Financial Liberalization, Financial Restraint, and Entrepreneurial Development

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Abstract

This paper considers the interactions between the financial sector reform and entrepreneurial development. Using simple models of occupational choice and a two-armed bandit model of learning, it analyzes the effects of financial liberalization policies in the form of free entry into banking and free market determination of interest rates on the development of industrial entrepreneurship. The analysis focuses on the two issues: (i) the poaching externality effects in a competitive banking, and (ii) the effects of short-termism in competitive banking for accumulation of information capital regarding the entrepreneurial talents in an economy. The analysis of the poaching externality shows that a competitive banking may fail to finance socially efficient experimentation with potential industrial entrepreneurs, as the economy might get stuck in a binding liquidity constraint trap, especially when an economy starts with unfavorable initial conditions, like low prior probability of a good industrial entrepreneur or a low productivity industrial sector. Policies of entry restriction as advocated in the Financial Restraint paradigm can relax the liquidity constraint, and thus can increase the supply of credit to the new industrial entrepreneurs under mild conditions. The analysis of short-termism takes, as its point of departure, the widely accepted proposition that competition destroys the franchise value of banks and thus reduces the incentives for the bank to act as a long-term agent. This has important implications for entrepreneurial discovery; a myopic bank ignores the value of information generated by any given industrial experiment for all future loan decisions. Using a two armed bandit model, we demonstrate that, under plausible conditions this undervaluation of information reduces supply of credit to the new entrepreneurs. Our analysis show that a two-track policy where entry restraint is implemented in the industrial sector lending but competition is preserved in the lending to the competing economic activity (like agriculture) can be useful to tackle the problems of poaching externality and undervaluation of information capital by banks.

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(1) Introduction

The financial sector has been accorded a prime place in the literature on industrialization and economic development (See, for example, Schumpeter, 1934, Cameron, 1967; Shaw, 1973, Mckinnon, 1973; Stiglitz, 1992, King and Levine, 1993, Sussman and Zeira, 1995). The Financial Repression paradigm of McKinnon and Shaw which emphasizes the importance of liberalization of the financial market has become a corner-stone of the market-oriented development strategy of the last few decades. Financial liberalization approach advocates a free market determination of interest rates and an increased competition in the financial sector. A liberalized and competitive financial market has been viewed as a necessary and enabling factor for the success of private sector led development. In fact, the combination of privatization and financial liberalization has become no less than a new orthodoxy in both theory and practice of development. However, a curious aspect of this development strategy is that, until recently, it largely ignored the most critical factor in a private sector led development, the role of entrepreneurs. As a corollary, the interaction between financial liberalization and entrepreneurial development is treated only tangentially, if at all.

The standard approach has been to assume (implicitly or explicitly) that either there exists a repressed entrepreneurial class which can be unleashed by reducing government intervention, or a new entrepreneurial class will emerge spontaneously in response to liberalization without

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1There are alternative perspectives in the literature about the role of entrepreneurs in an economy. For Schumpeter, entrepreneurs are innovators; for Knight, they are basically risk-takers. The concept of entrepreneurship used here is different from the Schumpeterian view and closer to the Knightian perspective. The entrepreneurs in the developing countries are imitators rather than innovators. The critical aspect of good entrepreneurship is the capability to organize, adapt and manage a new venture or new technology, new in the context of the country but borrowed from other developed countries. The entrepreneur in a developing country is thus a risk taker, but the risk is due to the unproven entrepreneurial skill and unfamiliarity with a new technology.
any significant time lag. For example, in a very influential book on *financial repression*, McKinnon assumes that there are household-entrepreneurs dispersed in the rural economy each with an idiosyncratic indivisible investment opportunity. A segmented capital and financial market prevents realization of highly profitable indivisible investment opportunities. In this framework there is no dearth of entrepreneurship, the problem lies with government intervention in financial market that hinders efficient financial flows across sectors and also stunts financial mobilization. The implicit assumption of a well-developed private entrepreneurial class has also played a critical role in the policy advice of the international organizations like World Bank and IMF, especially in the decades of 1980s and early 1990s. \(^2\) Over the last few decades, under the auspices of IMF and World Bank sponsored structural adjustment programs, a large number of developing countries have pursued massive privatization. The growth experience of the private sector has, however, been largely disappointing: the private investment had been sluggish in a large number of countries for a long time following privatization (Serven and Solimano (1994), Chibber et. al., 1992). The standard explanation of slow investment response is that because of macro-economic instability the option value of not committing resources into irreversible investment has been high and private investors were holding back. But as the evidence accumulated showing that investment sluggishness remained a problem even in economies with stable macro-economic environment (Caprio, 1994, Serven and Solimano, 1994), the plausibility of macro-economic instability hypothesis became suspect. An alternative explanation which has been largely ignored is that the disappointing performance of the private investment reflects a deep-seated structural problem in the economy, the absence of a well-developed entrepreneurial class.

The entrepreneurial base with proven capability is very small in a typical developing country. The discovery of good entrepreneurs from a vast pool of potential candidates in a typical developing country may prove extremely difficult. More importantly, contrary to the privatization-financial liberalization view of development, a *Laissez Faire* financial sector may not be conducive to the development of private entrepreneurship. An observation that cuts across different country experiences is that a competitive private credit market tends to concentrate its lending to only

\(^2\)There has, however, been a recent revival of interest in the development of private entrepreneurship, especially in the context of transition economies. See, for example, McMillan and Woodruff (2002).
the established entrepreneurs with a proven track record (Akerlof (1970), Nabi (1989), Sobhan (1990) and Stiglitz (1992, 1993)). In other words, a competitive credit market is unwilling to experiment with new entrepreneurs. There is now a substantial body of evidence showing that the young untested firms are less likely to get bank finance in a competitive banking market (See, for example, Petersen and Rajan (1995), Cetorelli and Gambera (2001), Fischer (2000), and Dell’Ariccia (2000)). As a result, in a competitive credit market, the vast pool of potential entrepreneurs fails to manage start-up finance, and the discovery of new entrepreneurs do not occur. It is crucial both in theory and policy of economic development to understand why the competitive private credit market so often fails to generate a sustained process of entrepreneurial discovery.

This paper, using simple occupational choice and learning models, explores the effects of financial liberalization on the development of entrepreneurship. In particular, it addresses the following question: does financial liberalization in the form of increased competition in the banking sector and a free market determination of interest rates encourage or discourage the entrepreneurial development? The issue is critical for the validity of the privatization-financial liberalization strategy of development. This paper shows that a free market and free entry Neoclassical approach to the financial sector is likely to be a constraining factor in the development of a private industrial entrepreneurial class. So the two corner-stones of the prevailing consensus, private sector led development and financial liberalization, work at cross purposes.

Our analysis focuses on the following two issues: (i) there is a negative effect of competition on a bank’s incentives to experiment with new entrepreneurs due to poaching externalities through bidding for good entrepreneurs, which results, as we will see later, in a form of binding credit constraint, (ii) the short-termism resulting from a lack of franchise value in a competitive market weakens further the incentives for experimentation as the banks do not incorporate the value of information generated by an entrepreneur for the future loan decisions. Our analysis is built on simple models of occupational choice where there is symmetric ignorance about the quality of entrepreneurship of a borrower; both the bank and the prospective entrepreneur do not

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3In his seminal paper on lemons principle, Akerlof (1970) referred to this phenomenon of concentration in the example of “managing agency system” of South Asia.
know the type of an entrepreneur. This puts the focus on two related issues: (i) who bears the cost of discovery of an untested entrepreneur, and (ii) the (possible) inefficiency of a competitive market for discovery of entrepreneurial talents in an economy. The implications of short-termism for accumulation of information capital is analyzed using a simple model of Two-Armed Bandit with one arm known. A major policy implication of the analysis presented in this paper is that appropriate interventions restricting competition in the banking sector and interest rate controls (deposit rate) may be conducive to the development of an entrepreneurial class at an early stage of development. A two-track policy is advocated where restriction on competition is implemented in the industrial lending but competition is preserved in agricultural lending. In such a policy regime deposit rate control can be a powerful policy instrument for encouraging accumulation of information capital about the entrepreneurial talents in an economy. The results of this paper thus provide complementary arguments for the policies of Financial Restraint recently advanced by Hellmann, Murdock, and Stiglitz (1997, 2000), where policies to restrain competition, and interest rate regulations enhance the franchise value of a bank and provide incentives to control moral hazard and to mobilize savings from previously unexplored segments of an economy.

