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Deposit Mobilization through Financial Restraint

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Introduction

In his seminal work on financial development, Shaw (1973) noted that financial systems in developing countries were mostly characterized by low levels of formal intermediation and a weak institutional structure. Along similar lines, McKinnon (1973) noted that self-intermediation was prevalent in many developing countries.

Since then, discussions of financial development have mainly focused on "liberalization," as the lack of financial deepening was normally due to government extracting rents from the financial sector. The (often explicit) assumption of this discussion was that a competitive financial system with a "laissez-faire" government would be the desired system. But experiences with liberalization have provided mixed results. Equally troublesome, some of the fastest-growing economies, such as post war Japan and more recently several of the East Asian NIC's followed a path that was markedly different from the free market solution (cf. Stiglitz 1993a,b). These events have call into question a simplistic "free financial markets" paradigm. On the other hand, numerous experiences show that "old-fashioned" financial repression is not a desirable system either (cf. Fry 1988a,b)[1], leaving us with the difficult problem of finding appropriate ways to mix government and markets. In Hellmann, Murdock and Stiglitz (1995) we develop an argument of how governments can enable the private financial markets to work more efficiently. The essence of this approach is that the government creates rent opportunities, but leaves it to private agents to take the actions that capture the benefits of the opportunity. By creating rent opportunities that induce agents to take socially beneficial actions, a better outcome may be achieved than under a free market system with laissez faire.

In this paper we apply these ideas to the specific issue of deposit mobilization. This issue is central to the debate on financial deepening. Mobilizing deposits is crucial in many developing countries. Domestic funds provide a cheap and reliable source of funds for development, which is of great value developing countries, especially when the economy has difficulty raising capital in international markets. Yet, in many developing countries, there is a considerable amount of savings that are not intermediated through the formal sector. In particular, there exists a significant savings potential in the rural (and/or semi-urban) sector in many developing countries (cf. Adams 1978, Vogel 1984). One of the reasons for the lack of savings mobilization is that

[1] Empirical results show that economic growth is strongly correlated with financial deepening (cf. King and Levine 1993) but that economic growth is not monotonically related to rates, once rates are positive (cf. Murdock and Stiglitz 1992).

banks simply do not cater to significant parts of households. Indeed, in many rural areas banks are entirely absent, and even in urban and semi-urban areas banks do not reach out to a significant proportion of the population.

Since banks in many developing countries have been nationalized, the causes for poor deposit mobilization are often related to the incentive structure within the public sector.[2] As governments begin to privatize banks, however, we are faced with the question of how private markets are likely to pursue deposit collection. In particular, we need to ask what type of market failures are likely to occur, and what government policies can address these failures.

In this paper we will develop two models, that show the limitations of competitive deposit mobilization, and derive what policies may address these problems. In the first model, we consider the investment decision of a bank to open a new branch in a catchment of unproved quality. If the bank has imperfect information about the profitability of the new catchment, it may have a problem expropriating the benefits of an explorative investment. If the catchment is not profitable, the bank will bear the cost of exploration, but if the catchment is good, other banks will follow suit and compete away profits in the new catchment. Put differently, there is a market imperfection in that information about the profitability of a catchment becomes public information after entry. In this paper we show that in such a context a limit on competition may be socially beneficial. By granting the first-mover bank (temporary) exclusive rights over its new catchment it can be compensated for the exploration costs. We show that a restriction of competition is in general superior to a policy of subsidization under competition. We show that the expected return to entry is not necessarily a monotonic function of the private signal, the government may not be able to induce the efficient entry condition, regardless of the amount of subsidy. By offering an appropriate length to the exclusive rights, the government can always induce efficient entry. And once the exclusive right expires, subsequent entry eliminates the static allocative inefficiency associated with restrictions on competition, indicating that an exclusive right of limited duration is superior to a permanent monopoly position.

The second model is concerned with a situation where banks are already competing in a market for deposits, but where the market is not yet fully penetrated. In particular we examine a situation where a portion of depositors is not familiar with the process of depositing their money

[2] Indeed, while some governments have provided explicit incentives to deposit mobilization (e.g. Korea, cf. Cho and Hellmann 1993), other countries have failed to provide these incentives (e.g. Tanzania, cf. Krahnen and Schmidt 1994).

in banks. This can be because of a lack of information, a general distrust of banks, or the cost of "monetizing" savings.[3] Banks however can invest in “growing the market.” The idea is that banks become actively engaged in soliciting households to deposit their wealth with banks. This can take a number of forms: a bank may engage in an advertising campaign, it may use business contacts to convince people to monetize their savings and deposit them with banks, or it may offer subscription bonuses to people opening a new account. The effect of such a campaign is to attract new customers that fall in one of two categories. Some customers will have previously deposited their money with a different bank, while others are newly introduced to the banking system. We argue that while campaign investments are in general beneficial by introducing new customers to the banking sector - thus increasing financial depth, - they can also become an inefficient form of non-price competition, when attracting customers away from one bank to another.

We develop a simple model that allows us to analyze under what circumstances a bank will want to grow the market through an “educational advertising campaign.” In a competitive equilibrium banks will undertake no investments in growing the market. This is because they are making zero profits on the margin, implying that they have no benefits of attracting additional customers. As a result, there are no incentives to deepen market penetration. If the government imposes a deposit rate ceiling, banks make positive profits on the marginal depositor. They will make positive amounts of campaign investments, thus introducing new customers to the system, as well as competing customers away from each other. We show that as long as the market is in a sufficiently low state of financial depth, lowering the deposit rate from the competitive equilibrium rate will be welfare-enhancing, even when we take into account for the effect that lower deposit rates induce some households to substitute out of formal sector deposits. Once the market is sufficiently penetrated however, deposit rate controls are no longer desirable: at that point the gains from increased financial depth are more than offset by the costs of disintermediation.

The two models are an application of the framework discussed in Hellmann, Murdock and Stiglitz (1995). The first model illustrates the importance of limitations on competition. Exclusive rights of new catchments ensures that banks, that want to deepen their deposit base by

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[3] The last aspect is very common in developing countries: households hold their wealth in non-monetary forms, such as real assets (life stock, real estate, etc.) and/or gold. It needs some effort on behalf of the banks to convince people to sell these assets in order to get a higher return by depositing the proceeds in the formal sector.

opening new branches, can appropriate rents from these activities. The second model illustrates the benefits of modest deposit rate controls. A positive margin on attracting new depositors is necessary if banks are to grow the deposit market. The deposit rate control, however, should not be permanent in this model: once financial deepening has occurred, there are inefficiencies due to pricing and non-price competition.

The remainder of this paper is structured as follows. Section 1 reviews briefly the main aspects of *financial restraint*. Section 2 discusses incentives to deposit mobilization through exclusive rights for new branches. Section 3 discusses deposit mobilization through non-price competition. It is followed by a brief conclusion.

Section 1: An Overview of *Financial Restraint*

Financial restraint is a set of policies designed to improve the efficiency of financial markets. Its two fundamental building blocks are deposit rate control and limitations on the amount of competition in the financial sector. *Financial restraint* embodies a set of financial policies designed to create rent opportunities that induce agents in the financial sector to engage in beneficial activities that are underprovided in a competitive market. In a related paper, Hellmann, Murdock and Stiglitz (HMS henceforth) (1995), we develop a much broader outline of the *financial restraint* framework. In this section we only highlight the main aspects of the argument developed in that paper.

