{\theta} L_t^{1-\theta} - w_t L_t$. On the equilibrium of labour market, labour demand L_t is equal to labour supply, $N_t = N$, which is obtained by maximizing the entrepreneur's profit subject to L_t. Thus, we have $w_t = w(k_t) = A(1-\theta)k_t^{\theta}\pi^{\theta}$ and the maximized profit function at each period *t* as much as

$$\Pi_t = A\theta\psi k_t^{\theta}, \text{ with } \psi = L_t^{1-\theta} = \pi^{\theta-1}. \quad (3)$$

3. The Financial Market Equilibrium

This system refers to an economy without the presence of bank as financial intermediary. In the first period, the agents divide their savings s_t between liquid and illiquid assets. Liquid assets are considered as the inventory of consumption goods. One unit invested in liquid asset at *t* directly yields $n > 0$ units of consumption goods at both $t+1$ and $t+2$. On the other hand, one unit invested in illiquid asset yields *R* units of capital goods only at *t*+2. If illiquid asset is liquidated at *t*+1, then the agents receive the "scrap value" of *x* units of consumption goods, where $0 < x < n$.

In order to establish the agents' budget constraint, we define z_t^m and q_t^m as the proportion of liquid asset and illiquid asset invested at *t*, respectively. The superscript *m* stands for financial market. Hence, we have

$$z_t^m + q_t^m = 1, \text{ where } z_t^m \geq 0,\ q_t^m \geq 0. \quad (4)$$

In the first period, the agents' saving is equal to labour income, $s_t = w_t$, and is divided into $z_t^m s_t$ units of liquid asset and $q_t^m s_t$ units of illiquid asset. Let $i_L, i_{IL,} i_S$ be the interest rate of liquid asset, illiquid asset, and "scrap" value of illiquid asset, respectively. In the second period, let ω_{1t} be the income of non-entrepreneurs after one period, where

$$\omega_{1t} = (nz_t^m + xq_t^m)\, w_t\ ;\ n = 1 + i_L \text{ and } x = (1 + i_s) \quad (5)$$

On the contrary, by hypothesis, entrepreneurs' consumption at the second period is zero.

At the beginning of the third period, entrepreneurs sell their illiquid assets and reinvest them in physical capital, so that $(1+i_{IL})q_t^m s_t = k_{t+2}$. This situation corresponds to the financial autarky case, as entrepreneurs sell their illiquid assets by themselves. Let ω_{2t} be the income received by entrepreneurs after selling out their illiquid assets, but before the production is realized. Specifically, we have

$$\omega_{2t} = nz_t^m w_t + Rq_t^m w_t, \text{ where } R = 1 + i_{IL}, 0 < x < n < R, \tag{6.a}$$

and,

$$k_{t+2} = Rq_t^m w_t. \tag{6.b}$$

Note that in the third period (t+2), entrepreneurs will use their income of illiquid investment to finance physical capital and use it for production. Hence, we have $Rq_t^m w_t = k_{t+2}$ as defined in (6.b).

Using the profit function in (3) and the budget constraints in (4), (5) and (6.b), the agents' expected utility function, whatever their types, is as follows

$$U(q_t^m) = \left(\frac{-(1-\pi)}{\gamma} (xq_t^m w_t + n(1-q_t^m)w_t \right)^{-\gamma} + \pi\left(A\theta\psi(Rq_t^m w_t)^{\theta} + (1-q_t^m)nw_t\right).$$

Meanwhile, the agents' optimization program is defined as $\underset{0 \le q_t^m \le 0}{\arg\max}\left\{U(q_t^m)\right\}$.

From the first order condition, we obtain the optimal proportion of illiquid asset ($\overline{q}_t^m$) as follows.

$$\overline{q}_t^m = \overline{q}^m(w_t) = \frac{n}{(n-x)} - \frac{\left(B(w_t)\right)^{\frac{1}{-1-\gamma}}}{w_t(n-x)} \tag{7}$$

where $B(w_t) \equiv \dfrac{\pi}{\pi - 1}\left(\dfrac{nw_t - AR^{\theta}w_t^{\theta}\theta^2\psi}{w_t(n-x)}\right)$.

