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Abstract

This paper argues that there is a fundamental conflict between financial liberalization and private sector led development strategy in developing countries. Using a simple model of occupational choice with moral hazard, it shows that under financial liberalization banks may (i) fail to finance new entrepreneurs because of poaching externality, and (ii) systematically favor projects with front-loaded returns at the expense of projects with strong learning effects. We identify two types of policies that are helpful in escaping from a 'no entrepreneurial experimentation equilibrium': intersectoral and intertemporal policies. Among intersectoral policies, a deposit rate ceiling, or a tax on the deposits coupled with a 'contingent subsidy' to the new industrial financing (but not interest rate subsidy) may be helpful for entrepreneurial discovery. The intersectoral policies are, however, not effective in weeding out short-termism in project choice. Among intertemporal policies, a dual track policy where competition is preserved in the lending to competing activities (agriculture) but limited duration monopoly is awarded to industrial lending is shown to be effective for both the discovery of new industrial entrepreneurs and tackling short-termism in project choices.

JEL Codes: G2, O16, E4, L26

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(1) Introduction

The *Financial Liberalization* approach that grew out of the critique of *Financial Repression* in developing countries in 1950s and 1960s (McKinnon (1973) and Shaw (1973)) has become a corner-stone of the market-oriented development strategy of the last few decades. Financial liberalization advocates a free market determination of interest rates and increased competition in the financial sector. A liberalized and competitive financial market is 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 by early 1980s. 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.[2] As a corollary, the implications of financial liberalization for entrepreneurial development are treated only tangentially, if at all. This paper develops a simple two-sector occupational choice model with moral hazard to explore what kind of financial sector reform policies are appropriate for discovery of entrepreneurial talents and fostering learning in the industrial sector of a developing economy. Our analysis shows that, contrary to the current consensus, financial liberalization may constrain the development of private sector as it stifles bank's incentives for entrepreneurial experimentation. We identify a set of financial sector policies called *Financial Restraint* that might be useful for entrepreneurial discovery and learning in developing countries.[3]

This paper addresses two issues central to the development of industrial entrepreneurship in developing countries where the entrepreneurial base with proven capability is very small. They are: (i) the discovery of entrepreneurial talents, and (ii) incentives for entrepreneurial learning. In contrast to the standard adverse selection models of credit markets in the tradition of Stiglitz

[2]There 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.

[3]"Financial Restraint" creates *rent opportunities* for private agents so that they are induced to take socially beneficial actions. It is thus fundamentally different from financial repression where government extracts rents from private sector through state owned banks and seignorage, and thus may hinder financial deepening. Under financial repression, the interest rates are kept so low that the real interest rate may be negative, as was the case in many developing countries during 1960's and 1970's. In contrast, the financial restraint advocates mild interest rate controls so that the real interest rate is positive and not pushed too low. For a more complete discussion of the financial restraint, please see Hellmann, Murdock, and Stiglitz (1997)).

and Weiss (1981), we start from the observation that the first order problem for the development of industrial entrepreneurship in a developing country is one of revelation and accumulation of information capital, not the asymmetry of information between the bank and an entrepreneur. In the standard models of credit market, the entrepreneur knows her own type, but the bank does not. However, in a developing country, the set of people who know their entrepreneurial type is extremely small. The more realistic assumption, in this context, is one of 'symmetric ignorance' where both bank and the potential entrepreneur do not know the entrepreneurial type.[4] The critical policy issue from this perspective is what kind of financial sector reform will foster experimentation with new entrepreneurs by the banks. The discovery of good entrepreneurs from a vast pool of potential candidates in a developing country may, however, prove extremely difficult due to number of factors including lack of collateral, risk aversion, and time preference (impatience) as emphasized in the traditional literature on occupational choice and entrepreneurship. While acknowledging the importance of these factors, we focus on the implications of *inalienability* (Hart and Moore, 1994) of entrepreneurial capital which has largely been ignored in the discussion of financial sector reform policies in developing countries. The return to the discovery of a good industrial entrepreneur is spread over time, and the banks might find it difficult to appropriate adequate share of the future returns to justify the risk taking because of *inalienability* of entrepreneurial capital. This appropriability problem becomes especially severe as the banking sector becomes more competitive. The negative effects of competition in the financial sector on new entrepreneurs due to *poaching externality* (i.e., bidding for good entrepreneurs once the information is revealed) is well recognized in the literature on developed countries (for a survey, see Cetorelli (2001)).[5] More important in the context of developing countries is the implication that, contrary to the privatization-financial liberalization view of development, financial liberalization

[4]This symmetric ignorance assumption is, however, standard in the occupational choice literature in the tradition of Kanbur (1979) and Kihlstrom and Laffont (1979). In addition to the realism, the assumption of symmetric ignorance is important for deriving clear analytical results. Note that the implications of adverse selection depends on the precise information assumption. Under the standard Stiglitz-Weiss (1981) case where the banks know only the expected returns, the market outcome leads to underinvestment. But, under the alternative assumption that the banks know the return (if successful) but not the probability of success of an entrepreneur, the market outcome leads to over-investment (see DeMeza and Webb, 1987). In contrast, the assumption of symmetric ignorance allows us to focus on the implications of inalienability of entrepreneurial capital and the resulting poaching externality in a clean way.

[5]Increased competition in the product market may also be detrimental to the development of industrial entrepreneurship in a developing economy. For an interesting analysis using the general equilibrium framework of occupational choice a la Kanbur (1979, 1981), see Grossman (1984). Grossman (1984) shows that free trade can reduce the pool of industrial entrepreneurs in LDCs relative to autarky when there is no efficient risk sharing mechanism to start with, and, in equilibrium, the developing economy is an importer of the industrial good.

may not be conducive to the discovery of entrepreneurial talents in developing countries as it significantly increases the degree of competition in the financial sector. The second issue under focus in this paper is that of *short-termism* in project choice by private banks which is likely to retard entrepreneurial learning. That the private banks are averse to financing long-term industrial investment is widely discussed in the policy literature. The so-called *development banks* were initially conceived in the developing countries to provide finance for long-term industrial projects precisely because of the problem of short-termism, although their performance has been largely discouraging[6]. The projects with strong learning effects that result in significant productivity gains later but may not yield adequate returns initially are likely to be redlined in a regime of financial liberalization. The reason again is that the banks are unwilling to finance learning if it cannot ensure an adequate share of the future stream of profits because of poaching in a competitive financial sector. Learning enriches human capital of an entrepreneur, but absence of indentured servitude, the banks cannot claim "property rights" to this human capital. The upshot of the above discussion is that the two corner-stones of the prevailing consensus in development policy, private sector led development and financial liberalization, seem to work at cross purposes.

This paper thus reopens the debate on the appropriate financial sector reform policies in developing countries by focusing on the development of industrial entrepreneurship as a process of discovery and learning. In a recent paper, Hasuman and Rodrik (2003) analyze development as a self-discovery process in a related but different context.[7] The focus of Hausman and Rodrik (2003) is on the discovery of cost of production of new products in a developing country and the attendant problem of rent dissipation due to imitation by the followers once a suitable product is discovered. In contrast, our focus is on the discovery of entrepreneurial talents and the rent dissipation because of competition in the banking sector. In the Hausman and Rodrik (2003) analysis, the financing of the entrepreneurs is not addressed. Implicit in their analysis is the assumption that once a suitable product is discovered (like ready-made garments in the case of Bangladesh), the potential entrepreneurs have little difficulty in managing the finance to enter into the sector.[8] Our analysis focuses on the fact that even if there is no competition from imitative entrepreneurs, the competition among banks resulting from financial liberalization can create rent

[6]For an interesting analysis of development banks, See Aghion (1999).

[7]For an early contribution that emphasizes the role of active learning, see Hoff (1997).

[8]This assumption is a good description of the case of ready made garments export industry in Bangladesh discussed in Hausman and Rodrik (2003). The government owned banks in Bangladesh provided the credit required by the entrepreneurs setting up ready made garments factories at very favorable terms. However, the performance of the state owned banks in Bangladesh had been discouraging, in general (for a discussion, see Sobhan, 1990).

dissipation problems. In the Hausman and Rodrik (2003) world, the rent dissipation negatively affects the ex ante incentives of the potential entrepreneurs to experiment with new products, and thus it is a *demand side* failure in the discovery process. In this paper, the failure in the discovery process comes from the *supply side* of the credit market, the banks may not be willing to experiment with new entrepreneurs because of poaching externality.