Our premise is that market failures are pervasive in the financial sector because of imperfect information and other transactions costs (cf. Stiglitz 1993a).[4] One way to overcome these inefficiencies is for the government to affect the incentive structure in an otherwise private, profit-oriented, financial sector. The government can create rent opportunities, that induce private agents to take actions that are socially beneficial, but would otherwise not have been taken in competitive markets under "laissez-faire." Note that this is a fundamentally different approach than the old-fashioned interventionist thinking, where the government undertakes the believed socially beneficial actions itself. By leaving the actions to the private market, the government is effectively "out-sourcing" them, leaving the efficiency of execution to private

[4] A government-owned financial system on the other hand may be even worse, because of government failures and weaker mechanisms to resolve these inefficiencies.

agents, and by-passing the numerous inefficiencies that can be expected from direct government action. Note also that this approach differs substantially from a view of government distributing rents. Subsidies and related support programs are typically not performance-based, and may create greater dependency on the part of subsidized firms, rather than self-sufficiency. When the government creates rent opportunities but then allows profit-maximizing firms to pursue those rents, private information is incorporated in allocation decisions and the most efficient firms/banks profit and grow the most.

There are a number of important inefficiencies in the financial market, that governments may want to address though *financial restraint*. In HMS (1995) we identify three main areas that may be of particular concern to many developing and even developed economies -- moral hazard in banking, deposit mobilization, and asset substitution.

First we argue that moral hazard in banking, and the related problems of bank failures are endemic to a perfectly competitive banking system. Indeed, in HMS (1994) we show that competitive equilibria may have the property that banks gamble with, or even attempt to "loot," their depositors' money, *even* in a market regime where there is no deposit insurance and depositors can rationally foresee these actions. As pointed out by Caprio and Summers (1993), the problem is that banks do not value enough their "franchise." Their future income streams are not sufficiently high for banks to value their continued operation enough to efficiently monitor their investment portfolio. Banks may choose the (privately) optimal investment portfolio to maximize returns in the short run at the possible cost of being closed down thereafter, even if this harms the social return to the portfolio. In HMS (1994 and 1995) we show that deposit rate controls can precisely provide the franchise value that would induce banks to behave more as a long term player. Moreover, restrictions on competition may become necessary to prevent that the effect of deposit rate controls is not undermined by non price-competition from new entrants and/or from incumbents.

Second, we argue that *financial restraint* increases the incentives to invest in deposit mobilization, and thus to financial deepening. The present paper will focus on this topic.

A third aspect of *financial restraint* concerns the mitigation of undesirable side-effects, in particular the problem that deposit rate controls may lead to asset substitution, where depositors seek out alternative savings vehicles. Restrictions on competing asset markets, such as bond markets or foreign savings instruments, are discussed in HMS (1995).[5] These restrictions perform the role of limiting inefficient reallocation of savings in response to deposit rate control. The reallocation incentives for depositors are increasing as the deposit rate falls, indicating a limit on the extent of deposit rate control.

Having briefly outlined the rationale for *financial restraint*, it is necessary to clarify the difference between *financial restraint* and financial repression. The fundamental difference is illustrated by Figure 1. In financial repression, government repress deposit (as well as lending) rates, *in order to finance budget deficits*. The government is using the financial sector to extract rents from the private sector. Not surprisingly, we see undercapitalized banks lacking commercial orientation and often engaging in unsound practices. Moreover, financial repression is associated with high (and volatile) inflation rates, as part of the government's extraction of rents. Under *financial restraint*, however, the government needs to maintain a low inflation environment, where real interest rate must remain positive and predictable (cf. HMS 1995).[6] Most important, the government does not extract rents from, but creates rents within, the private sector.

Figure 1:

	Rent Extraction	No Direct Rent Flow	Rent Creation
High Inflation	**Financial Repression**	"Southern Cone"*	
Low Inflation		Free Markets	***Financial Restraint***

* There was some indirect rent extraction from the financial sector through the inflation tax

Our arguments supporting a regime of *financial restraint* as a tool to promote financial deepening are theoretically motivated, but they have some empirical roots. In particular they are

[5] A fourth effect discussed in HMS (1995) concerns lending rate controls, and is outside the focus of this paper.

[6] This implies that a precondition for financial restraint is that there is a reasonably stable macro-economic environment, and no heavy direct taxation of the financial sector.

inspired by the success of a number of East Asian economies, including post-war Japan (see also Stiglitz 1993b). The creation of rents within the financial sector played an important role in the process of economic development for these countries.

Section 2: Deposit mobilization through exclusive rights on new branches

In this section we describe a model that captures the decision of a profit-maximizing bank on whether to open a branch in a previously unserved area. The investment is costly, and the expected return is uncertain due to limited knowledge about the quality of the potential depositors in the area. In a competitive market, the bank has too little incentive to develop a rural branch network because of the public good nature of the information about the quality of the deposit base. If it invests and quality is poor, it loses its investment. If the quality is high, competitive entry limits profits.

If the government offers exclusive rights for banks developing new branches, the private incentives of the bank approach the social optimum, relative to those of a competitive market. The arguments is analogous to the arguments for "patent protection." In order to induce sufficient entry, investors need protection from competitors that free-ride on the inventors' investments in information discovery. In the model described herein, it is possible to exactly replicate the social optimum entry condition if the government offers an exclusive right of appropriate length and provides a subsidy equal to a fraction of the fixed cost of entry. Moreover, protection is superior to subsidization in a competitive market. The amount of the subsidy necessary to induce entry is always less when accompanied by an exclusive right, and a subsidy will not necessarily replicate the efficient entry conditions when the bank is subject to competition immediately after entry. This is because with competition a bank will not enter It may be the case that a bank will choose not to enter a higher quality catchment because it is more likely to face competition after entry.

<u>Section 2.1: Description of the model</u>

We consider the bank's decision whether to enter a particular rural catchment area of depositors. In the country, there are many rural catchments of potential depositors. Each catchment can be modeled using a Hotelling framework where households supply one unit of deposit and are distributed with uniform density (D) around a unit circle. All households in a particular catchment have the opportunity to self-intermediate, earning a return on their deposit (s). If a bank opens a branch in their catchment, then depositors may choose to monetize their savings and open an account at the branch. Transacting with the bank is costly, however, when the branch is far from their home. If a household is a distance x from home, the cost of transacting with the bank is bx. Households maximize their net return on savings, so a household will monetize its savings if:

$$r - bx > s$$

where r is the deposit rate offered by the bank.