The rest of the paper is structured as follows. Section 2 discusses the basic insights analyzed later in greater details using formal models. The next section places the present research in proper perspective by tracing out its intersections with the existing literature. Section 4 presents the basic set-up and then discusses the main results on the effects of poaching externalities in competitive banking for entrepreneurial discovery. The sub-section 4.1 develops a simple model of poaching externalities in the credit market for fresh entrepreneurs and derives conditions for existence of a binding credit constraint. The next sub-section (4.2) is devoted to the analysis of inefficiency of competitive banking under a binding liquidity constraint and shows that, under plausible conditions, the supply of credit to the fresh entrepreneurs in a competitive credit market is too low from a social efficiency point of view. Section 5 is devoted to an analysis of the adverse implications of short-termism endemic in competitive banking for the accumulation of information capital about the entrepreneurial talents in an economy. It shows that due to short-termism a competitive bank’s investment in the discovery of new entrepreneurs is too conservative and
socially inefficient. The paper ends with a summary of the results and a discussion of the major policy implications for financial sector development in developing countries.

(2) The Basic Insights

Competition and Poaching Externality

Here we identify three factors the interaction of which might result in a form of binding liquidity constraint so that a competitive banking sector provides too little loans to the new entrepreneurs from a social efficiency point of view. The three critical factors are: Indivisibility of Investment, Information Externality, and Inalienability of entrepreneurial capability.

1. Indivisibility of Investment:

If the investment activity required for discovery of the entrepreneurial capability is divisible, then the entrepreneur herself can finance it incrementally without any outside finance. But the characteristic feature of new growth promoting economic activities like agro-processing or industrial plants is that they are indivisible, and thus require investment of a large chunk of financial capital. This means that the discovery of entrepreneurial capability cannot be pursued without outside finance. Moreover, what is critical here is the amount of own savings compared to the size of the project contemplated rather than its absolute size per se. This points to the fact that in a country with low per capita income, investment in a project of moderate size may be impossible to undertake without outside finance. In this sense, not only the large manufacturing investments need outside finance, starting up a micro enterprise can also be critically dependent upon the availability of outside finance.  

The importance of indivisibility of investment as a constraining factor has been emphasized in development finance literature. For example, McKinnon (1973) emphasizes the problems of internal finance constraint as it deters the adoption of high productivity indivisible investment, and Hellmann, Murdock and Stiglitz (1996) points out that the large fixed cost of establishing a new bank branch can be an important factor constraining the development of a network of depository institutions in a developing country. The experience with the micro finance programs like Grameen Bank and BRAC in Bangladesh has shown that even undertaking a project that requires only $25–$50 is impossible without outside finance for a vast pool of asset-poor potential micro entrepreneurs.
2. Information Externality about Entrepreneurial capability

A potential entrepreneur can learn about her true capability only by undertaking an actual investment project. It is assumed that the success or failure of an investment and thus the type of an entrepreneur becomes public knowledge by the end of the life cycle of the initial project. This information externality about entrepreneurial capability gives rise to commitment problems on the part of an entrepreneur. Once revealed as good type, an entrepreneur can always strike a better deal with the other banks. It shifts the cost of discovery due to the failed experiments entirely on to the bank that finances a new entrepreneur.

3. Inalienability of entrepreneurial capital:

This refers to the fact that the characteristics of good or bad entrepreneurship is embodied in a person herself. This non-separability is called “inalienability” in Hart and Moore (1991). This creates problems for writing appropriate contracts. Because, if a bank finances a new entrepreneur, within the standard legal framework where financial slavery is illegal, the bank can not claim property rights to this entrepreneurial capability. A good entrepreneur’s access to other competing banks can not be restricted by a legally enforceable contract.

The assumption that there is symmetric ignorance about the quality of entrepreneurship puts the present analysis in a different bracket compared to the bulk of the work on credit market in the tradition of Stiglitz and Weiss (1981). The standard literature is built on the assumption that the entrepreneur knows her type with certainty, but the bank does not, which gives rise to adverse selection. Since our focus is on the discovery of entrepreneurial quality, it has closer affinity to the literature on R&D competition. This negative effect of competition in the credit market through bidding for the good entrepreneurs is also the focus of an interesting work by Petersen and Rajan (1995). Our analysis complements theirs, even though it also differ on a number of counts. While Petersen and Rajan (1995) rely on the standard adverse selection framework, our focus is on the question of who bears the cost of discovery of good entrepreneurs starting from symmetric ignorance about the capability of a potential entrepreneur. We use an occupational choice model to derive conditions under which competitive credit market is inefficient and entry restriction might be welfare enhancing. For an extended discussion, see section (3).

Obviously, the assumption of a perfect revelation of entrepreneurial type is not realistic. When the first financier bank has more information about an entrepreneur’s capability than the competing banks, the poaching externality effect might be diluted due to the “winner’s curse”. However, observe that if a successful entrepreneur can share information with competing banks (say by opening up its financial and accounting records), then it is not likely to constrain the ability of a good entrepreneur to switch banks.
Using a simple model of occupational choice, we show that the above three factors might result in a form of **binding credit constraint** and, as a result, the supply of credit to the new entrepreneurs in a competitive banking market might be too low from social point of view. The possibility of a binding liquidity constraint also induces the entrepreneurs to choose socially inefficient projects with high initial return but no dynamic learning effects, and thus discriminates against the projects with strong dynamic growth potentials.

**Competition and the Value of Information Capital**

A major concern about financial sector is its susceptibility to short-termism and crises. As emphasized by Caprio and Summers (1993) and Hellmann et al. (1997), among others, a competitive banking sector is especially prone to crises and short-termism as the banks do not have any *franchise value* to protect. Since competition dissipates all the profits (rents), the net present value of rents generated by the bank as an ongoing entity (i.e., franchise value) is zero, at best. In this situation, the banks (managers) may find it profitable to “gamble on resurrection” by taking on excessive and correlated risks or by siphoning off resources (“looting” in the phrase of Akerlof and Romer (1993)), and thus forcing a bank to inefficient bankruptcy for private profit. The important point for our analysis is that competition systematically leads to short-termism in the banking sector and this has important implications for entrepreneurial discovery. A bank with myopic horizon ignores the value of information generated by the entrepreneurial experiments of any given generation for all future loan decisions. In other words, a competitive bank’s investment in accumulation of information capital about entrepreneurial capability is too low compared to a social optimum. We use a simple two-armed bandit model of occupational choice to analyze the implications of short-termism in the banking sector for accumulation of information capital about entrepreneurial capability.

The above discussion points to some important reasons to suspect that a *Laissez Faire* credit market established through unfettered financial liberalization will fail to provide socially efficient

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*It has been a common argument against the private banks in developing countries that they are interested in financing only the short gestation economic activities like trading, and are, in general, averse to financing long gestation industrial projects. In fact, this lack of long term financing was one of the major rationale for the popularity of specialized development banks in the public sector of most of the developing countries during the decades of sixties and seventies.*
level of start-up finance for new entrepreneurs. As we discuss later in greater detail, the appropriate policies to correct this form of credit market failures is to create *rent opportunities* through entry restraint and interest rate controls, and induce the banks to increase the supply of credit to the new entrepreneurs closer to the socially efficient level.

(3) Relation to The Previous Literature

The issues (both substantive and analytical) raised in this paper intersect a number of areas in economic literature. On substantive issues, the concern about too little financing for new entrepreneurs is related to the literature on entrepreneurial development (theoretical and empirical) and the role of private credit market in the discovery of entrepreneurial talents. On an analytical level, the concern about poaching externality is closely related to a burgeoning literature on information externality which focuses on the problems of ex-ante commitment and ex-post opportunism. In particular, the analytical structure of the present problem has similarity to that of R&D competition widely studied in industrial organization literature.

The standard approach to the analysis of entrepreneurial development is that of *occupational choice* models (Khilstrom and Laffont, 1979; Kanbur, 1979; Banerjee and Newman, 1993, Eswaran and Kotwal, 1990). The basic theoretical approach is to analyze the effects of differential risk preference and intertemporal discount factor on the choice between a safe wage labor and risky entrepreneurial activity. With the assumption of a perfect capital market, the choice to become an entrepreneur solely depends on time preference and risk aversion parameters (This strand of literature started with the contributions of Khilstrom and Laffont, 1979; and Kanbur, 1979). However, the untenability of the assumption of a perfect capital market was soon recognized in the face of pervasive evidence of credit rationing, and internal finance constraints on the investment behavior of firms even in countries with most developed credit and capital markets (see for example, Fazzari et al. 1988, Stiglitz, 1992, Hubbard, 1998). The subsequent literature, both theoretical and empirical, placed increasing emphasis on the critical role played by access to financial capital. On a theoretical level, the contributions of Shorrocks (1988), Evans and Jovanovic (1989), Holtz-Eakin et al. (1994), and Eswaran and Kotwal (1990) have shown that differential access to capital results in differential risk-bearing capacity and thus lead to different occupational choice
even though time preference and risk aversion parameters are identical across agents.