The analysis presented in this paper has important policy implications. It shows that, contrary to the financial liberalization view, measured interventions in the financial sector may be appropriate for development of an industrial entrepreneurial class at an early stage of development. We show that there are two types of policies that can help discover entrepreneurial talents: (i) policies that affect the intersectoral margin (agriculture vs. industry), (ii) policies that affect the intertemporal calculus of the bank. Under competition in banking, it is not possible to tax the agricultural lending to tilt the intersectoral returns in favor of the industrial lending. Interest rate subsidy, a common policy instrument, may be counterproductive when moral hazard is important in the entrepreneurial discovery process. An indirect but effective policy instrument that affects the intersectoral margin is the deposit interest rate; any policy that reduces the deposit interest rate (like a deposit rate ceiling as advocated in the Financial Restraint literature (see Hellmann et. al, 1997), or a tax on deposit rate) can be effective in encouraging banks to lend to new industrial entrepreneurs. A subsidy contingent on the success of an industrial project is also effective in inducing the banks to lend to new entrepreneurs. However, when such subsidy is paired with a revenue-neutral tax on the deposit rate is a better policy if government capability in a country is not too limited.[9] The policies that affect the intersectoral margin are, however, ineffective in tackling the problem of short-termism in project choices. A dual-track policy regime where restriction on competition is implemented in the industrial lending but competition is preserved in agricultural lending is shown to be effective in both discovery of new industrial entrepreneurs and implementing projects with strong learning effects. 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 temporary entry restrictions and mild interest rate controls (along with capital requirements) enhance the franchise value of a bank, and thus provide incentives to control moral hazard. This makes the financial sector less prone to crisis.[10]

[9]The subsidy policies may, in general, be more susceptible to corruption. The suitability of a policy instrument for any given country has to take into account the constraints imposed by the capability of the government. We discuss the implications of corruption for policy instrument choice later in the paper.

[10]The argument that a deposit rate ceiling can improve the stability of the financial sector has a long intellectual

They also show that mild deposit rate control and entry restraint can induce banks to mobilize savings from previously unexplored segments of an economy (Hellmann, Murdock, Stiglitz, 1996. See also Chiappori et. al. (1995)).

The rest of the paper is structured as follows. Section 2 places the present research in proper perspective by tracing out its intersections with the existing literature in greater detail. Section 3 presents a two sector occupational choice model with moral hazard in industrial activity. The subsection (3.1) considers a simplified version of the model without moral hazard and discusses the negative effects of poaching externalities in competitive banking on entrepreneurial discovery. The following sub-section (3.2) sets up the details of the model with moral hazard in industrial activity. Section 4, arranged in a number of subsections, presents the main results on no-industrial-experimentation trap under financial liberalization and alternative policies for escaping from such a trap. The next section (5) is devoted to the analysis of short-termism under alternative policies. Section (6) discusses the implications of government capability differences across countries for the choice of appropriate policy. 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) Related Literature

The standard approach to the analysis of entrepreneurial development is that of *occupational choice* models (Kihlstrom and Laffont, 1979; Kanbur, 1979, 1981; 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 safe wage labor and a 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. However, the untenability of the assumption of a perfect capital market was soon recognized in the literature (see for example, Fazzari et al. 1988, Stiglitz, 1992, Hubbard, 1998, Banerjee, 2004). The subsequent literature, both theoretical and empirical, placed increasing emphasis on the critical role played by access to financial capital. On theoretical level, the contributions of Shorrocks (1988), Evans and Jovanovic (1989), Holtz-Eakin et al. (1994), and Eswaran and Kotwal (1990) show that differential access to capital results in differential risk-bearing capacity and thus lead

pedigree. See, for example, Tobin, 1970.

to different occupational choice even though time preference and risk aversion parameters are identical across agents. This paper departs from the standard occupational choice model of entrepreneurship in a critical way by assuming that both the entrepreneur and the bank are risk neutral.

The critical difference of our model from the standard Stiglitz-Weiss (1981) type credit rationing models is that a potential entrepreneur may be red-lined from the credit market even in the absence of any informational asymmetry. In contrast to the adverse selection models, the assumption of symmetric ignorance and the associated problem of discovery 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 decentralized market solution 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. In contrast, in the case of discovery of entrepreneurs, it is not possible to design a patent right for the financier bank. Because it 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 poaching externality and commitment failure addressed here has close similarity to a branch of literature in labor economics on *general training* (see Becker, 1962, Oi (1962), and Stiglitz, 1975). 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. The importance of poaching externality in the context of credit market was emphasized by Mayer (1988). A more recent contribution is Petersen and

Rajan (1995) where they discuss the negative effects of competition in banking sector on small business financing in USA due to bidding for the good entrepreneurs. However, the focus and the objectives of our analysis is very different from theirs. Unlike Petersen and Rajan (1995), we are interested in analyzing the efficacy of alternative financial sector reform policies (*financial liberalization* versus *financial restraint*) for entrepreneurial discovery and tackling short-termism in project choice, especially in the context of developing countries.

(3) The Model

The economy consists of two sectors called agriculture and industry.[11] 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 industry is lumpy and requires a fixed amount of financial capital which is normalized to 1. The return on industrial investment depends on the characteristics of the entrepreneur. There are two types of entrepreneurs: good and bad. In case of a good entrepreneur, the success of the project depends on the effort chosen $E \in [0, 1]$. The cost of effort to the entrepreneur is $C(E) = \frac{\alpha}{2}E^2$. The return from the industrial investment for a successful entrepreneur is $R^m > R^a$ and $R^m > 1$.[12] We assume that a good entrepreneur does not suffer from moral hazard in effort choice if she can finance the industrial investment with her own funds. As shown below, this implies that $\alpha \leq R^m$. Under this restriction on the intensity of moral hazard, the effort choice of a good type entrepreneur is distorted by a debt contract, but $E^* = 1$ under self financing. If the investment is undertaken by a bad type, the gross return (before deduction of principal and interest charges) from industrial investment is zero irrespective of the effort level chosen. So a failed entrepreneur does not repay anything to the bank. The above assumptions imply that the effort and entrepreneurial type are strong complements. There is no asymmetry of information between the bank and the entrepreneur regarding the distribution of entrepreneurial talents and thus they entertain identical estimate of probability of drawing a good entrepreneur. We denote this common estimate by P.

A bank can lend to four groups of people: (i) safe "agricultural sector", (ii) industrial entrepreneurs already proven good, (iii) new industrial entrepreneurs, or (iv) failed industrial entrepreneur. The bank maximizes the expected return on its loan portfolio. We denote the interest

[11] We emphasize here that "agriculture" is meant to represent any competing activity where the uncertainty about entrepreneurial type is not important. This may include sectors like real estate and trading, among others.

[12] This last condition that $R^m > 1$ is needed to rule out negative profit maximizing interest rate by a monopolist bank.

rate on agricultural loan by i^a. The deposit interest rate at which the banks can get funds in period t is denoted by i_t^d.[13]

A 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 $\hat{w} \geq 0$. The $\hat{w}$ may reflect the return on agriculture without any purchased inputs (like traditional farming without fertilizer, pesticide etc for which no bank loan is needed). Note that under competition in the agricultural lending, the return on agricultural loan in any given period t may be higher than the reservation payoff, i.e., $Y_t^a = R^a - i_t^a = R^a - i_t^d \geq \hat{w}$. The bank that finances the discovery of entrepreneurial type observes the type of an entrepreneur at the end of the first period when the information is revealed. An entrepreneur who is successful in the industrial activity can credibly reveal its type to the outside banks by incurring a cost $\tilde{C}$ at the beginning of the next period. One way to think about $\tilde{C}$ is that it represents the market structure in banking, the smaller is the number of banks around, the higher is $\tilde{C}$. In this interpretation, $\tilde{C}$ is a negative function of the number of banks competing in the industrial sector, i.e. $\tilde{C}(N_b)$ and $\tilde{C}'(N_b) < 0$, where N_b is the number of banks active. We assume that there exists a threshold $\hat{N}_b \geq 1$ such that $\forall N_b > \hat{N}_b$, the entrepreneur finds it optimal to incur the cost and thus reveal its type to the outside banks. We also assume that in a perfectly competitive banking market, the entrepreneur does not need to incur any cost to reveal her type. An unsuccessful industrial entrepreneur can re-apply for the industrial loan or go back to the agricultural sector in the second period.[14] To keep the model as simple as possible, we abstract from savings-investment decision, and assume that the entrepreneur needs to borrow the whole amount for industrial investment in the second period even though it can use part of the first period income to incur the information revelation cost $\tilde{C}$ at the beginning of the second period.