The optimal proportion of illiquid investment $\overline{q}_t^m$ depends on the labour income w_t. In Bencivenga and Smith (1991), $\overline{q}_t^m$ is constant. Moreover, the existence of $\overline{q}_t^m$ in which $0 \le \overline{q}_t^m \le 1$ can be examined by the limit value of $\overline{q}_t^m$ when $w_t \to 0^+$ and $w_t \to \infty^+$.

From (7), it is straightforward to obtain $\lim_{w_t \to 0^+} \overline{q}_t^m = -\infty$ and $\lim_{w_t \to \infty^+} \overline{q}_t^m = 1$, since $AR^{\theta}w_t^{\theta}\theta^2\psi > nw_t$. Hence, there is a value of w_t which implies that $\overline{q}_t^m = 0$. We use (6.a), (6-b), (7) and the first order condition for maximal profit to construct the dynamics of capital stock. The dynamics of capital stock is defined as follows

$$k_{t+2} = Rq^m(k_t)w(k_t) \equiv \phi_m(k_t) \tag{8}$$

In other words, we have an equation that describes the evolution of the capital stock over time.

4. The Financial Intermediary Equilibrium

In this section, we consider the presence of banks as financial intermediary that decides agent's financial decisions. We assume that bank is a coalition of young agents who can be either non-entrepreneurs or entrepreneurs. Let z_t^b and q_t^b be the proportion of liquid and illiquid investment realized by banks, respectively. Thus, we have

$$z_t^b + q_t^b = 1. \tag{9}$$

Bank ensures non-entrepreneurs to receive R_{1t}^b units of consumption goods at *t*+1 from each unit invested at *t*, where

$$(1-\pi)R_{1t}^b = \alpha_{1t} z_t^b n + \alpha_2 q_t^b x \tag{10}$$

α_{1t} and α_{2t} are the part of liquid and illiquid asset liquidated at the second period, respectively. Bank then chooses the values of α_{1t} and α_{2t}. On the other hand, bank also ensures entrepreneurs to receive R_{2t}^b units of capital goods at *t*+2 from each unit of time *t* illiquid investment and $\tilde{R}_{2t}^b$ units of time *t*+1 consumption goods from each unit liquid asset invested at *t*. For the withdrawal after two periods, there are π entrepreneurs who must receive R_{2t}^b units of capital goods from each unit of illiquid investment. Thus, πR_{2t}^b factor must be equal to the rest of illiquid asset $(1-\alpha_{2t})$ multiplied by the income of investment $R\, q_t^b$. Thus, bank must provide capital goods for entrepreneurs as much as

$$\pi R_{2t}^b = (1-\alpha_{2t}) R\, q_t^b \tag{11}$$

In addition, entrepreneurs must receive $\tilde{R}_{2t}^b$ units of consumption goods for each unit of liquid investment at *t*. The constraint $\pi \tilde{R}_{2t}^b$ must be equal to the rest of consumption goods $(1-\alpha_{1t})$ multiplied by $z_t^b n$. Thus, bank must provide consumption goods for entrepreneurs as much as

$$\pi \tilde{R}_{2t}^b = (1-\alpha_{1t})\, z_t^b n \tag{12}$$

In the next step, we define the program of financial intermediary for both non-entrepreneurs and entrepreneurs. First, if there are $(1-\pi)$ non-entrepreneurs who will liquidate their investment at *t*+1, bank must hold $R_{1t}^b w_t$ units of consumption goods to be distributed at *t*+1. Second, as there are also π entrepreneurs who will liquidate their investment at the beginning of *t*+2, bank must hold $R_{2t}^b w_t$ units of capital goods and $\tilde{R}_{2t}^b w_t$ units of consumption goods to be distributed at *t*+2.