Banks maximize profits. They have a fixed cost (per period) of serving a market equal to F. If no bank currently serves a particular catchment, then banks do not observe s. Rather they know that the distribution of s, G(s, θ) and they observe the signal θ , where

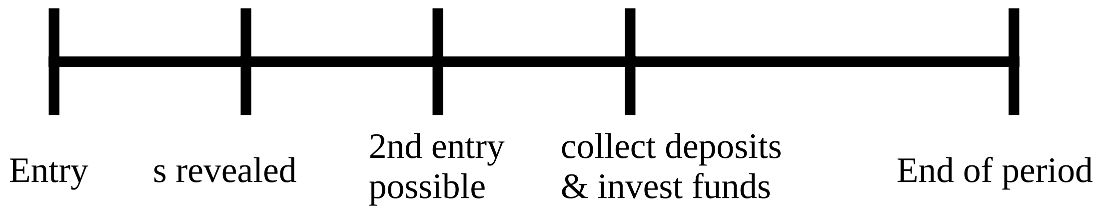
$$G(s,\theta_1) < G(s,\theta_2)\ \forall \text{s if } \theta_1 < \theta_2$$

Once a bank enters a given market, all banks observe s with certainty.[7] Hence there is a public good aspect associated with entry into new markets.

The structure of competition is shown in Figure 2. The bank enters the market, s becomes observable and then a second bank may enter as well. Then banks choose r and deposits are collected and the funds invested. The important aspect here is that if the market is sufficiently attractive (i.e. s is below a critical threshold), then a second bank will enter and compete for deposits. This creates a discontinuity in the expected profits when s falls. Normally, lower s implies higher profits, but as s crosses below the threshold where competition ensues, profits decrease.

Figure 2:

[7] It is not necessary for the results presented in this model for us to assume that s becomes perfectly observable after entry -- this is only a simplifying assumption. The only necessary requirement for our fundamental result to hold -- that entry is underprovided when free entry is allowed -- is that a potential competitor's estimation of s improves after entry.



Banks can invest deposits in a competitive lending market where they earn a return L on their funds.[8] This can be thought of as a situation where banks use funds collected in rural areas to support investment in the urban center. Alternatively, banks may have profitable investment opportunities in the rural catchment. For example, some high expected return projects may not be undertaken because they require (relatively) large capital investments and the transaction costs of collecting them through self-intermediation are too great. For the purposes of this analysis, we will abstract from the specifics of the lending allocation, and simply assume banks earn L on their investment. As a consequence, the maximum deposit rate that banks may pay is L. For simplicity, we assume that G has support over [L-b,L].[9] Expected bank profits in the first period are:

$$\pi = \int_{L-b}^{L} (\pi | s) dG(s,\theta)$$

where $\pi | s$ depends on the structure of competition and will be discussed later. After the first period, if the catchment is not profitable (given the structure of competition), the bank will withdraw. We can define $\bar{s}$ by $[(\pi | \bar{s}) = 0]$. If $s<\bar{s}$, then the bank will operate profitably in the catchment for all future periods, effectively providing it with an annuity. Thus the total expected profits from entry are:

[8] The focus of this paper is on deposit mobilization, so we ignore any effects an increase in the supply of funds may have on the lending market equilibrium. This assumption may be justified, however, if the volume of savings in any particular rural catchment is small relative to the total volume of funds intermediated. Also, if there is equilibrium credit rationing in the lending market, the lending rate may remain unchanged with an increase in the volume of savings.

[9] There is no loss of generality here. We can describe all possible relevant distributions over this support. If $s < L - b$, then a bank with monopoly power will act as if $s = L - b$. This is because the monopoly will choose to serve the entire catchment. If $s > L$, then any bank will lose F, the fixed cost of entry and gain no deposits. We can describe each of these situations with a probability mass on the appropriate extreme of the support.

$$E(\pi|\theta) = \int_{L-b}^{L} (\pi|s)dG(s,\theta) + \frac{\delta}{1-\delta}\int_{L-b}^{\bar{s}} (\pi|s)dG(s,\theta)$$

where δ is the discount factor. All banks observe the same signal θ about the distribution of s in a given catchment, but the government does not observe the signal. Part of the goal of policy will thus be determining an efficient mechanism to utilize the private signal to encourage efficient entry into rural catchment areas.

In subsections 2.2 through 2.5, we will determine the entry conditions that would be used by a social planner to maximize welfare, by a profit-maximizing firm guaranteed a monopoly position in the catchment, and by a profit-maximizing firm vulnerable to competition from subsequent entry. Our results presented in subsection 2.6 are based primarily upon the comparison of these three entry conditions.

Section 2.2: Socially Efficient Entry

We will first consider the decision of the a hypothetical social planner as to whether entry into a rural catchment is efficient, given the available information. We assume that the social planner (unlike the government) can observe θ. If s<L, then for at least some depositors near it, the branch offers higher returns than self-intermediation. The fixed cost F is incurred (in the first period) before the value of s is discovered. Hence, the social planner must trade off the expected gains from monetizing savings versus the cost of entry. Before paying the fixed cost in any subsequent period, the gains from monetizing the savings must at least cover the fixed cost, defining s* by $[(W|s^*) = 0]$. Expected welfare (where welfare is measured by the total social return to entry) is thus:

(1) $$E(W|\theta) = \int_{L-b}^{L} (W|s)dG(s,\theta) + \frac{\delta}{1-\delta}\int_{L-b}^{s^*} (W|s)dG(s,\theta)$$

The social planner will offer a rate L to depositors, so that all depositors for whom the social return increases with formal intermediation choose to monetize their savings. Depositors up to a distance x* from the bank will open accounts, where x* is defined by:

$$L - bx^* = s, \text{ or } x^* = \frac{L - s}{b}$$

All households on each side of the bank up to a distance x* from the branch will choose to open accounts with the bank. Given s, per period welfare from entry is:

$$W|s = 2\int_{0}^{x^*} D(L - s - bx)dx - F$$

$$W|s = \frac{D(L-s)^2}{b} - F$$

If s is sufficiently high, then the surplus generated from entry is negative (because it fails to cover the fixed cost). The bank will withdraw from the market in the second (and all subsequent periods) when $s > s^*$, where

$$(W|s^*) = 0 \Rightarrow s^* = L - \sqrt{\frac{bF}{D}} = L - \frac{1}{\sqrt{\frac{bD}{F}}}b$$

Entry then is socially efficient when

$$E(W|\theta) = \int_{L-b}^{L} \frac{D(L-s)^2}{b} dG(s,\theta) - F + \frac{\delta}{1-\delta}\int_{L-b}^{s^*} [\frac{D(L-s)^2}{b} - F]dG(s,\theta) > 0$$

<u>Section 2.3: Entry by a Monopolist</u>

The monopolist will enter the market when its expected profits, given θ, are positive, or

(2) $$E(\pi^m|\theta) = \int_{L-b}^{L} (\pi^m|s)dG(s,\theta) + \frac{\delta}{1-\delta}\int_{L-b}^{s^m} (\pi^m|s)dG(s,\theta) > 0$$

Once the bank observes s, it can choose its profit-maximizing deposit rate. The monopolist must trade-off two opposing effects in deciding this deposit rate. When it increases the rate, it can attract a larger number of depositors, but its margin on all depositors it captures then falls. The profit maximizing rate exactly balances these two effects.