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

[13] We assume, for simplicity, that the potential entrepreneurs have zero savings. The supply of savings is generated by households which are not explicitly modeled.

[14] Note that the bank will prefer an untested entrepreneur to finance industrial activity over a failed one. So if at the initial equilibrium there is no financing for the new industrial entrepreneur, it means that the failed entrepreneurs are also redlined. Since we are interested in analyzing what policies can induce the banks to provide loans to new industrial entrepreneurs starting from a no-industrial finance trap, we concentrate on the case where a failed entrepreneur goes back to the agriculture in the second period.

industrial project.

The time line in the model is as follows: at the beginning of period 1, the potential entrepreneur decides whether or not to apply for industrial loan. If she applies and the loan is approved by the bank, she chooses the optimal effort given the common estimate of the probability of a good entrepreneur in the population. At the end of the first period, the returns to the investment accrues and the information about the entrepreneurial type is revealed to the entrepreneur herself and the financier bank at zero cost, but not to the other banks. At the beginning of the second period, the entrepreneur, if a good type, decides whether or not to switch banks by incurring the information revelation cost $\tilde{C}$. Assuming that $\tilde{C}$ is small enough, i.e., the banking market structure is competitive enough, it is optimal to reveal information and apply for industrial loan in the second period. A failed entrepreneur, on the other hand, goes back to agricultural sector at the beginning of the second period.

(3.1) A Benchmark: Entrepreneurial Discovery in the Absence of Moral Hazard

We first consider the simple case where there is no effort choice and thus no moral hazard in industrial activity, i.e. set $E = 1$. The rate of return in this case is R^m when the entrepreneur turns out to be a good type. This implies that the bank does not worry about moral hazard due to high interest rate. The main result in this simple setting is that even without the limits on interest rate arising from moral hazard, a competitive banking economy can be trapped in an equilibrium where the banks refuse to finance the discovery of industrial entrepreneurs. This is due to *binding liquidity constraint* faced by an entrepreneur. The liquidity constraint results from the fact that the entrepreneur cannot credibly commit to share the returns to good entrepreneurship in the second period as the entrepreneurial capability is *inalienable*; the entrepreneur finds it optimal to switch banks in the second period. Let i_1^b stand for the minimum first period interest rate needed by the bank for giving loan to the new entrepreneur. From the individual rationality constraint of the bank, we have:

$$i_1^b = \frac{1 + i^a}{P} - 1 \tag{1}$$

Denote the maximum interest rate that the entrepreneur is willing to pay (ignoring the liquidity concerns) and still take the industrial loan by i_1^e. From the participation constraint of the

entrepreneur, we have:

$$i_1^e = R^m \left(\frac{1+\beta}{\beta} \right) - R^a \left(\frac{P+\beta}{\beta P} \right) + \frac{i^a}{P} \tag{2}$$

where $\beta = 1 + \rho$ is the inverse of the discount factor of the entrepreneur. We concentrate on the case where $i_1^e \geq i_1^b$. Then we say that the bank is unwilling to finance a potential new industrial entrepreneur because of *binding liquidity constraint* if the following holds:

$$i_1^e \geq i_1^b > R^m \tag{3}$$

Note that the entrepreneur is always liquidity constrained in a liberalized competitive banking economy in the sense that the maximum interest rate she is willing to pay is higher than the maximum she can credibly commit to, i.e.,

$$i_1^e > R^m \tag{4}$$

But the liquidity constraint can be *non-binding* allowing the bank to give loan to the new industrial entrepreneur. This happens when we have

$$i_1^e > R^m \geq i_1^b \tag{5}$$

The following result follows from the definition of a binding liquidity constraint as in inequality (4) above.

Proposition 1 *In a competitive banking economy: the likelihood of a binding liquidity constraint is, ceteris paribus, higher (i) the lower is the productivity of the industrial sector, R^m, (ii) the lower is the initial probability estimate of a good entrepreneur, P, and (iii) the higher is the agricultural interest rate, i^a.*

The developing countries are, in general, characterized by low values of P and R^m compared to a developed economy. The return to industrial activities common in developing countries like textile or ready-made garments are relatively low.

(3.2) The Model with Moral Hazard

We now turn to the analysis of the more general case when the bank's ability to increase the first period interest rate might be limited by the fact that a higher interest rate reduces the

probability of success (optimal effort) by a good entrepreneur in the industrial activity. We first provide an analysis of the optimal effort choice when the entrepreneur can finance the industrial investment with self financing. The case of self-financing provides a good benchmark to understand the costs of debt contract arising from moral hazard. Then we analyze the optimal effort choice of an entrepreneur under a debt contract.

Optimal Effort Choice Under Self-financing

The time consistent optimal effort choices by an entrepreneur who invests own funds in the industrial activity are denoted by E_1^{*s} and E_2^{*s}. The second period optimal effort choice is solution to the following:

$$\begin{aligned} Max_{E_2} Y_2^s &= \left[E_2 R^m - \frac{\alpha}{2} E_2^2\right] && (6) \\ E_2^{*s} &= \frac{R^m}{\alpha} && (7) \\ Y_2^{*s} &= \frac{R^m}{2}; \text{ assuming } \alpha \leq R^m && (8) \end{aligned}$$

Note that if the degree of moral hazard is so high that $\alpha > R^m$, the optimal effort level in second period is less than one and thus the probability that the industrial project succeeds is less than one for a self-financing entrepreneur who has already been proven to be of good type. To focus on the case where moral hazard is driven by debt contract, we assume that $\alpha \leq R^m$. This implies that for a self financed entrepreneur the optimal effort choice is at a corner solution when $\alpha < R^m$ because the upper bound on the effort level is equal to one.

Now the optimal (and time consistent) first period effort choice is solved from the following:

$$\begin{aligned} Max_{E_1}\ Y^s &= Y_1^s + PE_1 \frac{Y_2^{*s}}{\beta} + (1 - PE_1)\frac{R^a}{\beta} \\ Y_1^s &= PE_1 R^m - \frac{\alpha}{2} E_1^2 && (9) \\ \text{Solutions are} \quad &: \quad E_1^{*s} = \frac{P}{\alpha}\left[R^m + \frac{1}{\beta}\left(Y_2^{*s} - R^a\right)\right] && (10) \\ Y_1^{*s} &= PE_1^{*s} R^m - \frac{\alpha}{2}\left(E_1^{*s}\right)^2 && (11) \end{aligned}$$

It is efficient for an unproven entrepreneur to invest in the industrial activity if the discounted

expected returns is higher than the returns from investing in the competing activity, i.e., agriculture. This implies that the following holds:

$$Y^{*s} = Y_1^{*s} + PE_1^{*s}\frac{Y_2^{*s}}{\beta} + (1 - PE_1^{*s})\frac{R^a}{\beta} \geq R^a + \frac{R^a}{\beta} \tag{12}$$

In the rest of the paper, we assume that the investment in the industrial activity is efficient in the sense of inequality (12) above.

The Optimal Effort Choice Under a Debt Contract

Time consistency requires that the entrepreneur solves the following problem first:

$$Max_{E_2} Y_2 = \left[E_2 (R^m - i_2) - \frac{\alpha}{2}E_2^2\right] - \tilde{C} \tag{13}$$

The solutions to the above problem (13) are:

$$E_2^*(i_2) = \frac{1}{\alpha}(R^m - i_2) \tag{14}$$

$$Y_2^*(i_2) = \frac{1}{2\alpha}(R^m - i_2)^2 - \tilde{C} \tag{15}$$

Note that $\tilde{C} = 0$ under perfect competition and monopoly in banking.

The optimal (time consistent) first period effort choice is solved from:

$$Max_{E_1}\ Y = Y_1 + PE_1\frac{Y_2^*}{\beta} + (1 - PE_1)\frac{Y_2^a}{\beta} \tag{16}$$

$$Y_1 = PE_1(R^m - i_1) - \frac{\alpha}{2}E_1^2 \tag{17}$$

$$Y_2^a = R^a - i_2^a \tag{18}$$

The optimal first period effort is given by:

$$E_1^* = \frac{P}{\alpha}\left[(R^m - i_1) + \frac{1}{\beta}(Y_2^* - Y_2^a)\right] \tag{19}$$

(4) Financial Sector Reform for Entrepreneurial Development

(4.1) Financial Liberalization and Entrepreneurial Stagnation

Proposition 2

Consider a free entry banking economy where the banks would finance new industrial entrepreneurs if the success were certain, i.e., $P = 1$. Such an economy is trapped in a no information revelation equilibrium with no credit to the new industrial entrepreneurs if the probability estimate belongs to an open interval $P \in \left(\check{P}, \tilde{P}\right)$, even though it is efficient for the new entrepreneurs to invest in the industrial activity.

