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Financial Intermediation and Employment

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Abstract: This paper explores the relationship between financial intermediation and employment. We explain why some economies have low financial intermediation even when financial intermediation is *safe*. Moreover, we seek to explain why these economies tend to be poor and vulnerable, and also have large self-employment even when the latter has low productivity. We model *safe but unsound* banks and show that the effects of bad banking can be overcome only partially by corrective taxes. The model is extended to incorporate the illegal sector of the economy as well as the labor laws.

Key words: Financial intermediation, self-employment, tax, labor laws.

JEL Classification No.: G20, J23, O17.

1 Introduction

This work was motivated by two stylized facts regarding less developed countries (LDCs from now on), poor financial development and the low level of formal sector employment. We use a simple theoretical model to examine the linkages between these two aspects.

That the level of financial development in LDCs is relatively low compared to that in developed countries is well known. Private credit, for example, is less than 25% of GDP in low income countries. In high income countries, the corresponding minimum figure exceeds 50% (the maximum figure exceeds 110%). Similarly, market capitalization is less than 20% in LDCs, whereas it lies between 20% and 80% in high income countries (World Bank, 2001). There is also evidence to show that financial depth is positively correlated with growth (World Bank, 2001, p. 5-6). Moreover, there is some evidence on causality as well. It has been shown that the causality runs from financial development to the real sector (e.g. Levine, et al. , 2000, and Rajan and Zingales, 1998). Greenwood and Smith (1997), Levine (1997), and Levine and Zervos (1998) discuss the interlinkages between the real sector and the financial sector. This paper further explores the relationship between these two sectors.

The second stylized fact in the context of LDCs is that employment in the formal sector, sometimes also called the organized sector, is relatively small e.g. it is less than 10% in India (see Government of India, 2002). The bulk of the work force is engaged in the informal sector, unlike in the case of developed countries[1]. The informal sector is characterized by self-employment.

The literature has, however, treated the two phenomena of low employment in the formal sector and little financial intermediation as if they are unrelated. In a series of papers, it has been shown that investor protection is important for financial markets (e.g. Shleifer and Wolfenzon, 2002, and La Porta et al. , 2002). This literature suggests that financial development is low if investor protection is low. This is indeed the case in LDCs. Similarly, while studying the low level of formal sector employment in LDCs, the emphasis has been mainly on the artificially high levels of wages,[2] absence of infrastructure, the

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[1]The share of *non-corporate businesses* in total assets in USA in 1998 was 10.4% (p. 186, Table 5.1, Bertant and StarrMcCluer, chapter 5 in Guiso et al, 2002). Percentage of households with holdings in *business equity* in 1998 in USA was 11.5% (p. 190, Table 5.3, op. cit.)

[2]In the Harris-Todaro model, for example, such high wages can be attributed to govern-

inappropriate choice of technology[3] etc.

In this paper we seek to fill this gap in the literature by examining the inter-connections between low employment in the formal sector and little financial intermediation. Our hypothesis is that *financial intermediation increases with the level of formal sector employment.* The basic idea is as follows. When economic agents get regular wage employment, they deposit their wealth in a bank. Otherwise they go in for self-employment, using up their wealth to set up an owner managed enterprise (OME from now on). So they deposit a smaller fraction of their wealth in banks. Hence, bank deposits depend on the volume of formal sector employment. This linkage will play an important role in our analysis. This relationship, as far as we are aware, has not been explored in the literature.

While most of our arguments apply to financial intermediation in general, our analysis was, to a large extent, motivated by the problems facing the banking sector. One justification is that in the LDCs the banking sector is much more important compared to non-bank financial intermediaries and the financial market. This can be attributed, at least partially, to the fact that there is reasonably strong protection of an investor as a bank depositor,[4] as compared to protection of an investor as an equity or (non-bank) debt holder. Henceforth, we will refer to banking and financial intermediation interchangeably.

In the context of the inefficiencies in financial intermediation, one factor that has received considerable attention is the large volume of non-performing assets (NPAs from now on) in the banking sector. While NPAs undoubtedly constitute a serious problem, their importance may have been somewhat over-estimated. Leaving aside the distributional issues, NPAs are a serious problem if they are accompanied by allocative inefficiency. Since the issue is allocative inefficiency and not NPAs *per se*, we may, for simplicity, abstract from NPAs and focus on allocative inefficiency. Accordingly, we consider a scenario where there are no

mental regulations or the presence of uninonized labor in the formal sector. Of course, the formal sector sometimes deliberately pays a higher wage rate so as to attract the best quality labor, or to reduce labor turn-over (see Ray (1998)).