The occupational choice model lent motivation to a number of empirical analysis of self-employment selection (see, for example, Brock and Evans, 1986; Rees and Shah, 1986). An increasing number of empirical studies use variants of occupational choice model with credit rationing for analyzing data on self-employment choice (see, for example, Evans and Jovanovic, 1989; Holtz-Eakin et al., 1994; Evans and Leighton, 1989; Audretsch and Vivarelli, 1993). One of the main findings of this empirical literature is that the decision to start one’s own business critically depends on the access to financial capital.

This paper departs from the standard occupational choice model of entrepreneurship in a number of significant ways. First, the focus here is on a specific form of liquidity constraint (the precise definition given later) which results from the interplay of the three factors discussed earlier. The critical difference from the standard Stiglitz-Weiss (1981) type credit rationing model is that a potential entrepreneur may be excluded from the credit market even in the absence of any informational asymmetry. In fact, in contrast to the asymmetric information literature, in our analysis of poaching externality, the prospective entrepreneur does not know her type and the crux of the issue is who bears the cost of discovery of the entrepreneurial type. This feature of the model makes clear the connection of the present research to the literature on patent rights in R&D competition. As in the literature on R&D competition, the private market is inefficient in the present case because it is difficult to ensure that the firm (bank) financing the discovery of a good entrepreneur will be able to capture enough rent to cover its cost before competition dissipates the rent. But there is a critical difference from the standard R&D problem. It arises from inalienability of the object of discovery, i.e. entrepreneurial capability. In the R&D case, a contract can be written which ensures sufficient share of the rent to the discoverer, and the standard way of doing it is to grant a limited duration patent right to the discoverer. However, in the case of discovery of entrepreneurs, it is not possible to design a patent right for the financier bank. Because it

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9This ignorance about ones own type and the associated problem of discovery is a feature of the credit market model of Lang and Nakamura (1990). Although there is a generic similarity between their and our analysis, their focus was on the explanation of persistence of boom and bust in an economy.
would tantamount to financial Slavery. Observe that the rent to good entrepreneurship is not restricted only to the first project undertaken, but accrues to other projects undertaken by the same entrepreneur throughout her lifetime. Thus even if the entrepreneur can be restricted to the bank for refinancing needs for the first project, the entrepreneur has the freedom to go to the lowest bidder for all other projects undertaken after the revelation of her entrepreneurial type. This implies that allowing for equity contracts between the bank and the entrepreneur only partially alleviates the problem, as the bank is still unable to capture most of the future rents associated with the good entrepreneurship. The problem of commitment failure addressed here has close similarity to a branch of literature on on-the-job training (in Becker’s phrase general training). The problem there is that a private firm always provides less than socially optimal level of training to the employee, because after accumulating the human capital the employee can leave the firm and get a better job with another firm (see, for example, Evans, 1994).

The closest precursor that addresses the problems created by poaching externality discussed in this paper is Petersen and Rajan (1995) where they point to the negative effect of competition in banking sector on small business financing due to bidding for the good entrepreneurs. However, our paper differs from theirs in a number of ways. First, we embed the poaching externality problem in a standard two sector occupational choice model in the tradition of Kanbur (1979) and Khilstrom and Laffont (1979). This allows us to address interesting policy issues regarding the interactions between financial sector and entrepreneurial development in the context of developing countries. Second, the informational assumption in our model is different from that in Petersen and Rajan (1995). In our model, there is symmetric ignorance about the quality of entrepreneurship, both the bank and the entrepreneur do not know the type of a potential entrepreneur. In contrast, Petersen and Rajan rely on the standard adverse selection framework, where the entrepreneurs know their type. As a result, their paper ignores the issue of inefficiency of a Laissez Faire credit market for building information capital about entrepreneurial capability, which is a central concern of the present paper. Third, Petersen and Rajan do not address the the problem of short-termism in competitive banking and its implications for the discovery of entrepreneurial capability. Fourth, unlike Petersen and Rajan who concentrate on the small and medium sized enterprizes in US economy, we discuss the policy implications of the analytical
results derived here within the broader debate about financial liberalization and private sector development in developing countries.

(4) The Basic Set-up

The economy consists of two sectors called agriculture and manufacturing. Investment in agriculture is divisible and yields a constant rate of return of $r^a$. $r^a$ is the rate of return net of principal but before deduction of the interest charges. Investment in manufacturing is lumpy and requires a fixed amount of financial capital which is normalized to 1. The return on manufacturing investment depends on the characteristics of the entrepreneur. There are two types of entrepreneur: good and bad. If the investment in the manufacturing sector is undertaken by a good type, the rate of return is $r^m$ and $r^m > r^a$. The gross return (before deduction of principal and interest charges) from manufacturing investment is assumed to be zero in case of a bad entrepreneur. The economy consists of $N$ individuals where $N$ is large. Up to any period $t$, the entrepreneurial type of $N_t$ is revealed. The magnitude of $N_t$ is determined by the number of new people who got loan for a manufacturing investment cumulated up to period $t$. Of the revealed segment of the population, the number of good type is denoted by $N^g_t$. There is no stochastic shock in the model. Also there is no asymmetry of information. Both bank and entrepreneur utilize $N_t$ and $N^g_t$ to estimate the probability that a new entrepreneur will turn out to be of good type. Since there is no asymmetry of information between the bank and the entrepreneur, their estimates of probability are identical. We denote this common estimate by $P$.

The banking sector is assumed to be competitive. The bank can lend to three groups of people: (i) safe agricultural sector, (ii) safe loan to industrial entrepreneurs already proven good, or (iii) finance the experimentation of new industrial entrepreneurs. The bank maximizes the expected return on its loan portfolio. Competition in the banking sector implies that banks compete for the proven good entrepreneurs and the bargaining power completely lies with the entrepreneurs. We denote the interest rate on agricultural loan by $i^a$. The deposit interest rate at which the banks can get funds is denoted by $i^d$. It is assumed that the supply of loanable funds at interest rate $i^d$ is perfectly elastic.\(^{10}\) The zero profit condition for the agricultural loans imply that $i^a = i^d + \tau$

\(^{10}\)We assume, for simplicity, that the potential entrepreneurs have zero savings. The supply of savings is generated
where \( \tau \geq 0 \) is the unit transactions cost for the banks. Thus the parameter \( \tau \) can be interpreted as a measure of (in)efficiency of the banking sector.

The prospective industrial entrepreneur can either apply for an industrial loan or take an agricultural loan and earn a safe agricultural income. If she does not take any loan (agricultural or industrial), her reservation payoff is \( \hat{w} > 0 \). This may reflect the return on agriculture without any purchased inputs (like traditional farming without fertilizer, pesticide etc for which no bank loan is needed). Alternatively, \( \hat{w} \) can be interpreted as wage in the labor market. It is assumed that, under competition in the agricultural lending, the return on an agricultural loan is higher than the reservation payoff, i.e., \( r^a - i^a > r^a - (i^d + \tau) > \hat{w} \). Since the entrepreneurial capability is unknown, it is assumed that the prospective industrial entrepreneurs compete for industrial finance and the bargaining power lies completely with the banks.\(^{11}\)

In this economy, we analyze the decision problem of a bank facing a random applicant for industrial loan from the unrevealed segment of the population. For simplicity, it is assumed that each individual has a life span of two periods and a period is defined to cover the life cycle of the industrial project. Also it is assumed that the subjective time preference of entrepreneur is \( \rho > 0 \). Both the entrepreneur and the bank are assumed to be risk-neutral.

(4.1) A Simple Model of Competition and Poaching Externalities

The Supply of Credit: Bank’s Loan Decision

Fig. 1 shows the sequence of events relevant for the bank. At node (B)\(^{12}\) of Fig. 1, the bank decides whether to give loan or not to a new entrepreneur. If the bank decides in favor of giving a loan, the nature picks the type of entrepreneur at node (N)\(^{13}\). But the true probability

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\(^{11}\)Since, by assumption, the size of indivisible industrial loan is fixed, the debt contract needs only specify the interest rate.

\(^{12}\)B stands for bank.

\(^{13}\)N stands for nature.
\( P_0 \) is a private information of nature alone. The bank takes decision using its probability estimate \( P \). The debt contract specifies first period interest rate denoted by \( i_1 \). However, the bank earns income only if the entrepreneur turns out to be good. In case of a bad entrepreneur, the return to the investment project is zero. And the debt contract requires no payment from the failed entrepreneur. This can be thought of as the consequence of limited liability law. In the second period, because of competition, the bank cannot charge the good entrepreneurs an interest rate higher than \( i^a \). If it charges a higher interest, say, \( i = i^a + \delta \), then a competing bank can offer a contract at interest rate \( i = i - \epsilon \) where \( 0 < \epsilon < \delta \). With such alternative contracts available to the good entrepreneur, switching to a new bank always dominates as a strategy at node (GE) \(^{14}\) in the second period.