Given that it offers a rate r^m, the marginal depositor (at a distance x^m from the bank) will open an account with the bank if:

$$r^m - bx^m = s \text{ or } x^m = \frac{r^m - s}{b}$$

Profits, given s, are then:

$$\pi^m|s = 2\int_0^{x^m} D(L-r)\,dx - F$$
$$\pi^m|s = \frac{2D(L-r)(r-s)}{b} - F$$

The profit-maximizing interest rate is thus (from $\frac{d\pi^m|s}{dr} = 0$):

$$r^m = \frac{L+s}{2}$$

Giving

$$\pi^m|s = \frac{D(L-s)^2}{2b} - F$$

The monopolist will continue operation in the second and all subsequent periods when $s \le s^m$ where $s^m \equiv [(\pi^m|s^m) = 0]$, or

$$s^m = L - \sqrt{\frac{2bF}{D}} = L - \frac{\sqrt{2}}{\sqrt{\frac{bD}{F}}}\, b$$ [10]

The monopolist will enter when

$$E(\pi^m|\theta) = \int_{L-b}^{L} \frac{D(L-s)^2}{2b}\, dG(s,\theta) - F + \frac{\delta}{1-\delta}\int_{L-b}^{s^m}\left[\frac{D(L-s)^2}{2b} - F\right] dG(s,\theta) > 0$$

Section 2.4: Entry with the Threat of Competition

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[10] We will assume below that $4 \le \frac{bD}{F} < 8$, which implies that $L - \frac{\sqrt{2}}{2}b \le s^m < L - \frac{1}{2}b$.

The entry decision of a bank vulnerable to competition is different from those described above in a fundamental way -- the revealed value of s determines the structure of competition that the bank faces. If s is sufficiently small[11], the bank will have to compete for deposits. If, however, the value of s is large in some sense, then the bank will earn monopoly profits. This implies that when s crosses a critical threshold, the structure of competition changes and the profits of the bank fall discontinuously.

Assume for the moment that s is sufficiently small that it does not affect the pricing decision of either bank. N firms enter the market, spaced evenly around the Hotelling unit circle. A depositor located between two banks, offering rates r_1, r_2, respectively, will choose the first bank when

$$r_1 - bx^c > r_2 - b(\frac{1}{N} - x^c), \text{ or } x^c = \frac{r_1 - r_2}{2b} + \frac{1}{2N}$$

Profits given s are then:

$$\pi^c | s = 2\int_0^{x^c} D(L - r_1)dx - F, if\ s < L, -F \text{ otherwise}$$

$$\pi^c | s = D(L - r_1)(\frac{r_1 - r_2}{b} + \frac{1}{N}) - F$$

The profit-maximizing interest rate is thus (from $\frac{d\pi^c|s}{dr_1} = 0$):

$$r_1 = \frac{1}{2}(L + r_2 - \frac{b}{N})$$

Incentives for both banks are symmetric, so the equilibrium interest rate will be:

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[11] As we shall demonstrate, when s falls below a critical level, a second bank will entry and both banks will compete with each other for deposits on the margin. If s exceeds that critical level, then the bank will be effectively protected from competition and it will act like a monopolist.

$$r^c = L - \frac{b}{N} \text{ and } x^c = \frac{1}{2N}$$

We began by assuming that s does not bind the pricing decision of the bank. Thus, $s < s^c$ where

$$s^c \equiv r^c - bx^c$$
$$s^c = L - \tfrac{3}{2N} b$$

We can then determine profits when both banks compete with each other to collect deposits.

$$\pi^c | s = \frac{bD}{N^2} - F$$

Because we are considering a range where s is sufficiently small that bank compete with each other, it makes sense that s does not impose a binding constraint on either bank's decision. Thus, we should expect that profits under competition are independent of s, as is the case.

For simplicity, we want to limit the analysis to the case where <u>at most</u> two banks can enter in a competitive market. We therefore examine the case of $4F \le bD < 8F$.[12] This implies that, when two banks are competing in the market, $\pi^c | s = kF$ with $0 \le k < 1$.

Now let us assume that s creates a binding constraint on the pricing decision of the bank, i.e. $s \ge s^c$. Thus each bank will choose a deposit rate such that its marginal depositor (at a distance $x^d = \frac{1}{2N}$ from the bank) will be just indifferent between an account with the bank and self-intermediation.[13] This occurs when

$$r^d = s + \tfrac{1}{2N} b$$

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[12] We intentionally exclude the case of $8F \le bD < 9F$. This range of parameters creates a very special case whereby it is feasible for two non-competing monopolists to enter the market. For all other ranges of these parameters ($bD < 8F$ and $bD \ge 9F$), if an additional bank may profitably enter the market, then the banks will compete with each other for deposits.

[13] We can show this formally by considering the first order condition of the bank when it competes with another for deposits. $\frac{\partial \pi}{\partial r_1} = \frac{D}{b}[L - \frac{1}{N} b - r_1 - (r_1 - r_2)]$. In a symmetric equilibrium with $(r_1 = r_2)$, then $\frac{\partial \pi}{\partial r_1} < 0$ whenever $r_1 > L - \frac{1}{N} b$. Thus the bank will lower its deposit rate until the constraint on s becomes binding.

We can now determine profits under this duopoly-like structure of competition.

$$\pi^d | s = 2\int_0^{\frac{1}{2N}} D(L - r^d)dx - F$$

$$\pi^d | s = \tfrac{D}{N}(L - s - \tfrac{b}{2N}) - F$$

We can show that $s^c < s^d < s^m$, where $s^d \equiv [(\pi^d | s^d) = 0]$. Essentially, $(\pi^d | s^c) > 0$ and $(\pi^d | s^m) < 0$. Since $\pi^d | s$ is a continuous function, it must be that case that s^d is at an intermediate point between the two.

Section 2.5: The Structure of Competition as a function of s

The structure of competition depends on the value of s that is revealed. If $s < s^c$, then a second bank enters and the two compete, yielding profits of $\pi^c | s$. When $s^c \le s \le s^d$, a second bank enters and they both act like duopolists, earning profits of $\pi^d | s$. If, however, $s > s^d$ then a second bank would lose money if it entered. Thus the incumbent bank knows it has a monopoly position and will earn $\pi^m | s$.

Let us define $\hat{\pi}^c | s$ as the actual profits captured by the incumbent bank as a function of s. Then

$$\hat{\pi}^c | s = \begin{cases} \pi^c | s & \text{when } s < s^c \\ \pi^d | s & \text{"} \quad s^c \le s \le s^d \\ \pi^m | s & \text{"} \quad s > s^d \end{cases}$$