Using budget constraints (10), (11), and (12) we define the expected utility of financial intermediary in the following relation

$$U(c_{1t}, c_{2t}) = \frac{-(1-\pi)}{\gamma}(R_{1t}^b w_t)^{-\gamma} + \pi(A\theta\psi(R_{2t}^b w_t)^{\theta} + \tilde{R}_{2t}^b w_t) \tag{13}$$

To simplify (13), we assume that bank should only provide liquidity at *t*+1, since none of the capital assets is liquidated "prematurely". As well, bank should meet the following liquidity constraint

$$A\theta\psi R > n \tag{14}$$

By this assumption, we can reduce some variables as follows. In the third period (t+2), bank will only consider the existence of π entrepreneur. As a matter of fact, entrepreneurs realize the production in order to get the profit. Thus, their profit should be superior to all income of liquid investment. Such condition provides incentive for agents to become entrepreneur. In other words, $A\theta\psi R > n$, and

$$A\theta\psi\left((1-\alpha_{2t})(R/\pi)q_t^b w_t\right) > \left((n/\pi)q_t^b w_t\right) \tag{15.a}$$

Equation (15.b) is fulfilled if and only if bank set

$$\alpha_{2t} = 0. \tag{15.b}$$

Meanwhile, bank also maximizes the expected utility of non-entrepreneurs. Hence, bank will reallocate non-entrepreneur's illiquid assets into liquid assets at the beginning of t+1. For realizing this strategy, bank will set

$$\alpha_{1t} = 1 \tag{15.c}$$

Using (15.b) and (15.c), we simplify (10), (11) and (12) respectively to become

$$R_{1t}^b = \frac{z_t^b}{1-\pi} n, \tag{16}$$

$$R_{2t}^b = \frac{R}{\pi} q_t^b, \tag{17}$$

$$\tilde{R}_{2t}^b = 0. \tag{18}$$

Using (16), (17), and (18), and the budget constraint (9) we establish the program of financial intermediary as follows

$$U(q_t^b) = \frac{-(1-\pi)}{\gamma}\left(\frac{1-q_t^b}{1-\pi} nw_t\right)^{-\gamma} + \pi\left(A\theta\psi\left(\frac{Rq_t^b w_t}{\pi}\right)^{\theta}\right).$$

Hence, bank will choose q_t^b to maximize $U(q_t^b)$. From the first-order condition, we obtain the optimal proportion of illiquid asset ($\bar{q}_t^b$) as follows

$$\bar{q}_t^b = \bar{q}^b(w_t) = 1 - \frac{(1-\pi)\left(B_1(w_t)\right)^{\frac{1}{-1-\gamma}}}{nw_t}, \tag{19}$$

where $B_1(w_t) \equiv \dfrac{A\pi^{\theta-1}R^{\theta}w_t^{\theta-1}\theta^2\psi}{n}$.

Combining (11) and (19), we obtain

$$k_{t+2} = \frac{Rq^b(k_t)w(k_t)}{\pi} \equiv \phi_b(k_t). \tag{20}$$

This equation describes the relationship between the current and the future capital stock.

From (19), we also notice that the optimal portion of long-term investment (q_t^b) is decreasing in the income of short-term ventures. This situation is relevant, since higher income from short-term ventures should positively affect short-term investments. As short-term investments increase, long-term investments decrease following (9). This condition does not hold in Bencivenga and Smith (1991).

5. Capital Stock Accumulation and Threshold Effect

In comparing the level of steady state equilibrium of capital stock under the financial market and financial intermediary model, we specify Proposition 1 and 2 as follows.

Proposition 1

For $x=0$ we show that the optimal value of illiquid investment under financial intermediary is higher than the optimal value of illiquid investment under financial market. In other words, we have $\overline{q}_t^{\,b} > \overline{q}_t^{\,m}$.