On the other hand, a failed entrepreneur goes back to agricultural activity in the second period and receives only agricultural loan at interest rate \( i^a \). The first and second period returns on loans to different types of people are given at the end of the different branches of figure 1.

The individual rationality constraint of the bank can be represented as follows:

\[
P \left[ (1 + i_1) + \frac{(1 + i^a)}{\tilde{\beta}} \right] + (1 - P) \frac{(1 + i^a)}{\tilde{\beta}} \geq (1 + i^a) + \frac{(1 + i^a)}{\tilde{\beta}}
\]

(1)

where \( i_1 \) is the interest rate charged by bank at period 1 for the new industrial loan and \( \tilde{\beta} = (1 + i^d) \) is the discount rate of the bank. \( i^d \) is the parametric deposit interest rate paid by the bank on the deposit it takes.

Let \( i^*_1 \) stand for the minimum first period interest rate needed by the bank for giving loan to the new entrepreneur. Then

\[
i^*_1 = Min_{i_1} \left( \text{ such that IRC (1) is satisfied} \right)
\]

(2)

\(^{14}\)GE stands for good entrepreneur.
\( i^b_1 \) can be solved from the individual rationality constraint as:

\[
i^b_1 = \frac{1 + i^a}{P} - 1 \quad (3)
\]

Note that since \( P < 1, i^b_1 > i^a \). The premium demanded by the bank for lending to uncertain industrial entrepreneurs, \((i^b_1 - i^a)\), can be treated as a measure of the cost of discovery of entrepreneurial capability.

**The Demand for Credit: Occupational Choice of a Potential Entrepreneur**

Figure 2 shows the sequence of events for the entrepreneur. At node (E) the entrepreneur decides whether to apply for industrial loan or not based on the estimate of probability \( P \). In case of a positive decision, nature picks the entrepreneurial type. If the entrepreneur turns out to be good, the net rate of return in period 1 is \((r^m - i^a)\) and net return in second period is \((r^m - i^a)\). If the entrepreneurial type is bad, first period gross return is zero and the loan contract requires no payment to bank. So, the net return is also zero. But After discovering the entrepreneurial capability, the failed entrepreneur can go back to agricultural activity in the second period and earn a net return of \((r^a - i^a)\).

The individual rationality constraint (IRC) of the entrepreneur can be represented as follows:

\[
P \left[ (r^m - i_1) + \frac{(r^m - i^a)}{\beta} \right] + (1 - P) \frac{w^a}{\beta} \geq w^a \left( \frac{1 + \beta}{\beta} \right) \quad (4)
\]

where \( w^a \equiv r^a - i^a \) and \( \beta = 1 + \rho \) is the discount rate of the entrepreneur.

Let \( i^*_1 \) denote the maximum interest rate that will not deter the entrepreneur from taking new

\(^{15}\text{E stands for prospective industrial entrepreneur}\)
industrial loan. Then

\[ i_1^b = \text{Max}_{i_1} \text{ (such that IRC (4) is satisfied)} \tag{5} \]

\[ = r^m \left( \frac{1 + \beta}{\beta} \right) - r^a \left( \frac{P + \beta}{\beta P} \right) + \frac{i^a}{P} \tag{6} \]

**Equilibrium and Information Revelation**

Depending on the relationship between \( i_1^b \) and \( i_1^e \), there can be different types of equilibrium in the economy. We get the following necessary condition for a new entrepreneur getting an industrial loan:

\[ i_1^b \leq i_1^e. \tag{7} \]

**Definition**

The economy is said to be in *type I equilibrium* if equation (7) is violated; and in *Type II equilibrium* if it is satisfied.

**Type I Equilibrium**

In a type I equilibrium, no loan is advanced to the new entrepreneurs. So the economy is trapped in a low level equilibrium with no new industrial activity.

*Proposition 1*

*If \( r^m > r^a \), there exists a critical probability \( P^* > 0 \) such that for all probability estimates \( P < P^* \),*
the economy is characterized by type I equilibrium.

Proof:

From equation $i_i^b = i_i^e$, we have the following solution for $P^*$:

$$P^* = \frac{\beta (1 + r^a)}{\beta (1 + r^a) + (r^m - r^a)(1 + \beta)}$$

(8)

Since $r^m > r^a$ by assumption, $P^* \in (0, 1)$.

Now

$$\frac{\partial i_i^b}{\partial P} = -\frac{(1 + i^a)}{P^2} < 0$$

(9)

$$\frac{\partial i_i^e}{\partial P} = \frac{w^a}{P^2} > 0$$

(10)

So, if $P < P^*$, then $i_i^b(P^*) > i_i^e(P^*)$. Q.E.D.

Note that in this simple competitive banking economy, the likelihood of a type I equilibrium depends on the discount factor of the entrepreneur but does not depend on the discount factor of the bank. This is so because while the entrepreneur enjoys rents on the good entrepreneurship in the second period, the bank does not.

Type II Equilibrium

There are two types of equilibrium within type II equilibrium. One is characterized by positive loan to new entrepreneurs and thus reveals new information about entrepreneurial talents in the economy. The other involves no loan to new entrepreneurs and thus no information revelation about entrepreneurial capability. The nature of equilibrium obtained depends on the nature of liquidity constraint faced by the entrepreneur.

Definitions:
Liquidity Constraints

An entrepreneur is said to be liquidity constrained if she can not borrow against her expected net present value of income given the common estimate of probability, \( P \). The liquidity constraint arises from the fact that the entrepreneur if proven good gets rent on good entrepreneurship as long as she lives. So in the first period only a fraction of the net present value of the expected life-time income accrues to the entrepreneur. And the entrepreneur can not credibly promise to the bank more than what accrues in the first period. There can be two types of liquidity constraint depending on whether or not it deters the bank from giving loan to a prospective entrepreneur. If a liquidity constraint is such that the bank is willing to extend loan to a new entrepreneur, then it is called non-binding liquidity constraint. On the other hand, if the liquidity constraint is such that the bank is unable to give loan to the prospective entrepreneur, then it is called a binding liquidity constraint.

Type II Equilibrium With Information Revelation

The necessary and sufficient condition for type II equilibrium with information revelation is characterized by the following inequality:

\[
i_1^e > r^m \geq i_1^b
\]

In such an equilibrium, the first period equilibrium interest rate will be \( i_1^{**} = r^m \). So the bank can extract only part of the total life-time surplus generated by a good entrepreneur because of liquidity constraint. However, the existence of liquidity constraint, in this case, does not deter loan to new industrial entrepreneurs and the economy is under a regime of non-binding liquidity constraint.
Type II Equilibrium With No Information Revelation

This variety of type II equilibrium is characterized by no loan to new entrepreneurs and represents a low level equilibrium trap for the economy with no revelation of new information. The necessary and sufficient condition for type II equilibrium with no information revelation is characterized by the following inequality:

\[ i_1^e \geq i_1^b > r^m \]  \hspace{1cm} (12)

In this case, the maximum interest rate that can be extracted from an entrepreneur in the first period is less than the minimum required by the bank. As a result, no loan is given to the new entrepreneurs, and the economy is trapped in a no information revealing equilibrium. The liquidity constraint is binding in this case.

Proposition 2

The likelihood of a binding liquidity constraint is, ceteris paribus, higher
(2.a) the lower is the productivity of the industrial sector, \( r^m \),
(2.b) the lower is the initial probability estimate of a good entrepreneur, \( P \),
(2.c) the higher is the deposit interest rate, \( i^a \).

Proof:

Follows from the condition for binding liquidity constraint:

\[ \frac{1 + i^a}{P} - 1 > r^m. \]  \hspace{1cm} (13)

Q.E.D.

Since \( i^a = i^d + \tau \) under competition in agricultural lending, proposition (2.c) above implies that it is more likely to have a binding liquidity constraint when the deposit interest rate \( (i^d) \) is
higher and/or the banking sector is relatively less efficient (a higher $\tau$).

Under liquidity constraint (binding or non-binding), the threshold probability estimate below which there will be no loan to new industrial entrepreneurs is denoted by $P_{lc}^*$ where

$$P_{lc}^* = \frac{1 + i^a}{1 + r_m}.$$ (14)

The important thing to note in the above expression is that, in contrast to equation (8), it is independent of the time preference parameter of entrepreneur $\beta$. The inter-temporal preference of an entrepreneur can not be exercised in a liquidity constrained regime.