[3]See Sen (1968) on the debate regarding the choice of appropriate technology.

[4]The reason is the presence of public sector banks or deposit insurance. State banks are more common in low income countries (Figure 5, p. 15, World Bank). Moreover, deposit insurance coverage is relatively generous in low income countries. The ratio of deposit insurance coverage to per capita GDP is more than 6 in India as compared to a figure of less than 4 for USA (p. 108, World Bank, 2001)

NPAs but there is, nevertheless, allocative inefficiency.

There has been some literature on the role of the banking sector in the economy (see Allen and Gale (2000), and others[5]). Most of these papers, however, deal with developed economies. The usual framework is that of competition among banks and government regulations that drive managers to behave reasonably responsibly, barring some agency cost due to non-verifiable action. In this paper, however, we are concerned with a scenario in which public sector banks (PSBs from now on) dominate the banking sector. The crucial assumption is that there is a big separation between ownership and management in the bank. Following Jensen and Meckling (1976), this problem is well recognized in the literature in the context of the corporate sector. In the context of the PSBs, the problem due to separation of ownership and management gets further aggravated. The reasons are as follows. Firstly, monitoring of the bank managers by the owner viz. the government is weaker than in the case of the (private) corporate sector. Secondly, bank managers are public sector officials who can rarely be dismissed. This fact makes the bank managers more bold. Thirdly, in most LDCs, a borrower has, for all practical purposes, no access to the judiciary even if she can prove that she deserves to get a loan and has not got one (without bribing the bank officials). In this paper we focus on one particular manifestation of such self-serving behavior by bank managers, forcing the entrepreneurs to select inefficient projects. While this aspect of banking is well known in the literature, the implications of this behavior seem to have been underestimated. Usually it is assumed that deposits are given exogenously so that the nature of banking affects only the allocation of *given* deposits. We will show that deposits are endogenous and therefore, the implications of bad banking are more serious than they are usually thought to be.

Our framework is as follows. Consider an agent with some endowment of labor and capital. Suppose she has a job. She will obviously look for an optimal portfolio for her capital. This is the *standard finance problem*. But now suppose that she is, instead, unemployed and is likely to remain one. Will she forget her unemployment and consider the issue of optimal portfolio, or will she consider a portfolio that allows her to take care of both the wealth aspect as well as the employment aspect? We may refer to this as the *finance-cum-employment*

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[5]Diamond, D., 1984, Holmstrom and Tirole (1997), Stiglitz (1985, 1993), Bencivenga and Smith (1991), and so on.

problem. Investment in financial assets solves only her problem of choice of optimal portfolio. But she has another, possibly more, serious problem. She is unemployed! So it is the finance-cum-employment problem that is relevant and not the standard finance problem. The latter is a familiar problem (following Markowitz, 1952). But the former is not. The question is - what solves the finance-cum-employment problem? Can an agent invest in such a way that there is a job as well as an optimal combination of risk[6] and return on capital? Yes, provided she invests little (possibly zero, as in our model) in financial assets and mostly in an OME in which she has a job. She is, in other words, self-employed. This is a typical LDC problem. This is where it differs from the standard finance problem that is relevant in the context of a developed country.

We build a simple model comprising three classes of agents viz. an entrepreneur, a bank and households. The entrepreneur has two projects that require labor and capital. The entrepreneur has zero endowment of both labor and capital and must borrow money from the capital market and hire labor from the labor market, if she wants to start either project. A household is endowed with both labor and capital and, as mentioned before, she also has access to an OME which requires some capital investment, as well as labor. She can either opt for wage employment and put her wealth in the bank, or she can opt for the OME and invest the whole of her capital and labor in the OME.

The entrepreneur has access to two projects, good and bad, where the good project is more productive compared to the bad one. The bad project, however, yields a private benefit to the entrepreneur. Moreover, in case the bad project is chosen, the bank manager obtains a fraction of the private benefits accruing to the entrepreneur. We begin by showing that compared to the first best, the outcome is sub-optimal. This inefficiency can be traced to two sources. First, the choice of the bad, rather than the good project. Second, even under the bad project, the level of formal sector employment is less than optimal.