Proof:

From (7) and (19), we show that $(1-\pi)(B_1)^{\frac{1}{-1-\gamma}} / nw_t < (B)^{\frac{1}{-1-\gamma}} / nw_t$. Thus, we examine whether $B_1 < B$. From B_1 and B, we only examine if

$$(1-\pi)\left(A\pi\left(\frac{R}{\pi}\right)^{\theta} w_t^{\theta}\theta^2\psi\right)^{\frac{1}{-1-\gamma}} < \left(\frac{\pi}{1-\pi}(AR^{\theta}w_t^{\theta}\theta^2\psi - nw_t)\right)^{\frac{1}{-1-\gamma}}. \tag{21.a}$$

Equation (21.a) can be rewritten as

$$(1-\pi)^{\frac{\gamma}{-1-\gamma}} < \left(\pi^{\theta} - \frac{nw_t\pi}{AR^{\theta}w_t^{\theta}\theta^2}\right)^{\frac{1}{-1-\gamma}} \tag{21.b}$$

For $\gamma > -1$ the inequality is verified if the left hand side is less than one, while the right hand side is greater than one. By definition the value of the left hand side is less than one. For the right hand side, we proceed as follows

$$\left(\pi^{\theta} - \frac{nw_t\pi}{AR^{\theta}w_t^{\theta}\theta^2}\right)^{\frac{1}{1+\gamma}} < 1 \Leftrightarrow AR^{\theta}w_t^{\theta}\theta^2\pi^{\theta} < AR^{\theta}w_t^{\theta}\theta^2 + nw_t\pi.$$ Since $\pi^{\theta} < 1$, we verify that $AR^{\theta}w_t^{\theta}\theta^2\pi^{\theta} < AR^{\theta}w_t^{\theta}\theta^2$. As discussed above, Proposition 1 is laid down for $x=0$. This condition can be interpreted as the best case in which financial market is efficient, since there is no premature liquidation to fulfill the liquidity needs of two-period-lived agents (non-entrepreneurs). Proposition 1 explicitly shows that although the financial market is at the best condition, the illiquid investment of the financial market equilibrium is always lower than that of the financial intermediary equilibrium. To illustrate Proposition 1, we perform a numerical simulation by taking $R=10$, $\pi=0.4$, $\theta=0.75$, $\gamma=100$, $n=0.5$, $x=0$, and $A=1$ in which the condition $A\theta\psi R > n$ is fulfilled. Figure 1 shows that the optimal illiquid investment of the financial intermediary equilibrium is higher than that of the financial market equilibrium.

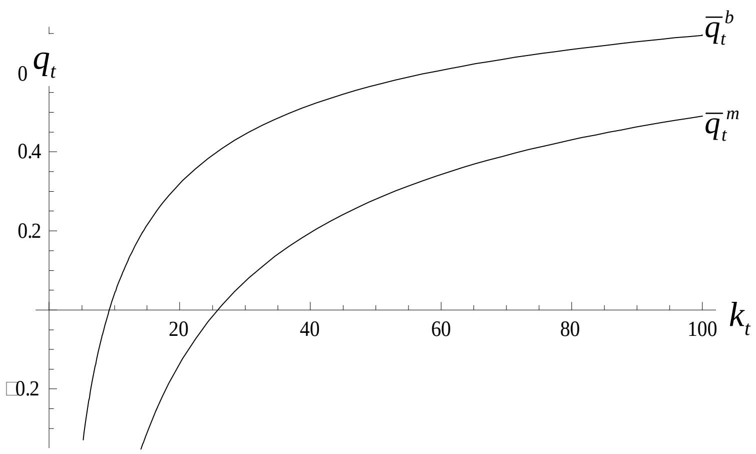

Figure 1. The Illiquid Investment in the Financial Market and Financial Intermediary Equilibrium

From Proposition 1, we further lay out Proposition 2 as a consequence of Proposition 1.