(4.2) The Inefficiency of Competitive Banking

In the type II equilibrium with no information revelation, the competitive credit market fails to discover potential good entrepreneurs because there is no commitment mechanism on part of the entrepreneur which ensures sufficient share to the bank of the rent on good entrepreneurship. Since any commitment by the entrepreneur not to change bank is not credible, the bank finances the discovery only if it can cover all the cost by jacking up the first period interest rate. This is a Pareto inferior outcome because there exists unexploited opportunity for welfare improvement of all the parties involved.

To see this, assume that in the second period the entrepreneur if proven good cannot move to another bank. We use this solution as the benchmark.

The Supply of Credit: Bank’s Decision

In the new regime, the individual rationality constraint of the bank can be represented as follows:

$$P \left[ (1 + i_1) + \left( \frac{1 + i_2}{\beta} \right) \right] + (1 - P) \frac{1 + i^a}{\beta} \geq (1 + i^a) + \frac{(1 + i^a)}{\beta}.$$ (15)
The bank now has access to two instruments, $i_1$ and $i_2$, to extract enough return to satisfy its individual rationality constraint. As a result, the bank can, to a certain extent, avoid the possibility of a *binding liquidity constraint* by reducing the first period interest rate and jacking up the second. The bank obeys only the present value constraint on returns stream to satisfy individual rationality.

What is the minimum first period interest rate that can be charged by the bank without violating its own rationality constraint? To find it out, observe that the maximum second period interest is equal to the second period gross return $r_m$. Denote the minimum first period interest required by bank as $i_{1,min}^b$, then

$$i_{1,min}^b = i_1^b - \frac{(r_m - i_a)}{\beta} \tag{16}$$

Since $r_m > r_a > i_a$,

$$i_{1,min}^b < i_1^b. \tag{17}$$

**The Demand for Credit: Entrepreneur’s Decision**

The individual rationality constraint of entrepreneur in a regime of no switching of banks can be represented as follows:

$$P \left[ (r_m - i_1) + \frac{(r_m - i_2)}{\beta} \right] + (1 - P) \frac{w^a}{\beta} \geq w^a \left( \frac{1 + \beta}{\beta} \right) \tag{18}$$

Under the new regime, the second period rent on good entrepreneurship available in a competitive banking with externality does no longer accrue to entrepreneur. Given that, in the market
for new industrial loan, the bargaining power lies completely with the bank, the bank specifies \( i_1 \) and \( i_2 \) to extract all the surplus from an entrepreneur without violating the participation constraint. This reduces the maximum first period interest an entrepreneur is willing to pay and still take an industrial loan compared to the competitive case. This effect resembles the quantity restriction effect under monopoly in that the cost of industrial loan is higher under the new regime. However, there is a critical difference. In the presence of a binding liquidity constraint, the reduction is in the excess demand and under suitable conditions, the amount of loan to new industrial entrepreneurs increases as the liquidity constraint is relaxed.\(^{16}\)

Denote the maximum first period interest rate an entrepreneur is willing to pay when the second period interest is equal to \( r^m \) as \( i^e_{1, \text{max}} \). Then we have the following expression:

\[
  i^e_{1, \text{max}} = r^m - w^a \left( \frac{1 + P}{P} \right) \tag{19}
\]

\(^{16}\)Another way to look at it is to note that the bank takes into account the participation constraint of the entrepreneur when deciding the interest rates. Thus, by construction, the monopoly bank can not drive out the entrepreneur by raising the cost of capital.

**Proposition 3**

In a type II competitive equilibrium with binding liquidity constraint, assume that (i) the initial probability estimate of a good entrepreneur \( P \) is less than a threshold, (ii) the productivity of agriculture is not too high so that \( r^a < 1 \). Then competitive banking equilibrium results in too little investment in entrepreneurial discovery.

**Proof:**

We show that, under the conditions of proposition 3, there exists some industrial project with return \( r^m \) such that
So the liquidity constraint is binding in a competitive banking equilibrium, while it is not under restrictions on switching banks. As a result, socially desirable loans can be made possible.

The condition for liquidity constraint under competitive banking, i.e., equation (20) implies the following inequality:

\[ r_m < \frac{1}{\rho_m} \]

where \( \rho_m \equiv \frac{1 + \alpha - P}{P} \).

Equation (22) is satisfied from the definition of \( \delta_{1,\text{max}} \):

\[ \delta_{1,\text{max}} = r_m - w^a \left( \frac{1 + P}{P} \right) < r_m \]

if equation (21), i.e., \( \delta_{1,\text{max}} \geq \delta_{1,\text{min}} \) is satisfied.

And equation (21) implies the following condition:

\[ r_m \geq \frac{\rho_m}{\rho_m} \]

where \( \rho_m \equiv \frac{1}{P \left( 1 + \tilde{\beta} \right)} \left[ \tilde{\beta} \left( (1 + P) w^a + (1 - P) \right) + \alpha \left( P + \tilde{\beta} \right) \right] \)
Now the set of $r^m$ satisfying equation (23) and (25) is non-null if the initial probability estimate is low enough to satisfy the following:

$$P < \frac{(1 + i^a) - \beta w^a}{(1 + i^a) + \beta w^a} < 1$$

(26)

Observe that a necessary condition for the inequality (26) to be satisfied is that $(1 + i^a) - \beta w^a > 0$, because, by definition, $P \geq 0$. It is easy to check that this necessary condition is satisfied as long as the following inequality holds:

$$\tau > \hat{\tau} \equiv \frac{(1 + i^d) \left[r^a - i^d - 1\right]}{2 + i^d}$$

(27)

where we use the facts that $\beta = 1 + i^d$, and $i^a = i^d + \tau$ under the assumption of competition in the agricultural lending. Now observe that $\hat{\tau} < 0$ if agriculture is not ‘too productive’ in the sense that the rate of return is less than hundred percent, i.e., $r^a < 1$. In this case inequality (27) above is automatically satisfied because, by assumption, $\tau > 0$.

So if the agricultural sector is not ‘too productive’ ($r^a < 1$) and the initial probability estimate $P$ is low enough to satisfy the inequality (26), then there exists a non-null open interval $(\underline{r}^m, \overline{r}^m)$ such that for any industrial project with productivity $r^m \in (\underline{r}^m, \overline{r}^m)$, the competitive banking equilibrium results in a binding liquidity constraint, but the bank provides loan to a new industrial entrepreneur if she (the entrepreneur) can not switch bank in the second period. Q.E.D.

**Binding Liquidity Constraints and Inefficient Project Choice**

The above discussion assumes that the time profile of the future rents associated with good entrepreneurship is a flat one implying that there is no dynamic learning by doing. In the presence of dynamic learning by doing, the time profile of rents will have a positive slope. In this case, the effects of a binding liquidity constraint under a competitive banking sector can be especially

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Note that the condition that $r^a < 1$ is over-sufficient. However, it seems to be a realistic assumption that in most of the developing countries the rate of return in agriculture is less than hundred percent implying $r^a < 1$. 

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damaging from a social point of view. To avoid a binding liquidity constraint, the entrepreneurs will systematically choose the projects with front loaded returns at the expense of projects with low initial return but high future returns due to strong productivity gains later from learning by doing. This also provides an explanation of the fact that the private banks usually favor financing short gestation investment projects like trading which yield high returns quickly but do not confer any significant dynamic learning externalities. In contrast, the temporary entry restrictions advocated by the Financial Restraint paradigm eliminates this type of inefficient project choice, as the bank can lower the initial interest rate and thus allows projects with strong learning effects to be undertaken. Note also that when there are Hirschman type linkage effects across different industrial projects that create geographic positive spill-overs, a monopoly bank can coordinate the investments in a village and avoid a no industrialization trap that can occur in a competitive banking due to coordination failure and problems of appropriation (for a model of banks as catalysts for industrialization through coordination of investments and supporting historical evidence from European industrialization, see Da Rin and Hellmann (2002)).