We then demonstrate that the linkage between formal sector employment and the volume of financial intermediation plays a critical role in exacerbating these inefficiencies. If the volume of financial intermediation was independent of the volume of formal sector employment, then the inefficiencies would have been much less.

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[6]The treatment of risk is familiar in the literature. So we abstract from risk altogether in our simple model in order to focus on issues that are less familiar in the literature.

The above analysis also throws some light on one very important question: Why is one country rich, while another is poor? We show that the cost of financial intermediation can explain differences in income across countries. Another issue is that, in some cases, the developed countries tend to be less vulnerable than the LDCs to financial distress. For example, in the 1980s, the USA went through the savings and loan crises but it did not significantly affect the economy. Again, in 1987, there was a stock market crash in the USA which hardly affected the economy. On the other hand, in the case of East Asia in late 1990s, the financial crises had considerable impact on the real sector. Our analysis suggests the following answer. In developed countries most of the economy is in the formal sector. Unless the shock is relatively large, this continues to be the case even after the shock. Since the size of the formal sector is not affected, neither is the volume of financial intermediation, given our hypothesis. Hence the economy is not affected. For LDCs, however, with financial distress the size of the formal sector declines, leading to a further fall in the volume of financial intermediation.

We then introduce taxes into the model. The objective is to see if taxation policy can be used to rectify some of the inefficiencies associated with bad banking. We find that, up to a level, an increase in the tax rate increases formal sector employment and thus improves welfare. This is interesting given the fact that tax policies are generally associated with a shrinkage in formal sector employment.

This result, however, needs to be qualified on several grounds. First, while low level of taxes may have a beneficial effect, tax rates that are too high would lead to a decrease in social welfare. Second, taxes cannot resolve one problem, the fact that under bad banking the bad project is selected. Finally, consider another scenario where the bad project can be produced either in the legal, or in the illegal sector (which does not pay any taxes). In this version we show that an increase in tax rates may result in production being shifted to the less productive illegal sector, thus leading to a fall in welfare. Consequently, one needs to be very careful before suggesting that tax policies can be used as a cure for bad banking.

Another stylized feature of LDCs is the presence of labor laws, e.g. minimum wage regulations. We show that the presence of such regulations would also stifle the expansion of the formal sector. Our analysis also throws some light on

the *observed* high capital intensity of production in the formal sector (see, for example, Mathur, 1991 and Fallor, *et al.*. , 1993).

Interestingly we find that the effect of bad banking is different from the effect of taxation and labor laws. While all three contribute to making the informal sector large, bad banking shifts activity from the entrepreneur to self-employment, whereas taxes and labor laws shift activity from the legal sphere (in the formal sector) to the illegal sphere (in the informal sector). But it is still directed by the entrepreneur. So the small share of the formal sector in an LDC is not a true reflection of the role of the entrepreneur in LDCs. It is not as small as would be indicated by the share of the formal sector. A part of the informal sector is also run by the entrepreneur. Similarly, there is considerable wage employment in the informal sector. So again the small size of employment in the formal sector is misleading. But there is an inefficiency nevertheless. This is due to the cost of operating in the illegal sphere of the informal sector.

The plan of the paper is as follows. Section 2 explains the basic model. Section 3 solves the basic model and examines the role of the endogenous supply of deposits. Section 4 shows that a corrective tax scheme cannot fully overcome the effects of bad banking. Section 5 extends the model to include the illegal sector. Section 6 examines the implications of labor laws. We conclude in section 7.