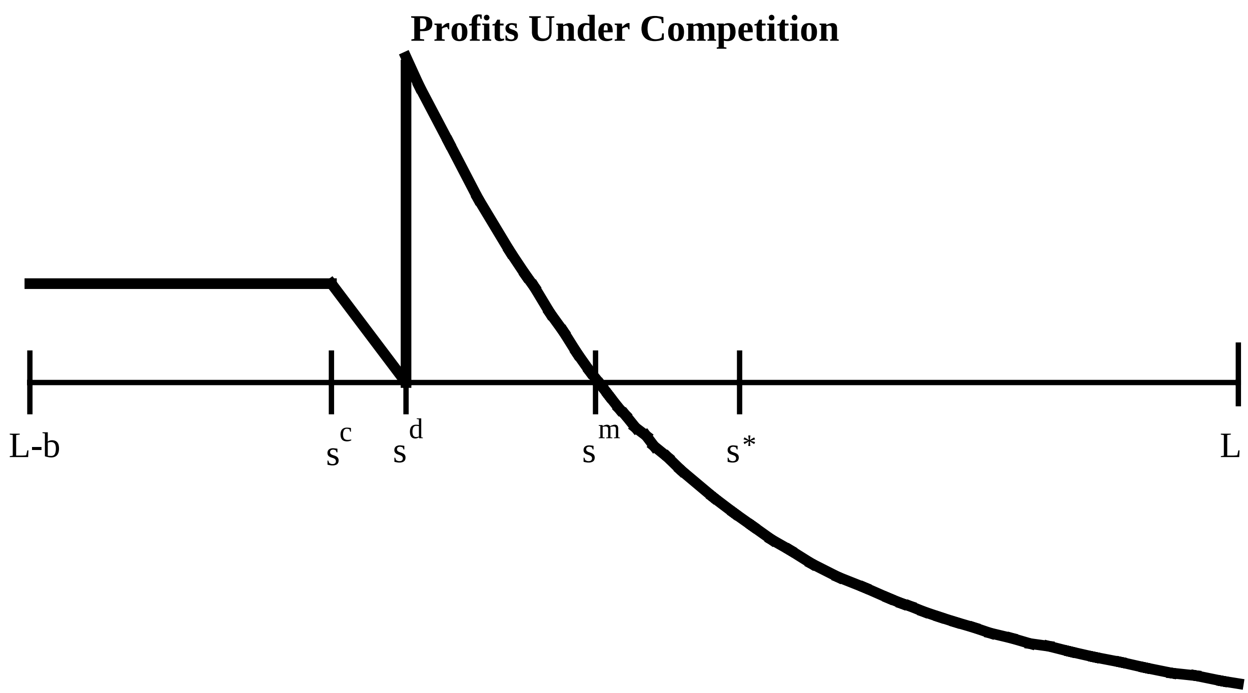
A bank will enter a market based on its signal θ of the quality of the catchment when

(3) $$E(\hat{\pi}^c | \theta) = \int_{L-b}^{L} (\hat{\pi}^c | s) dG(s,\theta) - F + \frac{\delta}{1-\delta} \int_{L-b}^{s^m} (\hat{\pi}^c | s) dG(s,\theta) > 0$$

i.e. when its expected profits from entry (given the type of competition it faces as a function of s) are positive.

An important feature of the underlying profit function $(\hat{\pi}^c | s)$ is that it is not monotonically decreasing in s. This is because there is a discontinuous increase in realized profits when s increases from s^d to $s^d + \varepsilon$. Realized profits are zero when s=s^d (by definition), whereas they are positive when $s^d + \varepsilon$ (because the structure of competition changes from duopoly to monopoly and $[\pi^m | (s = s^d + \varepsilon) > 0]$). We can see the shape of $(\hat{\pi}^c | s)$ in Figure 3 below.

Figure 3:



Section 2.6: Entry Incentives and Government Policy

First best entry incentives would have banks choose to enter the market whenever expected social welfare from entry is positive. Failing that, it is preferable that the entry decision efficiently utilize available private information about the quality of the catchment area. Specifically, since G(s,θ_1)<G(s,θ_2) whenever $\theta_1 < \theta_2$, the private incentive to enter the market should be increasing as θ decreases.

Result 2.1

The incentives to enter for the monopolist are always greater than that of the competitive firm, but always less than the social optimum.

Comparing the expected profits of the monopolist (Equation 2) to that of a competitive firm (Equation 3), we find that

$$E(\pi^m|\theta)-E(\hat{\pi}^c|\theta)=\frac{1}{1-\delta}[\int_{L-b}^{s^c}(\pi^m-\pi^c)dG(s,\theta)+\int_{s^c}^{s^d}(\pi^m-\pi^d)dG(s,\theta)]>0$$

This results follows directly from the observation that competition can never produce higher profits than monopoly. If this were possible, then the monopolist could just replicate the competitive equilibrium and be better off.

The entry incentives of the monopolist are similarly always less than the social optimum (from Equation 1).

$$E(W|\theta)-E(\pi^m|\theta)=\int_{L-b}^{L}(W-\pi^m)dG(s,\theta)+\frac{\delta}{1-\delta}[\int_{L-b}^{s^m}(W-\pi^m)dG(s,\theta)+\int_{s^m}^{s*}WdG(s,\theta)]>0$$

This is because of the allocative inefficiency arising from the monopolist's pricing power. In particular, the monopolist pays a deposit rate of $r^m=\frac{1}{2}(L+s)<L$. This results in depositors at the fringes of the market ($x^m<x\le x*$) choosing self-intermediation even though it is socially efficient for them to deposit their funds with the formal financial sector. If the monopolist cannot capture the entire social return, its incentives will be less than the socially efficient level.

<u>Result 2.2</u>

The expected profits for the monopolist are monotonic in θ, so that incentives for the monopolist to enter are increasing as θ decreases. Expected profits for the competitive firm are not necessarily monotonic, so that a lower quality signal (higher θ) may give a stronger incentive to enter.

Expected profits for the monopolist ($E(\pi^m|\theta)$) are increasing as θ decreases because profits given s ($\pi^m|s$) are decreasing in s and $G(s,\theta_1)<G(s,\theta_2)$ $\forall$s if $\theta_1<\theta_2$.

The result for the competitive firm is ambiguous because of the truncated nature of its returns. When s is sufficiently small ($s<s^d$), a second bank will enter the market, and the resulting

competition will drive profits to a level less than that achieved by the monopolist. From Equation 3,

$$E(\hat{\pi}^c|\theta) = \int_{L-b}^{L} (\hat{\pi}^c|s)dG(s,\theta) + \frac{\delta}{1-\delta}\int_{L-b}^{s^m} (\hat{\pi}^c|s)dG(s,\theta)$$

We demonstrated in subsection 2.5 that $\hat{\pi}^c|s$ is not monotonically decreasing in s. Given that θ represents a shift of first order stochastic dominance in G(s, θ), we know that $E(\hat{\pi}^c|\theta)$ is not necessarily decreasing in θ. As an example, let us assume that there is a large probability mass at $s = s^d$. A small increase in θ, may shift that probability mass to $s = s^d + \varepsilon$, resulting in a discontinuous <u>increase</u> in $E(\hat{\pi}^c|\theta)$.