(4.3) Policy Implications: Entry Restraint

Using a simple model, the above analysis shows that competition in the banking sector due to free entry can dissipate the rents required by the banks to experiment with new entrepreneurs. Experimentation with fresh entrepreneurs help build up the information capital on entrepreneurial talents in a developing economy. This is critical for the success of a decentralized private sector led development strategy. The analysis presented above provides an important argument for the temporary entry restriction policies recently advocated by Hellmann, Murdock, and Stiglitz (1997) as part of the Financial Restraint paradigm. A policy of limited duration monopoly right granted to the first entrant bank in a village can ensure that the banks can keep enough rents on the successful entrepreneurs to cover the costs of the failed entrepreneurs. The optimal duration of the monopoly right has to trade off the welfare costs associated with the quantity restrictions due to the monopoly power of the incumbent bank. Note that if a limited duration monopoly is awarded to the first bank entering a new village, it will also increase the agricultural interest rate and drive down the farmers to their reservation payoff \( \hat{w} \). The monopoly interest rate charged by the bank for agricultural loan is \( \hat{i}^a = r^a - \hat{w} > \hat{i}^a = \hat{i}^d + \tau \). As the interest rate
rate on agricultural loan increases, it also attenuates the incentives of a bank for providing risky industrial loans. One way to solve this problem is to use a two-track policy which ensures limited duration monopoly right for industrial financing to the first entrant bank while keeping the entry into agricultural lending unrestricted. One might argue that such a two-track policy will induce prospective entrepreneurs to apply for the agricultural loan at a lower interest rate and then use it for industrial financing (fungibility problem). Although it is a theoretical possibility, we have strong doubts about its empirical importance in developing countries for the following reasons. First, the lumpiness and the scale of an industrial investment is such that a potential entrepreneur would need a (very) large number of agricultural loans simultaneously to finance an industrial activity. Second, it is very easy for a bank to monitor if there is new industrial activity undertaken by a farmer who takes agricultural loans.

One might argue that a policy which subsidizes the bank directly for the costs of discovery of entrepreneurial capability can be a better approach. It can be viewed as a simple application of the theory of targeting familiar from the trade literature which says that interventions closest to the margin of a distortion is the optimal policy. But as emphasized by Hellmann at. al. (1996) in the context of deposit mobilization, such a policy may create the problem of excessive experimentation by the banks, and it also ignores the idiosyncratic information available to the banks about relative entrepreneurial potential of different villages. Moreover, a policy of subsidy implies a deadweight loss because of the distortionary taxes employed to finance the subsidy. A policy focusing on the entry, on the other hand, does not encourage excessive experimentation, and is not costly in terms of government budget. In fact, such a policy can raise revenue for the government if appropriately designed which makes it especially attractive (so-called Win-Win policy). One such option is to charge an entry fee for the later entrants who free ride on the information generated by the first entrant.

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18 The proof of proposition (3) presumes such a two-track policy. A similar proof can, however, be easily constructed for the case when the agricultural interest rate also goes up due to temporary monopoly power of the bank.

19 In terms of our model, the estimated probability of a good entrepreneur $P$ is likely to vary across different villages. We assume that the probability estimate is known to the bank and the villagers but not to the government.
5) Time Horizon of the Banks and the Value of Information Capital: A Simple Model

The recent literature on financial liberalization has highlighted the importance of franchise value for the banks to act as a long term agent. As emphasized by Caprio and Summers (1993) and Hellmann et. al. (1997, 2000), banking competition can have strong negative effect on the franchise value of a bank and thus shorten the time horizon of a bank. Hellmann et. al. (1997) argue that the policies of Financial Restraint like restricted entry and mild interest rate controls can create rent opportunities (or contingent rent) and increase the franchise value of a bank, and thus provide incentives to the bank to act as a long term agent. The basic argument of this section is that Financial Restraint also helps in experimentation with untested entrepreneurs, because a bank with a longer horizon takes into account the value of information generated by the loan to an entrepreneur of the current generation for the loan decisions in the future. The basic two period model analyzed so far can not incorporate the possibility of learning because the bank gives loan only once and does not take into account the value of the information generated by an initial loan in a multi-period setting. Thus the basic model can be interpreted as a model of a bank with myopic horizon which does not put any weight to the value of information accumulation. In this section we show that when the bank has a longer horizon, it is less likely to have a low level equilibrium trap with no industrial financing for new entrepreneurs. We extend the basic model to the simplest case of Bayesian learning by allowing the bank to provide loan to new entrepreneurs twice in a sequential manner. A set-up suitable for this analysis involves three periods \((t_1, t_2, t_3)\) and two overlapping generations of potential entrepreneurs (born at the beginning of \(t_1\) and \(t_2\)) drawn from a common underlying distribution. In period one, given the prior estimate of the probability of a good entrepreneur in the first period, the bank decides whether or not to give loan to a new entrepreneur. To differentiate across periods, we use time subscripts and denote the first period probability estimate as \(P_1\). If the bank gives loan to a potential entrepreneur, new information is revealed, and the bank updates its probability estimate on the basis of first period outcome before deciding the loan portfolio of the next period.
To model the decision making of a bank, we utilize the framework of Two-Armed Bandit first formulated by Thompson (1933). The standard Two-Armed Bandit model is concerned with the optimal sequence of plays of two slot machines with unknown and different probabilities of success. A special case of the standard model is concerned with the situation when the probability of success of one slot machine is known with certainty. This is called Two-Armed Bandit with one arm known. In our case, there is no uncertainty about the return to agricultural activity. The only uncertainty is about the quality of industrial entrepreneurship. So the bank’s decision problem of whether to give loan to a new industrial entrepreneur can be cast as a Two-Armed Bandit problem with one arm known.

The Bank’s Decision

Fig 3 shows the sequence of events for the bank. The decision tree has two parts corresponding to two loan decisions. The bank updates its probability estimate according to the Bayes’ rule after observing the outcome of the first loan. If no loan is advanced to the new entrepreneur at $t_1$, then there is no information revelation, and the probability estimate remains the same. According to a result due to Bradt, Johnson and Karlin (1956), if the known arm of a Two-Armed Bandit problem is chosen at any stage of the sequential decision then it is also optimal thereafter (see their Lemma 4.1). The intuition for this result is simple. Say, at a certain stage, given the probability estimate, it is optimal to choose the known arm. Now since there is no new information revealed at this stage, the decision problem for the next and each of the successive stages is identical to the current stage and hence should yield the same optimal decision rule, i.e. choose the known arm. So if the bank does not give loan to new entrepreneur in period one, it is optimal not to give loan to new entrepreneur in period two also. This is shown in the top most branch of the

\[\text{The statistical literature on Two-Armed Bandit problem is voluminous. For a recent text book treatment see, Pratt, Raiffa and Schlaifer (1995), and for a useful survey of the research, see Berry and Fristedt (1985). Examples of economic applications of the Two-Armed Bandit model include Rothchild (1974), Viscusi (1979a, 1979b), Roberts and Weitzman (1980). The solution to a general class of Bandit problems was derived by Bellman (1956) which utilizes Bayes’ principle and dynamic programming.}\]

\[\text{The Bradt et. al. Lemma uses uniform discounting. But the result readily extends to the case of geometric discounting, as is the case here (see, for example, Berry and Fristedt, 1985, Viscusi, 1979).}\]
decision tree in period two.

If at $t_1$, the bank decides to give loan to a new entrepreneur, it may or may not give loan to a new entrepreneur in $t_2$ depending on the prior probability estimate and the outcome of the initial loan. If the first period loan results in a successful industrial entrepreneur, then the updated probability is denoted by $P_{2}^{s}$ and in case of a failure by $P_{2}^{f}$. The interest rates charged by the bank are denoted by $i_{2}^{s}$ and $i_{2}^{f}$ for good and bad realization of entrepreneurial type respectively.

**The Entrepreneur’s decision**

We assume that there are two generations of potential entrepreneurs drawn from the same population of entrepreneurial type (born at $t_1$ and $t_2$). Each borrower lives for two periods, and as in the basic model, the period is defined to be equal to the life of an industrial project. The assumptions about rate of returns are also those of the basic model. In fact, the decision problem of generation $t_1$ is identical to that of the entrepreneur in the basic model. The difference from the basic model arises due to the fact that there is now a second generation of potential entrepreneurs born at the beginning of period $t_2$ who can observe the outcome of any loan given to the entrepreneurs of the first generation. So second generation of entrepreneurs update their probability estimate on the basis of the outcome of the first generation loan.

**The optimal solution to the bank’s decision problem**

We now derive the solution to the bank’s decision problem at period $t_1$. Since the bank is assumed to be risk neutral, it gives loan to a new industrial entrepreneur iff the expected return from the industrial loan is at least equal to the (certain) return on an agricultural loan when the second period decision is taken optimally utilizing the information revealed in the first period.

In a competitive credit market, the expected return from an industrial loan advanced at period $t_1$ is given by:
\[
ER^b(t_1, P_1) = P_1 [(1 + i_1)] + P_1 \left[ \frac{P_s}{\beta} (1 + i_2) \right] + (1 - P_1) \max \left[ \frac{P_f^f}{\beta} (1 + i_2), \left( \frac{1 + i^a}{\beta} \right) \right] \\
+ \frac{1 + i^a}{\beta^2}
\]

where \( ER^b(t_1, P_1) \) denotes the expected return to bank, the first term on the right hand side of equation (28) is the expected return at period one, the second term is the expected return in the second period in the event that the entrepreneur turns out to be a success, and the third term shows the expected return when the entrepreneur is a failure. The last term shows the return in third period under the assumption that the entrepreneur once revealed good can switch bank.