Proof:

Under free entry, the second period interest rate on industrial lending i_2^c is determined from the zero profit condition:

$$\begin{aligned} \Psi_2 &= E_2^*(i_2^c)\,(1+i_2^c) - 1 = i_2^d \\ &\Rightarrow \frac{(R^m - i_2^c)}{\alpha}\,(1+i_2^c) - 1 = i_2^d \\ i_2^c &= \frac{1}{2}\,(R^m - 1) - \frac{1}{2}\sqrt{(R^m+1)^2 - 4\alpha\left(1+i_2^d\right)} \end{aligned} \tag{20}$$

We assume that $(R^m+1)^2 - 4\alpha\left(1+i_2^d\right) > 0$.[15] Note that the competitive interest rate is given by the lower of the two solutions satisfying the zero profit condition. Denote the profit maximizing interest rate for a bank in the first period by i_1^{*c} when the second period interest rate is given by i_2^c above in equation (20):

$$\begin{aligned} i_1^{*c} &= ArgMax_{i_1}\ \Psi_1\,(i_2^c) = PE_1^*(i_2^c)\,(1+i_1) - 1 \\ i_1^{*c} &= \frac{1}{2}\,(R^m - 1) + \frac{1}{\beta}\left[\frac{1}{2\alpha}\,(R^m - i_2^c)^2 - Y_2^a\right] \qquad (21) \\ &= \frac{1}{2}\,(R^m - 1) + \frac{1}{2\beta}\,[Y_2^c - Y_2^a] \qquad (22) \end{aligned}$$

Now denote the maximum possible return (assuming the bank chooses the profit maximizing interest rate i_1^{*c}) on a first period loan when the bank faces competition in the second period by

[15] This inequality implies that we are considering an economy where a monopoly bank would make profit on a successful entrepreneur in the second period.

Ψ_1^{*c} :

$$\begin{aligned}\Psi_1^{*c} &= PE_1^*(i_1^{*c}, i_2^c)\,(1+i_1^{*c}) - 1 \\ &= \frac{P^2}{\alpha}\left[(R^m - i_1^{*c}) + \frac{1}{\beta}\,(Y_2^c - Y_2^a)\right](1+i_1^{*c}) - 1 \end{aligned} \tag{23}$$

The threshold probability estimate $\tilde{P}$ which makes the bank indifferent between new industrial lending and lending to agricultural lending is given by the following:

$$\begin{aligned}\Psi_1^{*c}\left(\tilde{P}\right) - i_1^a &= 0 \\ \frac{\tilde{P}^2}{\alpha}\left[(R^m - i_1^{*c}) + \frac{1}{\beta}\,(Y_2^c - Y_2^a)\right](1+i_1^{*c}) &= 1 + i_1^a \end{aligned} \tag{24}$$

Given the assumption that it is profitable to lend to the new industrial entrepreneurs in a competitive banking economy when there is no uncertainty about the entrepreneurial type in the first period, we have $\tilde{P} < 1$, because in this case the following inequalities hold (assuming that $i_1^a > 0$):

$$\begin{aligned}\Psi_1^{*c}\,(P=1) &> i_1^a \\ \Psi_1^{*c}\,(P=0) &< i_1^a \end{aligned}$$

Now the bank refuses to finance a new industrial entrepreneur if the probability estimate P is such that the highest possible return on a first period loan when facing competition in the second period is lower than the return on the competing activity in the bank's loan portfolio (i.e., agriculture). Note that $\Psi_1^{*c}(P)$ is a positive function of the probability estimate P, because i_1^{*c} and i_2^c are independent of P. This implies that if $P < \tilde{P}$, the expected return from the new industrial lending is lower than the return on agricultural lending i_1^a.

The requirement that the financing of new industrial entrepreneurship is efficient implies that the initial probability estimate cannot be smaller than a threshold (denoted as $\check{P}$), where $\check{P}$ is defined by the following equation (individual rationality constraint of a self-financed entrepreneur):

$$Y^{*s}\left(\check{P}\right) = Y_1^{*s} + \check{P}E_1\frac{Y_2^{*s}}{\beta} + \left(1 - \check{P}E_1\right)\frac{R^a}{\beta} = R^a + \frac{R^a}{\beta}$$

So if the initial probability estimate of successful industrial entrepreneurship in a free banking

developing economy is such that $P \in \left(\check{P}, \tilde{P}\right)$, then the banks do not finance the new industrial entrepreneurs, even though such investment would be efficient. QED.

(4.2) Financial Restraint: Policies for Development of Industrial Entrepreneurship

A major focus of this paper is on identifying financial sector policies that can help discover the entrepreneurial talents in a developing country that is trapped in an inefficient no information revelation equilibrium as characterized in proposition (2) above. As noted before, the current emphasis on financial liberalization in the form of increased competition in the banking sector and market determined interest rates are likely to be counterproductive if the issue is how to induce banks to experiment with new industrial entrepreneurs. There are two types of policies that one might design to make financing of new industrial entrepreneurship possible starting from such a no new industrial financing equilibrium: (1) inter-sectoral policies, and (2) inter-temporal policies. The intersectoral policies are aimed at improving the relative profitability of lending to new industrial entrepreneurs, while the intertemporal policies aim to increase the share of the future rent on good entrepreneurship that goes to the bank.

(4.2.1) Inter-sectoral Policies

A simple Pigouvian policy that alters the intersectoral profitability in favor of new industrial lending is a subsidy to the bank for new industrial financing. An interest rate subsidy, however, is not an appropriate policy instrument in the presence of the moral hazard in the new industrial activity. Because the optimal (i.e., profit maximizing) interest rate of a bank is a positive function of the rate of interest rate subsidy in the relevant range.[16] To see this consider the expected return function for the bank when the interest rate subsidy provided by the government is $\hat{\sigma}_1 > 0$:

$$\Psi_1^c\left(\hat{\sigma}_1\right) = \frac{P^2}{\alpha}\left[\left(R^m - i_1\right) + \frac{1}{\beta}\left(Y_2^c - Y_2^a\right)\right]\left[1 + \left(1 + \hat{\sigma}_1\right) i_1\right] - 1 \tag{25}$$

Note that the bank's return function is supermodular in interest rate i_1 and subsidy $\hat{\sigma}_1$ as long

[16]Note that we concentrate on the profit maximizing interest rate even though the bank does not have any market power. The reason is simple. We are analyzing an economy where there is no interest rate at which the bank would be willing to lend to new industrial entrepreneurs. This implies that the deposit rate is higher than the maximum possible (i.e., profit maximizing) return on a new industrial loan.

as the interest rate is smaller than a threshold:

$$\frac{\partial^2 \Psi_1^c(\hat{\sigma}_1)}{\partial \hat{\sigma}_1 \partial i_1} = \frac{P^2}{\alpha}\left[R^m - 2i_1 + \frac{1}{\beta}(Y_2^c - Y_2^a)\right] \tag{26}$$

As long as $i_1 < \frac{1}{2}\left[R^m + \frac{1}{\beta}(Y_2^c - Y_2^a)\right]$, we have $\frac{\partial^2 \Psi_1^c(\hat{\sigma}_1)}{\partial \hat{\sigma}_1 \partial i_1} > 0$. So an interest rate subsidy leads to higher interest rate choice by the bank and thus reduces the effort choice. This exacerbates the inefficiency from moral hazard and reduces the probability that a good entrepreneur will be successful in the first period. An alternative way to think about it is that an interest rate subsidy reduces the informativeness of the information revealed by the entrepreneurial experiment by increasing type 1 error. Denote the maximum interest rate (i..e, profit maximizing) as $i_1^*(\hat{\sigma}_1)$, then

$$i_1^*(\hat{\sigma}_1) = \frac{1}{2}\left[R^m - \frac{1}{1+\hat{\sigma}_1} + \frac{1}{\beta}(Y_2^c - Y_2^a)\right] < \frac{1}{2}\left[R^m + \frac{1}{\beta}(Y_2^c - Y_2^a)\right] \tag{27}$$

So $\forall i_1 \in [0, \hat{i}_1]$, the banks return function is supermodular in the interest rate and the interest rate subsidy. It is thus better to decouple the subsidy from the interest rate. This decoupling result is important, because lending rate subsidy is a common policy instrument in developing countries.