Result 2.3

Assuming the government knows G(s, θ *), there exists an efficient subsidy* $c^m F$ *with* c^m *<1 such that the monopolist has efficient entry incentives. Should the expected profits of the competitive firm be monotonic, then there exists a subsidy* $c^c F$ *such that entry incentives are efficient. The subsidy for competitive firms must exceed that for the monopolist (*$c^c > c^m$*). If competitive profits are not monotonic, then the government may not be able to provide the socially efficient incentive with a subsidy.*

Expected welfare $[E(W|\theta)]$ is monotonic in θ and always greater than the profits of the monopolist $[E(\pi^m|\theta)]$. If we define θ^* as the efficient entry signal (i.e., $\theta^* \equiv [E(W|\theta^*) = 0]$), then the optimal subsidy is:

$$c^m F = -E(\pi^m|\theta^*)$$

Then the monopolist will enter for all $\theta \leq \theta^*$ because

$$E(\pi^m|\theta) + c^m F = E(\pi^m|\theta) - E(\pi^m|\theta^*) \geq 0, \forall\, \theta \leq \theta^*$$

which is the efficient entry condition. Similarly, if competitive profits are monotonic in θ, then we can define the subsidy for the competitive firm as:

$$c^c F = -E(\hat{\pi}^c|\theta^*)$$

to generate the efficient entry incentives. It will always be more costly for the government to induce efficient entry in the competitive market structure.[14]

$$E(\hat{\pi}^c|\theta^*) < E(\pi^m|\theta^*) \Rightarrow c^c F > c^m F$$

If the competitive profit is <u>not</u> monotonic in θ, then the government may not be able to provide the efficient entry incentive. Non-monotonicity implies that:

$$E(\hat{\pi}^c|\theta)_1 < E(\hat{\pi}^c|\theta_2), \text{ for some } \theta_1 < \theta_2$$

In particular, if $E(\hat{\pi}^c|\overline{\theta}) < E(\hat{\pi}^c|\theta^*),$ for some $\overline{\theta} < \theta^*$, then the competitive bank will not enter when $\theta = \overline{\theta}$ even with a subsidy of $c^c F$. We have

$$E(\hat{\pi}^c|\overline{\theta}) + c^c F = E(\hat{\pi}^c|\overline{\theta}) - E(\hat{\pi}^c|\theta^*) < 0$$

<u>Result 2.4</u>

If the government offers a full subsidy equal to the fixed cost of entry, entry is excessive. The subsidization policy fails to utilize private information about the quality of the catchment.

If the government were to encourage entry by offering a subsidy equal to the total fixed cost, it will generate excessive incentives for entry. From Equation 6, the expected profits with the subsidy are:

$$E(\hat{\pi}^c|\theta) + F = \int_{L-b}^{L} [(\hat{\pi}^c|s) + F] dG(s,\theta) + \frac{\delta}{1-\delta} \int_{L-b}^{s^m} (\hat{\pi}^c|s) dG(s,\theta) > 0, \forall \theta$$

So competitive firms will have incentive to enter all markets, regardless of their signal of the quality of the catchment. With a complete subsidy of the fixed cost of entry, banks bear no downside risk from entry.

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14 Assuming $G(s^d, \theta) > 0, \forall \theta$.

Result 2.5

If the government grants a sufficiently long exclusive right (of duration T) and offers a subsidy equal to $c^p F$ *, then the government can induce efficient entry even when the returns under competition are not monotonic in* θ *. This subsidy is less than that needed by a firm in a completely competitive market but greater than that needed to induce efficient entry by the monopolist (i.e.* $c^m < c^p < c^c$ *). The advantage of an exclusive right with limited duration is that after T periods elapse, the static inefficiency arising due to monopoly power is eliminated by competition.*

If the government offers an exclusive right of T periods to the first entrant, the expected profits to the bank are:

$$E(\pi^p|\theta) = \int_{L-b}^{L} (\pi^m|s)dG(s,\theta) + \frac{\delta - \delta^T}{1-\delta}\int_{L-b}^{s^m}(\pi^m|s)dG(s,\theta) + \frac{\delta^T}{1-\delta}\int_{L-b}^{s^m}(\hat{\pi}^c|s)dG(s,\theta)$$

We make the claim that if T is sufficiently long, then the government can induce efficient entry with a subsidy. This is equivalent to the statement that there is no $\tilde{\theta} < \theta^*$ such that $E(\pi^p|\tilde{\theta}) < E(\pi^p|\theta^*)$.

To prove this let us consider the set of all $\bar{\theta} < \theta^*$ for which $E(\hat{\pi}^c|\bar{\theta}) < E(\hat{\pi}^c|\theta^*)$. For each of these $\bar{\theta}$ there exists some $\bar{T}$ for which $E(\pi^p|\bar{\theta}) \geq E(\pi^p|\theta^*)$. We can see this easily in the limiting case where $\bar{T} \to \infty$ because then $E(\pi^p|\bar{\theta}) = E(\pi^m|\bar{\theta})$ and $E(\pi^m|\theta)$ is monotonically decreasing in θ. If T represents then minimum $\bar{T}$ such that this condition is satisfied everywhere, then $E(\pi^p|\theta) \geq E(\pi^p|\theta^*), \forall\, \theta < \theta^*$.

The government can now offer a subsidy equal to

$$c^p F = -E(\pi^p|\theta^*)$$

We can see that $c^m < c^p < c^c$ because $E(\pi^m|\theta^*) > E(\pi^p|\theta^*) > E(\pi^c|\theta^*)$.[15] Even though a larger subsidy is necessary to induce efficient entry when the government grants an exclusive right of limited duration, rather than a permanent monopoly to the bank, there are large potential social

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[15] Assuming T is finite and positive.

gains from a competition in the future. Once the exclusive right expires, entry by a second bank will eliminate the deadweight loss from monopoly power. In particular, if the government has a lower discount rate than that used by the bank in its entry decision, the social gains perceived by the government from entry may far outweigh the economic loss from future competition as perceived by the bank.

Section 3: Deposit Rate Controls and Financial Depth

In the previous section we have examined the entry decision of banks into new catchment areas. In this section we will look at the related problem of how, in a given market, banks can "deepen" their market penetration. By financial depth we have a precise concept in mind: a deposit market has not achieved its full depth (i.e. has not been fully penetrated) if there exist households that are not depositing their wealth in banks, even though the deposit rate exceeds the return of their chosen alternative form of investment. This definition reflects the commonly observed phenomena in developing countries that although financial institutions are present, a significant proportion of households does not utilize their services. There may be several reasons for this, including lack of visibility of the banks, lack of knowledge and trust among households about the banks activities, and switching cost, such as when households hold their wealth in real assets that need to be sold off before their value can be deposited with banks.

In this section we ask the following question: Under what circumstances will private profit-maximizing banks spend resources to grow the deposit market, i.e. to attract those households that are currently outside of the formal system? To increase financial depth, banks can be proactive in a number of ways, ranging from spending resources on improving its infrastructure to actually engaging in a promotional campaign that educate households about the benefits of financial savings. We will summarize these activities as an "educational advertising campaign."

In a competitive banking environment, an educational advertising campaign is a tool of non-price competition, in the sense that banks spend resources on attracting new customers using mechanisms other than changes in the deposit rate. We will show that this non-price competition arises only when the government intervenes to place a ceiling on the interest rate banks may offer to depositors. Traditional economic analysis would emphasize the static allocative inefficiency of non-price competition. We emphasize, however, that this non-price competition can be beneficial in an environment characterized by low financial depth. If the campaign reaches households that are already in the financial system it will only induce households to switch between competing banks without creating social value. If, however, it reaches households previously not connected to the system, it creates social returns by increasing financial depth. Deposit rate controls create margins that allow banks to capture some of these social returns. As a consequence they allow for a *decentralized* solution to the challenge of increasing financial depth.

Section 3.1: Description of the Model

There are H households that each supply one unit of deposits. Household want to maximize the value of their savings, choosing between putting their wealth into either financial savings or into other uses, that we summarize as "self-intermediation." The return to self-intermediation for any particular household is s, where s is privately observed by households. For the entire economy, the distribution of these returns is G(s) with a support $[s_{min},s^{max}]$. For a given interest rate r, the probability that any particular household will choose to monetize its savings is G(r).