Proposition 2

The existence of banks enhances economic growth more significantly than the absence of banks.

Proof:

In the financial intermediary equilibrium, economic growth is determined by the value of $k_{t+2} = \varphi_b(k_t)$. Meanwhile, in the financial market equilibrium, economic growth is determined by the value of of $k_{t+2} = \varphi_m(k_t)$. From Proposition 1, it is straightforward to find $\mu_b > \mu_m$, where $\mu_b = \frac{\varphi_b(k_t)}{k_t}$ and $\mu_m = \frac{\varphi_m(k_t)}{k_t}$ are the change of capital stock in the financial intermediary and financial market equilibrium, respectively. Proposition 2 is thus proved.

From (8) and (14), we illustrate the dynamics of capital accumulation in each case as follows.

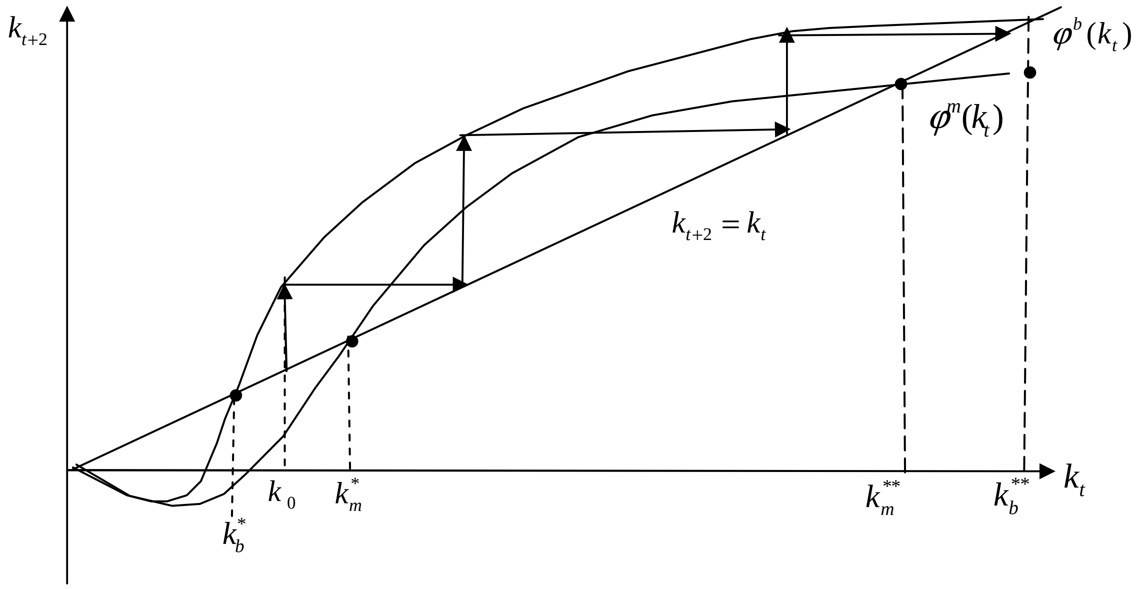

Figure 2. The Dynamic Path of Capital Stock

In Figure 2, we observe the existence of threshold effects at the stationary states k_b^* and k_m^* for the financial intermediary and financial market equilibriums, respectively. Threshold effect is defined as follows

Definition 1. *Threshold effect is a low level equilibrium trap or local underdevelopment trap when initial capital stock is very low, so that both financial intermediary and financial market can not enhance long-term economic growth.*

From Figure (1), we observe that there are three stationary states in both the financial intermediary and financial market equilibrium: (i) the trivial steady state at $k = 0$, (ii) the low level equilibrium trap (k^*), and (iii) the high level steady state equilibrium (k^{**}). Moreover, we observe that the financial intermediary system is more accurate than the financial market model to reduce the threshold effect. We verify this property in Proposition 3.