One can make the subsidy (decoupled from the interest rate) for industrial lending contingent on discovery of a good entrepreneur or provide subsidy irrespective of the outcome of the project. The uncontingent subsidy reduces the risk borne by the banks and does not affect the optimal interest rate choice by the bank. As we show formally below, an uncontingent subsidy dominates a policy of contingent subsidy when the objective is to make new industrial lending possible at a minimum fiscal cost. However, a 'contingent subsidy' might dominate the uncontingent subsidy from a social efficiency perspective as it reduces the interest rate charged by a bank and thus reduces the moral hazard in effort choice.

A critical disadvantage shared by all of the subsidy policies is that revenue raising in developing countries is difficult and can have significant efficiency costs (for, discussion of issues related to tax reform in developing countries, see Emran and Stiglitz, 2007; 2005). One might argue that a better policy instrument from this perspective is to tax lending to agriculture. However, under competition in banking, such a policy only increases the interest rate charged to agricultural loans as the banks try to satisfy the zero profit condition. A policy that does not involve any government tax revenue but can improve relative profitability of new industrial lending is to

implement deposit rate controls to reduce the first period deposit rate i_1^d. Such policies have recently been advocated by Hellmann et. al. (1997, 2000) in their work on Financial Restraint. In the context of present analysis, while a deposit rate control helps in the discovery of new entrepreneurs, a tax on the deposit rate combined with an appropriate subsidy (contingent on the discovery of a good entrepreneur) to the industrial lending may be a better policy for escaping from a 'no new industrial financing equilibrium', especially when the capability of the government is not severely limited. The following proposition states the results related to deposit rate and alternative subsidy policies.

Proposition 3

Consider an economy trapped in an equilibrium with no credit to new industrial entrepreneurs as characterized in proposition (2) above. Assume that the probability estimate for a good entrepreneur is $P = \tilde{P} - \eta$, *with* $\eta > 0$ *arbitrarily small.*

(3.1) there exists a threshold level of first period deposit interest rate $\overline{i}_1^d = i_1^d - \upsilon$ *below which the banks provide credit to new industrial entrepreneurs. A subsidy (uncontingent)* σ_1 *to new industrial lending in the first period combined with a suitable tax* $0 < \tau_1^d < \upsilon$ *on first period deposit rate makes new industrial lending possible at lower efficiency costs compared to deposit rate ceiling policy.*

(3.2) *given a tax rate* $0 < \tau_1^d < \upsilon$ *on deposits, consider three alternative subsidy rates* σ_1 *(uncontingent subsidy),* $\check{\sigma}_1$ *(contingent subsidy), and* $\hat{\sigma}_1$ *(interest rate subsidy) such that the tax-subsidy scheme is revenue-neutral in each case. The maximum possible return from lending to a new industrial entrepreneur is highest for the bank under the uncontingent subsidy scheme.*

(3.3) a contingent subsidy may dominate an uncontingent subsidy in terms of social efficiency even though the fiscal cost of a contingent subsidy scheme is higher.

Proof:

(3.1) To see that a deposit rate control that reduces the first period deposit interest rate may help in inducing banks to experiment with new entrepreneurs, note that zero profit condition in agricultural lending implies that $i_1^a = i_1^d$. This implies that when deposit rate is reduced, it also pulls down the equilibrium interest rate charged by the bank on its agricultural lending. Define

υ as below:

$$\begin{aligned}\Psi_1^{*c}\left(\tilde{P}-\eta\right)-i_1^a+\upsilon &= 0\\ \Psi_1^{*c}\left(\tilde{P}-\eta\right) &= i_1^d-\upsilon=\overline{\imath}_1^d\end{aligned}$$

So a deposit rate ceiling $\overline{\imath}_1^d$ induces banks to lend to new industrial entrepreneurs. Note that such a threshold $\overline{\imath}_1^d>0$ exists as long as the expected return on new industrial entrepreneurship is positive at the prevailing estimate of a good industrial entrepreneur, i.e, $P=\tilde{P}-\eta$.

Define the first period tax-subsidy scheme $\left(\tau_1^d,\sigma_1\right)$ as follows:

$$\Psi_1^{*c}\left(\tilde{P}-\eta\right)+\sigma_1=i_1^d-\tau_1^d \tag{28}$$

So a bank facing the tax-subsidy scheme will be willing to lend to an unproven industrial entrepreneur. Now as long as $\sigma_1>0$, we have $\tau_1^d<\upsilon$ and thus the distortion created in the deposit interest rate is lower compared to the deposit rate ceiling policy. Note that the above equation (28) admits a continuum of solutions for the tax-subsidy schemes all of which are less distortionary compared to a deposit rate control policy. When the tax and subsidy rates are equal, i.e., $\sigma_1=\tau_1^d=\kappa$, then we have $\kappa=\frac{\upsilon}{2}$.

(3.2) The return functions from lending to a new industrial entrepreneur under alternative subsidy schemes are:

$$\Psi_1^c\left(\hat{\sigma}_1\right) = \frac{P^2}{\alpha}\left[\left(R^m-i_1\right)+\frac{1}{\beta}\left(Y_2^c-Y_2^a\right)\right]\left[1+\left(1+\hat{\sigma}_1\right)i_1\right]-1 \tag{29}$$

$$= \Psi_1^c+\left\{\frac{P^2}{\alpha}\left[\left(R^m-i_1\right)+\frac{1}{\beta}\left(Y_2^c-Y_2^a\right)\right]\hat{\sigma}_1 i_1\right\} \tag{30}$$

$$\Psi_1^c\left(\check{\sigma}_1\right) = \frac{P^2}{\alpha}\left[\left(R^m-i_1\right)+\frac{1}{\beta}\left(Y_2^c-Y_2^a\right)\right]\left[1+\check{\sigma}_1+i_1\right]-1 \tag{31}$$

$$= \Psi_1^c+\left\{\frac{P^2}{\alpha}\left[\left(R^m-i_1\right)+\frac{1}{\beta}\left(Y_2^c-Y_2^a\right)\right]\check{\sigma}_1\right\} \tag{32}$$

$$\Psi_1^c\left(\sigma_1\right) = \left\{\sigma_1\right\}+\Psi_1^c \tag{33}$$

$$\text{where}\quad \Psi_1^c = \frac{P^2}{\alpha}\left[\left(R^m-i_1\right)+\frac{1}{\beta}\left(Y_2^c-Y_2^a\right)\right](1+i_1)-1$$

Note that the expressions in {} in equations (30), (32), and (33) show the expected fiscal cost associated with alternative subsidies. Denote the optimal interest rates (i.e., the interest rate

that maximizes bank's return) given different subsidy schemes as $i_1^*(\hat{\sigma}_1)$, $i_1^*(\check{\sigma}_1)$, and $i_1^*(\sigma_1)$. Let the revenue from a deposit tax τ_1^d be denoted as $R(\tau_1^d)$. Since the tax-subsidy schemes are designed to be revenue-neutral the expected fiscal costs of alternative subsidy schemes are equal to the revenue. Thus the difference in bank's expected return results only from the value of Ψ_1^c evaluated at alternative optimal interest rates (i.e., $i_1^*(\hat{\sigma}_1)$, $i_1^*(\check{\sigma}_1)$, and $i_1^*(\sigma_1)$) . Now note that $i_1^*(\sigma_1) = i_1^{*c}$ where i_1^{*c} was defined before in equation (22). So $i_1^*(\sigma_1)$ maximizes the value of Ψ_1^c. Since the optimal interest rates under the other subsidy schemes are different from i_1^{*c}, the value of Ψ_1^c is lower under these alternative subsidy schemes. This completes the proof for the part that given the same fiscal cost, the bank's expected return is highest under the uncontingent subsidy scheme.