It is, in general, difficult to solve, \textit{ex ante}, for the second period loan decision. However, since we are concerned with the characterization of the two regimes i.e. one with loan to new industrial entrepreneurs and the other with no loan to new entrepreneurs, it turns out that the second period decision can be simplified. The intuition goes as follows. Say, the probability estimate in period one is such that it is just enough for the bank to offer loan to a new industrial entrepreneur, i.e., the bank finds it unprofitable to finance a fresh industrial entrepreneur \( \forall P < P_1 \). Then, it follows from a standard result in Two Armed Bandit that the bank switches to the safe lending to the agriculture or revealed industrial entrepreneurs if the first loan to the industrial entrepreneur is a failure, but sticks to new industrial lending if the first loan turns out to be a success (see Viscusi (1979)). This simplifies the bank’s decision problem enormously. The relevant decision tree is depicted in figure 4. It shows the first period decision problem of the bank when the future payoffs are determined by the preceding argument.

Let \( P_1^* \) be the critical probability estimate that leaves the bank just indifferent between a new industrial loan and loan to a revealed (industrial or agricultural) applicant at the first period. Then \( P_1^* \) satisfies the following equation.

\[
ER^b(t_1, P_1^*) = (1 + i^a) \left[ 1 + \frac{1}{\beta} + \frac{1}{\beta^2} \right]
\]

(29)
Using equation (28) in equation (29) and rearranging terms, we get:

\[
P_1^* \left[ (1 + i_1) + \frac{P_2^*}{\beta} (1 + i_2^*) \right] - \left( 1 + \frac{P_1^*}{\beta} \right) (1 + i^*) = 0 \tag{30}
\]

Before turning to a discussion of the value of information for a long horizon bank, we state the following simple results which have important policy implications.

*Proposition 4*

*In an economy with Bayesian learning by banks*

(4.a) if the initial probability estimate is such that \( P_1 < P_1^* \), then the economy is trapped in an equilibrium with no loans for new industrial entrepreneurs,

(4.b) the likelihood of an equilibrium trap with no new industrial finance is, ceteris paribus, lower if the deposit interest rate \((i^d)\) is lower and the banking sector is more efficient (i.e., a lower \( \tau \)).

*Proof:*

(4.a) The proof is simple. If the probability estimate \( P_1 \) is less than the critical estimate \( P_1^* \), then no loan is advanced by the bank to the prospective industrial entrepreneurs in period one. By the geometric discounting version of the Bradt et. al. (1956) lemma (4.1), then giving no loan to the new entrepreneurs is optimal for all following periods.
Using implicit function theorem, from equation (30), we get

\[
\frac{\partial P^*}{\partial \iota^d} = -\frac{\partial \Psi(\cdot)}{\partial \iota} \frac{\partial \Psi(\cdot)}{\partial P^*} > 0 \text{ and } \frac{\partial P^*}{\partial \tau} = -\frac{\partial \Psi(\cdot)}{\partial \tau} \frac{\partial \Psi(\cdot)}{\partial P^*} > 0
\]  

(31)

where

\[
\frac{\partial \Psi(\cdot)}{\partial \iota^d} = \frac{P^*}{\beta^2} [(1 + i^a) - P^*_2 (1 + i^a_2)] - \frac{P^*}{\beta} < 0,
\]  

(32)

\[
\frac{\partial \Psi(\cdot)}{\partial \tau} = -\frac{P^*}{\beta} < 0,
\]  

(33)

\[
\frac{\partial \Psi(\cdot)}{\partial P^*_1} = (1 + i_1) - \frac{(1 + i^a)}{\beta} + \frac{(1 + i^a_2)}{\beta} \left[ P^*_2 + P^*_1 \frac{\partial P^*_2}{\partial P^*_1} \right] > 0
\]  

(34)

The inequality (32) follows from the observation that, given the definition of \( P^*_1 \), the bank prefers to give loan to the industrial entrepreneur in the second period when the initial industrial loan turns out to be a success. This implies that \( (1 + i^a) - P^*_2 (1 + i^a_2) < 0 \). The inequality (34) utilizes the following facts: (i) \( (1 + i_1) > (1 + i^a) > \frac{(1 + i^a)}{\beta} \), and (ii) \( \frac{\partial P^*_2}{\partial P^*_1} > 0 \). Q.E.D.

We note an important policy implication regarding deposit interest rate regulation that follows from the above results. A comparison of inequalities (32) and (33) shows that a marginal reduction in deposit interest rate has a larger impact on the critical probability estimate \( P^*_1 \) than a marginal improvement in efficiency of banking transactions (\( \tau \downarrow \)). This observation makes deposit interest rate a doubly attractive policy instrument, as it does not involve any direct resource costs while a reduction in banking transactions costs is likely to involve significant resource costs.\(^{22}\) The intuition behind this result is that a reduction in the deposit interest rate reduces both the discount rate of the bank and the equilibrium lending rate to agriculture, while the reduction in the transactions costs (\( \tau \)) leaves the discount rate unaffected. The following Corollary formally states the result.

Corollary 1

In an economy with Bayesian learning by banks, a reduction in the deposit interest rate is more effective in avoiding a no industrial financing trap compared to a reduction in the transactions costs of the bank.

The above result when combined with the recent results on the role of deposit rate control in

\(^{22}\)One should, however, not interpret this result as implying that there is no need for a reduction in the transactions inefficiency in banking.

(5.1) The Value of Information When Banks Have Long Horizon

The discussion in this section highlights the value of the information revealed by a first period loan for avoiding a low industrial finance equilibrium trap (*type I equilibrium* or *type II equilibrium with a binding liquidity constraint*). To focus on the value of information due to a longer time horizon, we concentrate on the case where the banks can not extract any rent from the good entrepreneurs once their type is revealed. The positive effects of rents on incentives to experiment with new industrial entrepreneurs (which was the focus of the preceding section) under *Financial Restraint* are thus abstracted away. The results of proposition (5) below thus understate the value of information under a regime of *Financial Restraint*.

In contrast to the basic model, it is, in general, not possible to have a tractable solution for \( P^*_1 \) from equation (30) above. Because the equation is nonlinear in \( P^*_1 \), as the second period probability estimate, \( P_2(.) \), is a function of \( P^*_1 \). This implies that it is not possible to analyze the likelihood of a *type I equilibrium* by comparing the solutions for the critical probability estimates for the myopic and long horizon cases. A related shortcoming of the approach is that it is not suitable for deriving comparative statics regarding the effect of different initial probability estimates. Also, one might think that it is not possible to rely on the framework developed earlier in terms of the critical interest rates required by the bank and the entrepreneur, as the decision tree (4) (and equation (30)) is valid only under the restrictive assumption that the initial probability estimate makes the bank just indifferent between a prospective industrial entrepreneur and the safe agricultural activity which is, in general different from the actual probability estimate (i.e., \( P^*_1 \neq P_1 \)). However, the preceding argument fails to appreciate the fact that at the critical first period interest rate that makes the bank just indifferent between a new industrial loan and safe agricultural activity given the first period probability estimate \( P_1 \), we can invoke exactly the same simplification of the Two Armed Bandit problem for a bank and the relevant decision tree remains that of figure (4).

\(^{23}\)It turns out that, although there are two real solutions for \( P^*_1 \), there is only a unique threshold in this economy. Because one of the solutions is negative, and thus can be ignored, as \( P^*_1 \geq 0 \) by definition.
In the following proposition, we show that, under certain plausible conditions, the critical first period interest rate below which the bank refuses to finance an untested industrial entrepreneur is smaller for a bank with a longer horizon. This means that an economy can be trapped in type I equilibrium or a type II equilibrium with binding liquidity constraint when banks have myopic horizon, but can avoid these bad equilibria if the banks act as longer term agents.

**Proposition 5**

Consider an economy where the entrepreneurs can switch banks so that the banks can not extract any rent from them once they are revealed to be of good type. In this economy

(5.a) A type I equilibrium characterized by no experimentation with prospective industrial entrepreneurs is less likely when banks have a longer horizon if the productivity of the industrial sector ($r^m$) is less than a threshold.

(5.b) A binding liquidity constraint and hence type II equilibrium with no information revelation is less likely when banks have a longer horizon if the initial probability estimate ($P_1$) is less than a threshold.