Proposition 3
In the financial intermediary and financial market equilibrium, the economy converges to higher long-term steady state equilibrium, if initial capital stock exceeds a threshold level. Moreover, the threshold level under financial intermediary is lower than the one under financial market.

Proof:
To prove Proposition 3, we verify the existence of threshold effect in both the financial intermediary and financial market equilibriums.

(i) The financial intermediary equilibrium

At the stationary states, we have $k = \varphi_b(k)$. However, it is difficult to solve algebraically the stationary capital stock (k). From Figure (1) we observe that

$k=\varphi_b(k)$ has two roots k_b^* and k_b^{**}. Alternatively, we derive $\varphi_b(k_t)$ in order to obtain the first-order condition as follows

$$\frac{d\,\varphi_b(k_t)}{d\,k_t}=-\frac{R(-1+\theta)\theta\left(\frac{\Omega}{n}\right)^{\frac{-1}{1+\gamma}}}{k_t\,n\pi(1+\gamma)}\left(-1+\pi+Ak_t^{\theta}n\pi^{\theta}(1+\gamma)\left(\frac{\Omega}{n}\right)^{\frac{1}{1+\gamma}}\right) \tag{22.a}$$

where $\Omega\equiv\left(\frac{A}{n}\left(\frac{R}{\pi}\right)^{\theta}\pi(-Ak_t^{\theta}\pi^{\theta}(-1+\theta)^{-1+\theta}\theta^2\psi)\right)^{\frac{-1}{1+\gamma}}$.

To show the existence of threshold effect k_b^*, we examine if there is k_t in which $\frac{d\,\varphi_b(k_t)}{d\,k_t}>1$. In other words, $\frac{d\,\varphi_b(k_t)}{d\,k_t}-1>0$ and $\varphi_b(k_t)$ intersects $k_{t+2}=k_t$ at k_b^* as shown at Figure 2. In order to simplify (22.a), we assume that $\pi\to1$ and hence, $\psi\to1$. Under this condition, we simply obtain

$$\lim_{\pi\to1}\frac{d\varphi_b(k_t)}{d\,k_t}-1=-\frac{k_t+Ak_t^{\theta}R(\theta-1)\theta}{k_t}. \tag{22.b}$$

Despite assuming that $\pi\to1$, we do not change the properties of the financial intermediary equilibrium. Since our purpose is to formalize the role of financial intermediary in enhancing entrepreneurship through long-term investment, the absence of non-entrepreneurs does *not* affect the change in capital stock. This is because economic growth should not be relied on non-entrepreneurs but entrepreneurs. From (22.b), we examine if there is k_t in which the right hand side of equation becomes positive. In other words,

$$-\frac{k_t+Ak_t^{\theta}R(\theta-1)\theta}{k_t}>0$$

$$\Leftrightarrow S=\left\{k_t\middle|k_t<\infty\wedge k_t>\left(\frac{1}{AR(1-\theta)\theta}\right)^{\frac{1}{\theta-1}}\right\} \tag{23}$$

Since $A,R>0$ and $0<\theta<1$, then $\left(\frac{1}{AR(1-\theta)\theta}\right)^{\frac{1}{\theta-1}}>0$ and we obtain

$$k_b^*=\left(\frac{1}{AR(1-\theta)\theta}\right)^{\frac{1}{\theta-1}} \tag{24}$$

Equation (24) is simply defined as the threshold level of the financial intermediary system, because for each k_0 where $k_b^*<k_0<+\infty$, we have $\frac{d\,\varphi_b(k_t)}{d\,k_t}>1$.