We denote the number of households which are connected to the financial sector by K. We assume that these households will choose between self-intermediation and financial savings on the basis of maximizing expected returns. Not all households, however, are connected to the formal financial sector. The remainder of households (H-K) will always self-intermediate, unless reached by an educational advertising campaign. Thus K is a measure of financial depth, ranging from 0 to H.

We assume that there are two banks that compete Bertrand in the deposit rate.[16] Banks have one further choice variable: they may invest in an educational advertising campaign. This campaign has two effects. First, it introduces households that were previously not connected to the formal financial sector to banks. Once a household has been exposed to an educational campaign, it is inside the financial system. Depending on the deposit rate it may then choose to deposit its wealth or not. Second, a campaign resolves the choice of an indifferent depositor. Whenever the two banks offer the same deposit rate, a household contacted by exactly one campaign will go to the banks it has been contacted by. If a household has been contact by both or neither banks, it remains indifferent. If the two banks offer different deposit rates, standard Bertrand competition implies that all depositors will prefer the bank with the higher deposit rate, irrespective of

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[16] The results with more than two banks are analogous. The only difference is that the probabilities that a household receives more than one message have to be appropriately modified.

campaigns. Banks cannot price discriminate between depositors previously connected or not, nor between households that were or were not reached by the campaign.

A campaign is costly. If we define c_i as the probability that a household is exposed to the campaign of bank i, then the cost of the campaign is determined by z(c_i), where z satisfies z(0) = 0, z'(c)≥ 0, z'(0) = 0; z'(1) = ∞ and z"(c) > 0.

Section 3.2: Investment under Competition

Let L be the expect value of an additional deposit to the bank. L could be the safe rate of return, or it could be the expected return on a lending portfolio. Let r_i be the deposit rate offered by bank I, and let d_i be the quantity of deposits mobilized by bank i. Profits for bank i are then given by:

$$\pi_i = (L - r_i) d_i (r_i, r_{-i}, c_i, c_{-i}) - z(c_i)$$

The number of deposits which the bank captures depends on its deposit rate relative to its competitor and on the total number of households with financial savings (which depends on K,c_i, c_{-i}). Applying the above selection criteria of households, we have

$$d_i(r_i > r_{-i}, c_i, c_{-i}) = [K + (H - K)(c_i + c_{-i} - c_i c_{-i})]G(r_i)$$

$$d_i(r_i < r_{-i}, c_i, c_{-i}) = 0$$

$$d_i(r_i = r_{-i}, c_i, c_{-i}) =$$

$$[K(0.5 c_i c_{-i} + 0.5(1 - c_i)(1 - c_{-i}) + c_i(1 - c_{-i})) + (H - K)(c_i(1 - c_{-i}) + 0.5 c_i c_{-i})]G(r_i)$$

Result 3.1: In a competitive equilibrium, banks will earn zero profits ($\pi_i = 0$) and offer deposit rates equal to the lending rate ($r_i = r_{-i} = L$). Banks will make no investments in growing the market, i.e. $c_i = c_{-i} = 0$.

Proof: Suppose that $r_i < L$. Then bank -i will offer and deposit rate of $r_{-i} = r_i + \varepsilon$, where ε arbitrarily small. Since $d_i(r_{-i}+ \varepsilon > r_i) > d_i(r_{-i} = r_i)$ for sufficiently small ε this deviation is always profitable. Thus $r_i = r_{-i} = L$ in equilibrium. Since banks must earn non-negative profits, $c_i = c_{-i} = 0$.

This result is due to the extreme properties of Bertrand competition. We use it as a convenient benchmark case to argue that if banks have no margin on deposits, they will be are unwilling to make investments to increase the size of the market. No investments are made in the campaign by either firm and K, the number of households with financial savings, always remains unchanged.

Total social income is thus:

$$I^{FM} = KF(L) + (H - K)E$$

where $E \equiv \int_{-\infty}^{\infty} s dG(s)$ and $F(r) \equiv [LG(r) + \int_{r}^{\infty} s dG(s)]$. E is the expected return under self-intermediation, while F(r) is the expected return with financial intermediation at a deposit rate r. For all $r > s_{min}$, we have $F(r) > E$.

Section 3.3: Investment under *financial restraint*

Now suppose the government intervenes to place a limit $\underline{r}$ on the deposit rate paid by banks. Both banks will offer $\underline{r}$ and then choose a level of c to maximize their profits. The derivative of the bank's deposits as a function of the size of its campaign is

$$\frac{\partial d_i}{\partial c_i} = [(H - 0.5K) - 0.5(H - K)c_{-i}]G(\underline{r})$$

so that a bank's first order condition for the optimal choice of c_i is given by

$$Q(\underline{r})[(H - 0.5K) - 0.5(H - K)c_{-i}] - z'(c_i) = 0$$

where $Q(\underline{r}) \equiv (L - \underline{r})G(\underline{r})$.

Let us define the following conditions:

Condition Q: $\frac{\partial Q}{\partial \underline{r}} = (L - \underline{r})g(\underline{r}) - G(\underline{r}) < 0$

Condition Z: $z''(c_i) > (H-K)\, 0.5\, Q(\underline{r}) \;\; \forall\, c_i$

Note that condition Q is always satisfied locally for $\underline{r}$ close to L. Condition Z is easily satisfied by choosing a sufficiently convex cost function.

We can now state:

<u>Result 3.2:</u> Whenever the deposit rate is set to a level $\underline{r}$ < L, and assuming condition Z holds, there is a unique stable and symmetric equilibrium, where each bank spends a strictly positive amount of resources on an educational advertising campaign. The equilibrium size of a campaign c_i is a decreasing function of K, an increasing function of H. If condition Q is satisfied (is not satisfied), then c is a decreasing (increasing) function of $\underline{r}$.

Proof: The first term of the first order condition is always strictly positive => $z' > 0$, => $c_i > 0$. Condition Z ensures that the Jacobian matrix is positive definite, guaranteeing a well-behaved equilibrium. The comparative statics are immediate from differentiating the first order condition with the respective variables.

Result 3.2 establishes the fundamental result that deposit rate controls can induce private banks to invest in growing the market. The bank's incentive to invest in an educational advertising campaign is stronger, the lower financial depth. The effect of an increase in the deposit rate is two-fold. For higher r, the margin on deposits decreases for those depositors that the bank successfully captures at a deposit rate of $\underline{r}$, making a campaign less attractive (as reflected by the $G(\underline{r})$ term). More depositors, however, would respond to a campaign at a higher deposit rate, making a campaign more powerful (as reflected by the $(L-\underline{r})g(\underline{r})$ term). If condition Q is satisfied, the first effect dominates, so that the size of the campaign is a decreasing function of the deposit rate. This will always be the case for $\underline{r}$ close to L.