**Proof:**

(5.a) We first show that the minimum interest rate required by the bank to give loan to a potential industrial entrepreneur is less with a longer time horizon. Denote the minimum interest rate required by the bank with Bayesian learning by $i^b_1(l)$. Then the solution for $i^b_1(l)$ is given by:

$$i^b_1(l) = (1 + i^a) \left[ \frac{1}{\beta} + \frac{1}{P_1} \right] - \frac{P_2^s}{\beta}(1 + i^a)$$  (35)

So we have:

$$i^b_1 - i^b_1(l) = \frac{1}{\beta} [P_2^s (1 + i^a_2) - (1 + i^a)] > 0$$  (36)
The last inequality follows from the fact that \( P_2 s (1 + i_2 s) > (1 + i^a) \) which, in turn, follows from the definition of \( i_b^h (l) \).

So the minimum first period interest rate required by the bank is lower when the bank takes into account the value of information generated by the first industrial loan for its loan decision in the second period. Now observe that the maximum interest rate an entrepreneur is willing to pay and still take a loan, i.e. \( i_e^c \) does not depend on the time horizon of the bank. So it is possible to find appropriate conditions under which the following inequality holds \( i_b^h (l) < i_e^c < i_b^h \). Then the economy is in type I equilibrium when the bank has a myopic horizon (i.e., provides loan to potential industrial entrepreneur only once) but not in an economy where banks act as a longer term agents. Observe that \( i_b^h \) does not depend on the return on the industrial activity, but \( i_b^h (l) \) does. This is because a profit maximizing bank extracts all of the surplus from a successful entrepreneur at the initial period of financing so that we can set \( i_s^a = r_m \). Now it is straightforward to show that the inequality \( i_b^h (l) < i_e^c < i_b^h \) holds if the productivity of the industrial sector is low enough to satisfy the following

\[
r_m < \min \{ \Omega_1, \Omega_2 \}
\]

where

\[
\Omega_1 = \frac{1}{(1 + \beta) P_1} [\beta (1 - P_1) + r^a (\beta + P_1)]
\]

\[
\Omega_2 = \left[ \frac{\beta \bar{\beta}}{\beta (1 + \beta) + \beta P_2} \right] \left\{ \frac{i^a}{\bar{\beta}} + r^a \left( \frac{P_1 + \beta}{P_1 \beta} \right) \right\}
\]

Q.E.D.

(5.b) Since \( i_b^h (l) < i_b^h \), we need to show that there exists industrial activities with a rate of return such that the following inequality holds: \( i_b^h (l) < r_m < i_b^h \), so that the liquidity constraint is binding when the bank is myopic, but it is not binding if the bank has a longer horizon. It is easy to show that the inequality \( i_b^h (l) < r_m \) implies (setting \( i_s^a = r_m \))

\[
r_m > \Omega_3 \text{ where } \Omega_3 = (1 + i^a) \left( \frac{P_1 + \bar{\beta}}{P_1 (P_2 + \bar{\beta})} \right) - \frac{P_2 s}{P_2 s + \beta}
\]

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The interval $[\Omega_3, i_1^b]$ is non-null if the following holds

$$(1 + i^a) > \Omega_4 \equiv \frac{P_1 \beta}{P_2^s - P_1}$$  \hspace{1cm} (37)$$

Observe that $\Omega_4 > 0$ if $P_1 > 0$ and

$$\lim_{P_1 \to 0} \Omega_4 = 0$$

So there exists a critical threshold $P_1 > 0$ such that $\forall P_1 < P_1$ the interval $[\Omega_3, i_1^b]$ is non-null. Q.E.D.

As noted before, to isolate the effects of a longer horizon *per se*, the above discussion assumes that the bank can not appropriate rent on good entrepreneurship in the third period. But under *Financial Restraint* the bank will be able to reap rents on good entrepreneurs in the third period. As a result, the minimum interest rate required by the bank in the first period for giving loan to a prospective industrial entrepreneur will be even smaller and thus the accumulation of information capital about entrepreneurial capability in an economy under *Financial Restraint* is likely to be much higher compared to an economy where banks suffer from short-termism due to rent dissipation in a competitive credit market.

Also, it is interesting to note an implication of the equation (36). It is straightforward to check that the interval $[i_1^b - i_1^s(t)]$ is a positive function of the initial probability estimate of a good entrepreneur ($P_1$). This follows from observing that $\frac{dP_2^s}{dP_1} > 0$. One interpretation of this result is that the benefits from a longer horizon depends positively on the initial conditions of an economy implying a form of complementarity between the policies of *Financial Restraint* creating franchise value for banks and the initial endowment of the entrepreneurial capability in an economy (as captured by a higher value of $P_1$).

(5.2) Policy Implications

The above discussion underscores the importance of ensuring that the banks act as long term agents and take into account the value of the information generated by the entrepreneurial experiments financed by their lending in a given period. As we already noted, the policies of entry
restraint and interest rate regulations suggested by the Financial Restraint approach (Hellman et. al. (1997, 2000)) to financial sector development are designed to create franchise value for the banks and thus provide incentives to control moral hazard and looting, and extend the time horizon of the banks. A Laissez Faire credit market, in contrast, fails to create franchise value endogeneously except for special cases (see Dinc (2000), for an example), and thus is prone to the problems of short-termism and crises. Our analysis thus complements the analysis of Hellman et. al. (1997, 2000) and strengthens the case for Financial restraint. One interesting conclusion from our analysis is that the control of deposit interest rate might be a potent policy instrument for entrepreneurial discovery and accumulation of information capital regarding entrepreneurial talents in an economy. As we already noted, deposit rate control can also be an important instrument for controlling moral hazard in banking (along with capital requirements) (see Hellmann et. al. (2000)). One concern against such a policy is that it might reduce the supply of savings and thus restrict investment due to a paucity of investible funds. This concern is, however, misplaced, as the available evidence clearly shows that the interest rate elasticity of savings is very low as long as the real interest rate is moderately positive and, in most cases, is not statistically significant (see Agenor and Montiel (1999) and Bandiera et. al. (2000)). One should, however, be careful about not pushing an economy to very low deposit interest rate as the supply of savings (intermediated through banks) may be very sensitive around zero real interest rate. This high sensitivity is due to the fact that a lot of inflation hedges (like land, gold) become attractive as savings instruments when the real interest rate on bank deposits is close to zero or negative. Our analysis also points to the need for reducing the transactions costs of a bank and thus points to an important role for modern technologies like computerized information management and modern accounting systems.

(6) Conclusions

This paper, using simple models of occupational choice, shows that financial liberalization in the form of competition in the banking sector and free market determination of interest rates is likely to be a constraining factor for the development of industrial entrepreneurship in a developing economy. The analysis focuses on two issues: (i) poaching externalities due to competition for good entrepreneurs, and (ii) undervaluation of the information generated by the entrepreneurial experiments by a competitive bank because of a myopic horizon which results from a lack of fran-
chise value in a competitive banking sector. We show that poaching externality in a competitive banking can result in a form of binding liquidity constraint and thus banks in a competitive market may fail to finance a potential industrial entrepreneur, even though such financing is socially desirable. Moreover, a competitive bank suffers from short-termism, and as a result, does not take into account the value of the information generated by an entrepreneurial experiment. This dilutes the incentives for banks to experiment with untested entrepreneurs and further reduces the supply of financing for fresh industrial entrepreneurs relative to a socially efficient level. The binding liquidity constraint under a competitive banking also induces the entrepreneurs to choose socially inefficient projects with high initial returns but little or no dynamic learning effects. A policy of limited duration monopoly awarded to a first entrant bank that enters into a hitherto unserved area and invests in entrepreneurial discovery can avoid such no-industrial-financing trap and inefficient project choices by the entrepreneurs. Our analysis points to the advantages of a two-track policy where the temporary entry restriction policies are implemented in the industrial sector, but competition is preserved in the lending to agricultural sector. Under such a two-track entry restraint, control of deposit interest rate can be an important policy instrument in inducing the banks to experiment with potential industrial entrepreneurs. The conclusions of this paper thus bring into focus a fundamental conflict between the two corner-stones of the current consensus in development policy: financial liberalization and private sector led development. Since the development of industrial entrepreneurship is at the heart of a private sector led development, the results presented here suggest that policies of Financial Restraint instead of Laissez Faire financial liberalization are appropriate for the success of a decentralized private sector led development strategy.
References


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Figure 1
Figure 2

Don't Take Loan

P

Take Loan

B

GE

N

BE

0, $r^u - i^u$

$P$, $r^u - i^u$

$P_0$, $r^u - i^u$

$r^u - i^u$, $r^u - i^u$
Figure 3
Figure 4

Diagram showing the flow of a loan with nodes labeled B, GE, N, BE, and arrows indicating the direction of the loan. The diagram includes labels such as $1 + i^a$, $1 + i^b$, $1 + i^c$, and $1 + i^d$. The diagram indicates the process of a loan being revealed and the different paths it can take.