(ii) The financial market equilibrium

Following the case of the financial intermediary system, we assume that $\pi \to 1$ and consequently, $\psi \to 1$. By solving the first-order condition for $\varphi_m(k_t)$ and its limit for $\pi \to 1$, we obtain

$$\lim_{\pi \to 1} \frac{d\,\varphi_m(k_t)}{d\,k_t} - 1 = \frac{A k_t^{\theta-1}\, n R(1-\theta)\theta}{n-x} - 1 \tag{25}$$

The threshold effect k_m^* exists, if and only if there is $k_t > 0$ in which $\frac{d\,\varphi_m(k_t)}{d\,k_t} > 1$ or $\frac{d\,\varphi_m(k_t)}{d\,k_t} - 1 > 0$. From (25), we have

$$k_m^* = \left(\frac{AnR\theta}{n-x} - \frac{AnR\theta^2}{n-x} \right)^{\frac{1}{\theta-1}} \tag{26}$$

Since $0 < \theta < 1$, then it is straightforward to denote that $k_m^* > 0$. Hence, the existence of threshold effect in the financial market system is acknowledged.

(iii). Financial intermediary vs. financial market

From (24) and (26), we now verify if the threshold level under financial intermediary is lower than the one under financial market. For this purpose, we need to show if

$$\frac{AnR\theta}{n-x}(1-\theta) < \frac{1}{AR(1-\theta)\theta} \tag{27}$$

As $\theta \to 1$, the left-hand side converges to 0, but the right hand side converges to infinity. Meanwhile, as $\theta \to 0$, the left hand side converges to 0, and the right hand side converges to 1. By these results, Proposition 3 is proved.

Threshold effects in the finance-growth nexus is one of our contributions in this paper. This finding is particularly important in developing countries, where banking sector is relatively more important than financial market to enhance economic growth. For instance, let k_0 be an initial capital stock that lies below the threshold level of financial market (k_m^*) as shown in Figure 1. In order to reach the long-run steady state equilibrium of capital stock, k_0 should be iterated by the $\varphi_b(k_t)$ curve. In turn, this mechanism can drive the economy to converge to k_b^{**}. Conversely, if k_0 is iterated by the $\varphi_m(k_t)$ curve, the economy may disappear because the steady state equilibrium of capital stock converges to zero. In this case, we denote that financial intermediary is better than financial market in order to ensure the existence and uniqueness of long-run steady state capital stock, and to reduce threshold effect. Hence, long-term economic growth can be well achieved as productive investments emerge and short-term ventures decline. By extension, the potential sources of speculation from short-term ventures can be reduced.

However, if the initial capital stock is too low, as it lies below the threshold level of financial intermediary ($k_0 < k_b^*$), the steady state equilibrium of capital stock can approach to zero, even if financial intermediary exists. In such a case, there is no positive link between financial development and economic growth in developing countries. On the other hand, if developing countries have sufficient initial capital stock, then the introduction of banking system ensures the economy to converge to higher long-run steady state equilibrium.

6. Conclusion

In this paper, we reevaluate the finance-growth nexus *à la* Bencivenga and Smith (1991). Our stylized feature is twofold. First, in modelling the finance-growth nexus, we use the Neo-classical growth framework instead of drawing endogenous growth as developed by Bencivenga and Smith (1991). Second, we distinguish the behaviour vis-à-vis of risk between non-entrepreneur and entrepreneur, as both agents have different liquidity needs.

By these features, we provide three original contributions in this paper. First, we show that entrepreneurship is always a growth-enhancing factor in both financial market and financial intermediary equilibriums. Second, we characterize the role of bank as financial intermediary in the process of savings and investments. Third, we show that financial intermediary is better than financial market in order to ensure the existence and uniqueness of the long-run steady state equilibrium of capital stock. Thus, financial intermediary is better than financial market in enhancing long-run economic growth. In this regard as well, we highlight that although threshold effect exists in the finance-growth nexus, the presence of banks as financial intermediary reduces such threshold effect. Threshold effect is important in the finance-growth nexus, since it shows the difficulty of developing countries to raise initial capital stocks. This situation may in turn impede production, physical capital accumulation and hence, long-run economic growth. Accordingly, threshold effect should be acknowledged in the future research in the finance-growth nexus, notably in developing countries, where externalities due to human capital and technological innovations are not yet well-developed.

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