(3.3) The contingent subsidy increases the probability that a good entrepreneur will be successful as it reduces the optimal interest rate charged by the bank. But it also decreases the return to the bank compared to the uncontingent subsidy. This implies that the required fiscal expenditure would be higher under a contingent subsidy given any arbitrary $P = \tilde{P} - \eta$. Thus the desirability of a contingent subsidy depends on the relative magnitudes of the social gains due to a higher success probability and the efficiency costs of the higher fiscal expenditure. Let the marginal cost of public funds be denoted as θ, i.e, to raise \$1 revenue, the society incurs efficiency loss of θ. The social gain from higher effort choice induced by the contingent subsidy (compared to the uncontingent subsidy) can be written as:

$$\frac{P^2}{\alpha}\left[i_1^{*c} - i_1^*(\check{\sigma}_1)\right](R^m - R^a)\left\{1 + \frac{1}{\beta}E_2^*(i_2^c)\right\} \tag{34}$$

The social cost of additional fiscal expenditure on contingent subsidy is given by:

$$(1+\theta)\left[\Psi_1^c(i_1^{*c}) - \Psi_1^c(i_1^*(\check{\sigma}_1))\right] \tag{35}$$

So a contingent subsidy dominates the uncontingent subsidy in terms of social welfare when the following holds:

$$\frac{P^2}{\alpha}\left[i_1^{*c} - i_1^*(\check{\sigma}_1)\right](R^m - R^a)\left\{1 + \frac{1}{\beta}E_2^*(i_2^c)\right\} > (1+\theta)\left[\Psi_1^c(i_1^{*c}) - \Psi_1^c(i_1^*(\check{\sigma}_1))\right] \tag{36}$$

Since $E_1^*\left(i_1^*\left(\check{\sigma}_1\right)\right) > E_1^*\left(i_1^{*c}\right)$, it is easy to check that a sufficient condition for inequality (36) to hold is:

$$(1+\theta) < \left(R^m - R^a\right)\left\{1 + \frac{1}{\beta}E_2^*\left(i_2^c\right)\right\} \tag{37}$$

Given a value of θ, inequality (37) will be satisfied when the productivity difference between industry and agriculture is higher, and the second period deposit rate and moral hazard are low implying higher effort choice in the second period under competition.QED

Discussion

Note that a two period model underestimates the value of the contingent subsidy (proposition 3.3), as the expected present value of the productivity gain from a successful new industrial entrepreneur is a positive function of the time horizon considered. A contingent subsidy is also likely to be desirable in a more general model where banks are involved in interim monitoring of the new industrial projects which can affect the success probability. In this case, an uncontingent lending subsidy may not be desirable, as the subsidy does not depend on bank's monitoring intensity. Another important advantage of a contingent subsidy is that it is, in general, less susceptible to corruption. We discuss in more details the implications of corruption (more broadly government capability differences across countries) for policy instrument choice later in the paper.

One concern with the policies that work through deposit interest rate is that a reduction in the deposit rate may reduce the savings and bank deposits in the economy. A closely related issue is if taxing deposits is likely to be part of an optimal tax structure to raise revenue for financing the subsidy to new industrial lending. A tax on deposits is especially suitable as a policy instrument in the present context for the simple reason that unlike other tax instruments a reduction in the deposit rate itself improves the relative profitability of new industrial lending without taking into account the revenue generated. Moreover, the marginal cost of public funds for a tax on the deposits depends on the elasticity with respect to the interest rate. The available evidence shows that the interest rate elasticity of savings and deposits is very low as the substitution and income effects of an interest rate change largely offset each other (see, for example, Bandiera et. al. (2000)). This low elasticity makes it an attractive tax base as is well known from the inverse elasticity rule of optimal taxation (Atkinson and Stiglitz, 1980).

A straight-forward but important implication of the above discussion is that high deposit interest rates that typically follow financial liberalization in a developing country will be especially detrimental to entrepreneurial discovery as it might result in an equilibrium where banks are

unwilling to experiment with new industrial entrepreneurship.[17]

(4.2.2) Intertemporal Policies

The policies to tackle the no entrepreneurial experimentation equilibrium trap discussed above are targeted at the margin of intersectoral profitability in banks loan portfolio. However, the fundamental source of the market failure in our model of entrepreneurial discovery is an intertemporal one; the banks are unable to appropriate large enough share of the future rent on good entrepreneurship which accrues entirely to the entrepreneur in a competitive banking economy established through financial liberalization. As discussed before, unlike the standard model of innovation and discovery in the industrial organization literature in the context of research and development, it is not possible to design a limited duration patent right for the financier bank that allows it to appropriate enough future rent on a good entrepreneur once its type is revealed. This is because of the fact that a bank cannot write a legally enforceable contract on the inalienable entrepreneurial ability. Given the incompleteness of the contract, the potential entrepreneur cannot credibly commit not to switch bank in the second period. An indirect way to provide "patent right" to a pioneer bank financing unproven industrial entrepreneurs is to restrict entry into banking so that switching banks becomes non-profitable for a good entrepreneur in the second period. Such entry restriction policies have been advocated by Hellmann et. al. (1996, 2000) in a series of papers on Financial Restraint. However, when the bank has market power, it extracts rents from not only the new industrial entrepreneurs, but also from the competing activities. This can be seen most transparently by considering the polar case where the pioneering bank is awarded monopoly rights. In this case, the monopoly bank increases the agricultural interest rate to capture all the rents, i.e., it sets the interest rate as below:

$$i_t^a = R^a - \hat{w};\ t = 1, 2$$

where $\hat{w}$ is the outside option if the agent decides not to take an agricultural loan. A universal monopoly right thus creates problems at the intersectoral margin even though it addresses the intertemporal distortion. The higher return on competing activity attenuates the bank's incentives for new industrial lending. Thus a better policy is where competition is preserved in the agricultural lending, but monopoly right is awarded for industrial lending. The following propo-

[17]For evidence that the deposit rate increased dramatically in many developing countries after financial liberalization in the 1980s, see Honohan (undated).

sition shows that such a dual track entry restriction policy can help escape the no information revelation banking equilibrium.

Entry Restraint and Entrepreneurial Discovery: A Dual Track Policy

Proposition 4

Assume that the economy is initially trapped in an equilibrium with no credit to new industrial entrepreneurs as characterized in proposition (2) above. Assume that the probability estimate for a good entrepreneur is $P = \tilde{P} - \eta$, *with* $\eta > 0$ *arbitrarily small and* $\tilde{P} \leq 1$. *Consider a dual track policy regime implemented in this economy where competition is preserved in agricultural lending, but a bank is awarded monopoly for industrial lending. The dual track policy makes lending to new industrial entrepreneurs possible if the degree of moral hazard is not too high, i.e.* $\alpha < \hat{\alpha}$ *and the probability estimate belongs to an open interval, i.e.,* $P \in \left(\hat{P}, \tilde{P}\right)$.

Proof:

With $P = \tilde{P} - \eta$, a bank under financial liberalization declines to finance new industrial entrepreneurs by proposition (2) above. In a dual track policy regime, denote the optimal time-consistent interest rates as $(\hat{\imath}_1, \hat{\imath}_2)$, where

$$\hat{\imath}_1 = \frac{1}{2}\left(R^m - 1\right) + \frac{1}{2\beta}\left[\frac{1}{8\alpha}\left(R^m + 1\right)^2 - Y_2^a\right] - \frac{1}{8\alpha\tilde{\beta}}\left[\left(R^m + 1\right)^2 - 4\alpha\left(1 + i_1^a\right)\right] \tag{38}$$

$$\hat{\imath}_2 = \frac{1}{2}\left(R^m - 1\right) \tag{39}$$

For details of the optimization of the bank under a dual track policy regime, see appendix 1. When $P < \tilde{P}$, the bank earns negative profit under competition. This also implies that the bank incurs loss in the first period when it chooses optimal interest rates under the dual track, because first period effort choice function is higher under competition, i.e., $E_1^*(i_1 \mid i_2^c) \geq E_1^*(i_1 \mid \hat{\imath}_2)$.This is because of the fact that under competition the second period interest rate is lower than under the dual track with monopoly power over industrial lending, i.e., $i_2^c \leq \hat{\imath}_2$. But if the moral hazard is not too strong, the bank makes profit on a successful entrepreneur in the second period under dual track for all $P > 0$. This can be seen from the profit maximizing return in the second period

for a monopoly bank (denoted as $\hat{\Psi}_2$) :

$$\hat{\Psi}_2 - i_2^d = \frac{1}{4\alpha}\left(R^m + 1\right)^2 - 1 - i_2^d \tag{40}$$

$$\hat{\Psi}_2 > i_2^d \Leftrightarrow \alpha < \hat{\alpha} \equiv \frac{\left(R^m + 1\right)^2}{4\left(1 + i_2^d\right)} \tag{41}$$