Section 3.4: Government Policy as a Function of Financial Depth

In an equilibrium with deposit rate controls, banks make positive investment in the campaign of c. This will induce some households previously not connected to the financial sector to open deposit accounts [(H-K)($2c - c^2$)] at a cost of 2z(c). Total household income under deposit control is then:

$$I = [K + (H - K)(2c - c^2)]F(\underline{r}) + (H - K)(1 - 2c + c^2)E - 2z(c)$$

The social planner has an indirect control problem of controlling c through $\underline{r}$. There is a trade-off between the gains benefits of having market growth versus the cost of distorting the deposit rate on the existing depositors. The competitive outcome is an extreme outcome in this trade-off, where $\underline{r}$ = L so that c = 0.

We can derive two important results from this maximization problem.

Result 3.3: *The exists a critical level K*, where 0 < K* < H, such that for all K ≥ K*, L is the optimal deposit rate, and for all K with K < K* the optimal deposit rate* $\underline{r}$** lies strictly below L. Moreover, the optimal deposit rate is a non-decreasing function of K.*

Proof: See appendix.

Result 3.4: *For any K < H, if the social planner can only control c through the control of* $\underline{r}$*, the optimal c will be smaller than if the social planner could control c directly.*

Proof: See appendix.

Result 3.3 has two important parts. First it formally shows that for a significant range of parameters (K ∈ [0,K*]) deposit rate controls are not only effective in inducing campaigns, but it is actually optimal for a social planner to use these deposit rate controls, despite their costs in terms of disintermediation. In the range K ∈ [K*,H] the marginal benefit of introducing further household into the system is not worth the cost of disintermediation.

Second, result 3.3 shows that the optimal level of the deposit rate depends on the level of financial depth. The more rudimentary financial intermediation (i.e. the lower K) the lower the optimal deposit rate. This is a formalization of a claim we have made repeatedly (cf. also Hellmann, Murdock and Stiglitz 1995), that the optimal amount of *financial restraint,* such as through deposit rate controls, is a direct function of the level of financial development.

Result 3.4 finally shows that while deposit rate controls can induce private banks to spend some amount of resources on deepening the financial markets, this amount may still be insufficient from a social planner's perspective. A government may therefore want to do more to promote financial deepening. We leave the discussion on the efficiency of further such policies to future research.

We have thus shown that competition in deposit rates leads to a situation where banks have no incentives to collect additional deposits. The fundamental insight is that the incentive to grow deposit market depends on the margins that banks make on deposits, i.e. the difference between lending and deposit rates. Deposit rate controls ensure that competition will not drive these margins down to zero. They are therefore a powerful instrument to allow private deposit markets to grow.

Conclusion

This paper asks the question under what circumstances banks have incentives to increase their deposit collection efforts. We compare outcomes under a perfectly competitive market with outcomes under *financial restraint*, i.e. a combination of deposit rate controls and restrictions on competition. In the first model we show that temporary exclusive rights may be an efficient way of inducing banks to open branches in new areas. In the second model we show that deposit rate controls can induce banks to grow the deposit market. Our analysis could be extended in a number of ways. For instance, we have only examined one among several possible forms of non-price competition. It would also be desirable to integrate the two models, in order to develop a "life-cycle" model of new branches. Beyond these theoretical questions, we also believe that there are interesting institutionally descriptive and empirical questions about when banks actively mobilize deposits, and exactly what activities they undertake for this purpose. Such research could thus contribute to the broader question of what policies may be most effective to promote financial deepening.

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Appendix

Proof of Result 3.3:

We begin by proving the first assertion. The social planner never wants to set the deposit rate above L, as no bank would be willing to collect deposits. The first derivative of I w.r.t. $\underline{r}$ is given by $\frac{\partial I}{\partial \underline{r}} + \frac{\partial I}{\partial c}\frac{\partial c}{\partial \underline{r}}$, where $\frac{\partial I}{\partial c} = 2[(H-K)(1-c)(F(\underline{r})-E) - z']$ and $\frac{\partial I}{\partial \underline{r}} = \frac{\partial F(\underline{r})}{\partial \underline{r}}[K + (H-K)(2c - c^2)$. Evaluating this at K = 0 and $\underline{r}$ = L yields $\frac{\partial I}{\partial c} = 2H(F(L)-E) > 0$, $\frac{\partial c}{\partial \underline{r}} < 0$ (since condition Q is always satisfied near L) and $\frac{\partial I}{\partial \underline{r}} = 0$, implying that I is decreasing in $\underline{r}$ near L. This implies that in a neighborhood of K = 0, the optimal deposit rate is always lower than L. Consider next the case of K = H. We immediately recognize that any campaign only wastes social resources (i.e. I is always a decreasing function of c, as the only term is -2z(c)). It follows that $\underline{r}$ = L optimal. Finally, consider the derivative of I w.r.t. $\underline{r}$ in the neighborhood of $\underline{r}$ = L and K = H, which is given by $H\frac{\partial F(L)}{\partial \underline{r}} > 0$. It follows that not just at K = H, but also in a neighborhood of K = H, the optimal deposit rate is L. Combining these two results, we can conclude that there exists K*, with 0 < K* < H, so that for all K smaller than K*, a reduction in the deposit rate increases social income.

To prove the second assertion, suppose first that condition Q is always satisfied. Consider $\frac{\partial I}{\partial K} = (1-c)^2[F(\underline{r}) - E]$, so that

$\frac{\partial^2 I}{\partial K\,\partial \underline{r}} = 2(1-c)[F(\underline{r}) - E](-\frac{\partial c}{\partial \underline{r}}) + (1-c)^2\frac{\partial F(\underline{r})}{\partial \underline{r}}$, which is positive, establishing that I is supermodular in $\underline{r}$ and K (cf. Milgrom and Roberts 1990). It follows that the optimal choice $\underline{r}$ is non-decreasing in K.

If condition Q is not satisfied everywhere, then it is possible that c increases with $\underline{r}$. The optimal choice of $\underline{r}$, however, will never occur at a point where this is true. This is because for every c_1 and $\underline{r}_1$, where condition Q is violated, there exists another $\underline{r}_2 > \underline{r}_1$, so that $\underline{r}_2 > \underline{r}_1$ is chosen at both $\underline{r}_2$ and $\underline{r}_1$. This can be deduced from the fact that c($\underline{r}$) is continuous, is decreasing (increasing) in $\underline{r}$ whenever condition Q is (not) satisfied, and satisfies c($\underline{r}$) = 0 at $\underline{r}$ = L. The social planner will always choose $\underline{r}_2$ over $\underline{r}_1$ to implement c_1, as this involves less disintermediation. We can therefore rephrase the social planner's maximization problems over the following restricted domain of deposit rates: $r \in [s_{min};L]$ and condition Q is satisfied at r. I is supermodular over this domain, and we obtain again that the optimal choice of $\underline{r}$ is a non-decreasing function of K.

Proof of Result 3.4:

In the direct control problem, the social planner would set $\frac{\partial I}{\partial c} = 0$, which involves c>0 whenever K < H. If K* < K < H no resources are spent on campaigns in the indirect control problem. If K ≤ K*, we have seen in the previous proof that for any optimal choice of $\underline{r}$ we have $\frac{\partial c}{\partial \underline{r}} < 0$. From the first-order condition of choosing the optimal $\underline{r}$, we have $\frac{\partial I}{\partial c} = \frac{\partial I}{\partial \underline{r}} / (-\frac{\partial c}{\partial \underline{r}}) > 0$. Again, the amount of resources spent on a campaign are less than in the direct control problem.