So the expected second period profit for a bank financing a new industrial entrepreneur is positive for any $P > 0$ if $\alpha < \hat{\alpha}$, i.e., $PE_1^*\hat{\Psi}_2 > 0$. Now observe that for $\eta > 0$ small enough, the first period loss incurred by a bank under dual track is more than compensated by the expected profit to be made in the second period. To see this, note that at $\eta = 0$ (so that $P = \tilde{P}$,), the monopoly bank can charge the competitive interest rate in the second period (i.e., i_2^c) and thus can ensure at least zero profit. This implies that when it chooses the profit maximizing interest rate in the second period, it makes strictly positive profit. By continuity, there exists a threshold $\hat{\eta} > 0$ (denote the corresponding threshold probability as $\hat{P} = \tilde{P} - \hat{\eta}$) such that the bank breaks even under a dual track policy regime. So we have

$$\hat{P}E_1^*\hat{\Psi}_2 = \tilde{\beta}\left[i_1^d - \hat{\Psi}_1\right] \tag{42}$$

So for all probability estimate $P \in \left(\hat{P}, \tilde{P}\right)$ the bank in a dual track regime lends to a new industrial entrepreneur if $\alpha < \hat{\alpha}$, but the economy is trapped in no new industrial financing equilibrium under financial liberalization (i.e., competitive banking). QED.

Discussion

The simple two period model used in this paper undervalues the advantages of a dual track policy regime for two reasons. First, the bank does not take into account the value of the information revealed by the entrepreneurial experiment. In a more general model a Bayesian bank would value the information generated and update the probability estimate P accordingly. One can extend the basic model in a two-armed bandit framework (with one arm known, i.e., agriculture) to analyze such a model. But the intuition is straight forward that the bank will be willing to experiment more in a dual track policy regime when it takes into account the value of information. Second, the net present value of entrepreneurial rent a bank can reap is higher the higher is the number of periods it is granted monopoly over industrial lending. So even if a bank in a dual track regime finds it unprofitable to lend to new industrial entrepreneurs in a two period context, it may still find it profitable in a multi-period model. However, a more general multi-period

model also raises the issue of optimal duration of the dual track regime. The government can use the duration of the dual track as a policy instrument to make sure that the pioneer bank gets enough share of the net present value of the entrepreneurial rent to make it possible to escape an inefficient equilibrium where no new industrial lending takes place.

Dual Track and Time Consistency

The monopoly awarded to the bank for new industrial lending creates two types of distortions. First, monopoly interest rate in the second period reduces effort levels in both the first and second periods (compared to a competitive benchmark). The other inefficiency arises from the fact that the bank cannot credibly commit to the interest rates that maximizes the net present value of profits from a new industrial lending because of time inconsistency. Denote the optimal (time inconsistent) interest rates that maximizes the net present value of returns for a monopoly bank by i_1^* and i_2^* which are solved from the following problem:

$$Max_{i_1,i_2}\Psi = \Psi_1 + PE_1^* \frac{\Psi_2}{\tilde{\beta}} + (1 - PE_1^*) \frac{i^a}{\tilde{\beta}} \tag{43}$$

$$\Psi_1 = PE_1^* (1 + i_1) - 1 \tag{44}$$

$$\Psi_2 = E_2^* (1 + i_2) - 1 \tag{45}$$

But absence a credible commitment mechanism the bank charges the dynamically consistent interest rate $\hat{i}_2 > i_2^*$, thus leading to inefficiently low effort choices in both the periods. The government can use its tax instrument to correct this distortion arising from time inconsistency in a dual track policy regime and thus can make it possible to induce banks experiment with new entrepreneurs, even though it is not profitable under a dual tack policy regime alone. The government can impose a tax τ_2^* such that $\hat{i}_2 (\tau_2^*) = i_2^*$. With a tax τ_2 on the second period lending interest rate, the bank under a dual track chooses the optimal interest rate in the second period

interest rate from the following:

$$\begin{aligned} Max_{i_2}\Psi_2(\tau_2) &= E_2^*[1+i_2(1-\tau_2)]-1 \\ E_2^*(i_2) &= \frac{1}{\alpha}(R^m-i_2) \\ \hat{i}_2(\tau_2) &= \frac{1}{2}\left[R^m-\frac{1}{1-\tau_2}\right] \end{aligned} \tag{46}$$

So to make sure that the second period interest rate faced by the entrepreneur is i_2^*, the government sets the tax rate τ_2^* such that:

$$\hat{i}_2(\tau_2^*) = \frac{1}{2}\left[R^m-\frac{1}{1-\tau_2^*}\right] = i_2^* < \hat{i}_2 = \frac{1}{2}(R^m-1) \tag{47}$$

Note that we need $\tau_2^* > 0$ (i.e., a tax not a subsidy on second period lending rate) for inequality (47) to be valid. The government can make sure that the return in the second period on a successful entrepreneur does not suffer by complementing this tax with a transfer scheme that returns the tax revenue to the bank in a lump sum manner. This result is formally stated in the following proposition.

Dual Track with Tax-Subsidy Scheme

Proposition 5

In dual track policy regime, the government can design a revenue-neutral tax-subsidy scheme where a tax τ_2^* is imposed on the lending interest rate in the second period and the expected revenue $R_2(\tau_2^*) = E_2^*\tau_2^* i_2^*$ is returned to the bank in a lump sum way at the beginning of second period. Such a dual track regime with tax-subsidy scheme can help escape from a 'no new industrial financing equilibrium' even when the dual track policy alone is not effective.

One important caveat to the above result from a practical point of view is that the governments, especially in developing countries, may not have the information required for calculating the optimal tax rate τ_2^*. This clearly limits the value of proposition 5 as a guide to policy making. However, the more general and robust conclusion relevant for policy choices is that a small tax on the second period lending rate would almost always be welfare improving in a dual track policy regime.

(4.2.3) Entrepreneurial Discovery: Deposit Rate Policies versus Dual Track

As discussed in propositions (3)-(5) above, both the intersectoral and intertemporal policies can induce banks to experiment with new industrial entrepreneurs. The cost of a dual track entry restriction policy is that it leads to higher interest rate and thus less than optimal effort choices. A policy of ceiling on deposit rate is neutral with regards to the optimal effort choice. A contingent subsidy financed by a tax on deposit rate has the advantage that it reduces the first period interest rate and thus leads to reduced moral hazard. But the cost of such deposit rate policies is the potential negative effects on the household savings. As discussed before, the potential adverse effects on savings, however, is likely to be small. There is an important caveat to the above though; one should 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 etc.) become attractive as savings instruments when the real interest rate on bank deposits is close to zero or negative. Also, as emphasized by Hellmann et. al. (1996) and Chiappori et. al. (1995), among others, an appropriately chosen deposit rate ceiling can, in fact, increase the aggregate savings mobilization through financial deepening.[18] This may be especially important in the context of developing countries where the rural areas are usually not served by the private banks. In addition, Hellmann et al. (2000) show that a mild deposit rate control in conjunction with capital requirement can create franchise value in banking and thus reduce incentives for "looting" (a la Akerlof and Romer, 1993) and bankruptcy for profit. This enhances the stability of the banking system. When such positive effects of deposit rate ceiling are taken into consideration, the conclusion regarding desirability of tax-subsidy (contingent) scheme as compared to a deposit rate ceiling reached earlier in proposition 3.1 needs to be qualified accordingly (see also the discussion below on the implications of corruption for choice of policy instruments).

The costs of dual track entry restraint arise from the moral hazard caused by monopoly interest rates in new industrial lending and depend on the slope of the maximum income function of the entrepreneur with respect to interest rate. If the degree of moral hazard as captured by the parameter α is high enough, then a tax on deposit rate combined with a revenue-neutral

[18] For evidence that deposit rate ceiling can help in financial deepening and deposit mobilization in the context of USA, see Sarr (2000).

contingent subsidy in a free entry banking regime might dominate as a policy instrument for entrepreneurial discovery. Another potential issue is the possibility that a dual track policy might create intersectoral arbitrage opportunities. However, the worry that the agricultural loans at lower interest rates can be used for industrial investment is, from a practical point of view, not a serious one, as the industrial investment would require a large number of agricultural loans given the scale differences.

(5) Financial Sector Reform and Short-Termism

Tackling Short-Termism in Project Choice: A Special Role for Intertemporal Policies

As noted in the introduction, one of the central concerns in developing countries is that the private banks are, in general, not willing to finance long gestation industrial projects, especially those with strong dynamic learning effects and productivity gains. It is thus extremely important to structure incentives for the banks to reduce the short-termism in project choice. The policies of financial liberalization, however, creates perverse incentives for the banks to concentrate their lending on quick-yield projects with front-loaded returns at the expense of long-gestation projects with significant learning effects.

The policies that focus on deposit interest rate (like deposit rate ceiling and a tax on deposits) are, however, not helpful in tilting bank's incentives in favor of projects with low initial return but high net present value due to strong learning effects later. This is due to the fact that the reduction in the deposit rate works at the margin of intersectoral returns, but the banks still need to satisfy zero profit condition in each period. This implies that the banks finance those projects first which give them maximum return in the first period. The subsidy policies are also likely to be subject to the same limitations. In principle, one can make the subsidy contingent on the type of new industrial projects according to the degree of learning effects. However, it is unlikely that a government will have the information regarding the degree of learning effects across different projects, and thus a general subsidy to all the new industrial activities seems to be the only feasible policy. Another important argument against differentiated subsidy according to learning benefits is that such a policy would create incentives for the banks to reclassify the industrial projects to maximize the subsidy payments from the government, especially because the government may lack the information to verify such projects.

A dual track regime on the other hand allows the bank to look at the net present value of different projects and finance the ones with highest NPV irrespective of the intertemporal pattern of the returns. Note that the dual track policy relies on the information advantage of the banks in screening the projects.

In the context of our model, dynamic learning can take two different forms: (i) a low initial return and a higher return in the second period, i.e., $R_1^m < R_2^m$, (ii) a reduction in the cost of effort to the entrepreneur in the second period, i.e., $\alpha_1 > \alpha_2$ where subscripts denote the periods. In proposition (6) below, we illustrate the ineffectiveness of the intersectoral policies in reducing short-termism in project choice by focusing on the case of deposit rate ceiling as a policy instrument.

Proposition 6

A reduction in deposit interest rate alone fails to provide banks with incentives not to finance low NPV projects with front-loaded returns. Under entry restraint, the banks have the appropriate incentives to finance projects according to NPV and thus help implement projects with low initial returns but strong productivity gains or cost reduction later due to learning effects.

Proof:

Consider three first period deposit interest rates $i_1^{d1} < i_1^{d2} < i_1^{d3}$, and two industrial projects with the first period expected returns for the bank $\Psi_1^1(i_1^d) > \Psi_1^2(i_1^d)$, and the net present values (NPV) as follows:

$$\Psi_1^1(i_1) + \frac{\Psi_2^1(i_2)}{\tilde{\beta}} < \Psi_1^2(i_1) + \frac{\Psi_2^2(i_2)}{\tilde{\beta}} \tag{48}$$

Choose the first period deposit interest rates such that the following holds:

$$i_1^{d3} > \hat{\Psi}_1^1(\hat{i}_1^1) > i_1^{d2} > \hat{\Psi}_1^2(\hat{i}_1^2) \geq i_1^{d1} \tag{49}$$

In inequality (48) and (49), the superscripts to Ψ denote the projects and the subscripts the time periods. What inequality (49) says is that (i) the maximum expected return in the first period for a bank from project 1 is less than the agricultural interest rate at the deposit rate i_1^{d3} but higher than the agricultural interest rate when deposit rate is i_1^{d2}, (ii) the maximum expected return in the first period for a bank from project 2 is less than the agricultural interest

rate at the deposit rate i_1^{d2} but higher than the agricultural interest rate when deposit rate is i_1^{d1} (assuming competition in agricultural lending). Now, consider a fully liberalized banking sector with competition both in agricultural and industrial lending. Starting from an initially high deposit rate i_1^{d3}, a policy that reduces it to i_1^{d2} makes it profitable to finance the project with front loaded return (project 1). A further reduction of deposit rate to i_1^{d1} induces the bank to lend to the entrepreneur with the back-loaded but higher NPV project (project 2). But it is still profitable for the bank to finance project 1. A dual track policy on the other hand allows the bank to rank the industrial projects according to NPV. In this case, given an appropriate deposit rate, the bank finances the socially efficient projects first, i.e., with the highest NPV. QED.

(6) Government Capability and Financial Restraint

Although we have mentioned the importance of government capability in the discussion above, here we provide a bit more systematic analysis of the implications of differences in government capability across countries for appropriate policy choice. One can rank the alternative policy instruments according to their degree of *corruption resistance* and use it as an additional criteria in practical policy choices. As mentioned before, the subsidy policies are, in general, more susceptible to corruption than a policy instrument like deposit rate control or deposit tax. The worry about corruption also makes "uncontingent subsidy" policy discussed in proposition (3.2) above less attractive, as the banks might create ghost industrial projects to reap the subsidies and then declare the "projects" as failure. The contingent subsidy is less prone to corruption and abuse by the banks when the government can reasonably verify the success or failure of an industrial project. To be sure, a contingent subsidy policy requires a higher level of government capability than what is required for a simple deposit rate control, deposit tax, or a dual track policy. As the capability of government improves in a country (for example, through anti-corruption reform and human capital accumulation in the bureaucracy), the set of policy instruments that can be employed becomes larger.

(7) Conclusions

This paper, using a simple model of occupational choice with moral hazard, 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 two corner-stones of current development policy consensus:

private sector led development and financial liberalization thus work at cross purposes. The analysis focuses on two issues: (i) discovery of entrepreneurial talents, and (ii) tackling short-termism in project choice to foster learning. We show that poaching externality in a competitive banking can result in binding liquidity constraint and thus banks may fail to finance entrepreneurial discovery. Our analysis shows that lending rate subsidy, a common policy instrument, may be counterproductive when moral hazard is important in the entrepreneurial discovery process. A policy of temporary entry restraint that awards limited duration monopoly right to a bank investing in entrepreneurial discovery can avoid a 'no entrepreneurial experimentation' trap. Deposit interest rate policies (like deposit rate ceiling, small tax on deposit rate) can encourage banks to experiment with new entrepreneurs in a competitive banking economy. When the government capability is not severely limited, a subsidy (contingent on the discovery of a good entrepreneur) financed by a tax on deposit rate may dominate the simple deposit rate ceiling or deposit tax policy. But deposit rate and subsidy policies (more broadly intersectoral policies) are ineffective in weeding out short-termism in project choice. Intertemporal policies like entry restrictions in industrial lending is effective in inducing banks to rank projects according to the net present value, and thus finance those projects which yield low initial returns but strong learning and productivity gains later on. Our analysis points to the importance of a dual-track policy regime where temporary entry restraint is implemented in the industrial sector, but competition is preserved in the lending to agricultural sector. Such a dual-track policy can be effective in tackling the problems of poaching externality and short-termism. The appropriate policy instrument for a given country, however, depends on the capability of the government. The conclusions of this paper run counter to the current consensus in development policy that a completely liberalized competitive financial sector is a necessary and enabling factor in private sector led development strategy. Since 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.

Appendix 1: A Bank's Optimal Interest Rate Choices Under Dual Track

Dynamic consistency requires that the second period optimal interest rate is determined as below:

$$\begin{aligned} Max_{i_2}\Psi_2 &= E_2^*(1+i_2)-1 \\ \hat{i}_2 &= \frac{1}{2}(R^m-1)>0 \\ \hat{\Psi}_2 &= \frac{1}{4\alpha}(R^m+1)^2-1 \end{aligned}$$

The optimal first period interest rate is solved from:

$$\begin{aligned} Max_{i_1}\Psi(i_1 \quad | \quad \hat{i}_2) &= \Psi_1 + PE_1^*\frac{\Psi_2}{\tilde{\beta}} + (1-PE_1^*)\frac{i^a}{\tilde{\beta}} \\ &= PE_1^*(\hat{i}_2)(1+i_1)-1+PE_1^*(\hat{i}_2)\left[\frac{\frac{1}{4\alpha}(R^m+1)^2-(1+i^a)}{\tilde{\beta}}\right]+\frac{i^a}{\tilde{\beta}} \\ \hat{i}_1 &= \frac{1}{2}(R^m-1)+\frac{1}{2\beta}\left[\frac{1}{8\alpha}(R^m+1)^2-Y^a\right]-\frac{1}{8\alpha\tilde{\beta}}\left[(R^m+1)^2-4\alpha(1+i^a)\right] \end{aligned}$$

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