2   The Basic Model

We consider a simple one period model with a single homogeneous output. The price of this good is normalized to 1. The model comprises three classes of agents viz. an entrepreneur, a bank, and households. The entrepreneur has two projects. Each project requires labor and capital. We make the simplifying assumption that she has zero endowment of both labor and capital. Thus if she wants to start a project, she must borrow funds and hire labor. The entrepreneur can invest in either one of two projects, G or B. Project returns are divided into two parts, verifiable and non-verifiable. Project G yields a verifiable return of $gf(K, L)$ and no non-verifiable income, where K and L denote, respectively, the amount of capital and labor employed by the entrepreneur. Project B yields a verifiable return of $bf(K, L)$ and a non-verifiable income of $pf(K, L)$. The latter can be interpreted as the private benefit of the entrepreneur. This may

be viewed as *tunneling* (Johnson, et al. , 2000). The private benefit can be interpreted as the entrepreneur diverting a part of the output for private use. The amount of capital and labor actually used in the project is verifiable, so that diverting capital or labor for private use is not possible. Project G (respectively B) is a good (respectively bad) project. Hence we assume that, for any given K and L, the aggregate return from the good project exceeds that under the bad project. Formally, we have

Assumption 1. $g > b + p$.

The situation that we are trying to model is where there are a number of identical, public sector banks operating in the formal sector. These banks collect deposits from the households and disburse loans to the entrepreneur. We will consider one representative bank.

In this paper, it is our objective to analyze the effects of 'bad' banking. Clearly, bad banking can have many dimensions. One well known aspect is that of NPAs. Another problem is that of idle capacity. In recent years a lot of effort has been devoted towards analyzing policies that take care of these problems[7]. We would like to argue that while both these problems are important, these does not capture all potential problems associated with 'bad' banking. Accordingly, we *assume* in our model that there are no NPAs.[8] We will write the zero NPA condition formally later. The banks have no access to outside capital, thus the loan disbursement cannot exceed the deposits, so that $K \leq D$ where K denotes loans by the bank and D represents deposits. Further, assume that there is no idle capacity. Formally, we have

$$K = D. \tag{1}$$

While in this model the no idle capacity condition is imposed by fiat, it is not too difficult to endogenously derive this result in a larger model. One way would be to assume that the banker uses her bargaining power to ensure that the entrepreneur takes the whole of the deposits as loans. Alternatively, one can impose parameter restrictions that ensure that the entrepreneurs want to

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[7]In India, both the laws and enforcement of recovery of loans have been made tougher in recent times. The ratio of NPAs to assets has marginally come down in the last few years (Datar, 2002).

[8]Assumption 4 later ensures that the equilibrium does not involve any NPAs.

borrow the whole of the deposits lying with the bank. Finally, it is possible to derive the same result if the government imposes this condition on public sector banks and the entrepreneur internalizes this fact when deciding how much to borrow. However, we abstract from all these aspects since these do not add to the essentials of our analysis.

We assume that bank officials force the entrepreneur to select the bad project. The bank management obtains a part of the private benefit from this project i.e. $(1-\alpha)pf(K,L)$, while the entrepreneur obtains $\alpha pf(K,L)$, where $0 < \alpha < 1$ is an index of the bargaining power of the entrepreneur.[9] Moreover, both the bank management and the entrepreneur know the identity of the projects. Further, the bank manager gets a private benefit only if the entrepreneur chooses the bad project.

There are a number of identical *households* of mass 1. Every household has an endowment consisting of 1 unit of labor and 1 unit of capital. Given that the households have a mass of 1, the total labor endowment in the economy equals 1 and the total capital endowment in the economy is also 1. So we have the following feasibility condition:

$$L, K \leq 1. \tag{2}$$

For simplicity of exposition, we assume that every household consists of exactly one agent. For simplicity, we assume that they have equal endowments, and that an owner-managed enterprise requires 1 unit each of labor and capital. It is not difficult to extend the model to allow for unequal endowments across households (including zero capital for some households).[10] In that case, there

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[9]The exact value of α would depend on various things, e.g. the bargaining power of the entrepreneur vis-a-vis the bank management, the nature of the technology, the social norms etc. For our model we assume that α is exogenously given.

[10]There is a large section of the work force in many LDCs that does not have, for all practical purposes, any capital. They are usually referred to as landless labor, rather than 'capital-less' labor (given the perceived significance of land relative to capital in an LDC). How does our model take care of this? Self-employment can take various forms. Consider casual laborers in many LDCs at, say, railway stations or ports. They are self-employed and this activity hardly requires any capital. Similarly, hawkers, vendors, cobblers, and so on are all self-employed with negligible capital. Our model assumed that each household has one unit of capital. This may be looked at as an average size. As compared to the landless or capital-less self-employed households, there would be others at the other end of the spectrum who would have 'large' capital which is used in their owner-managed enterprises. These would be the so-called small-scale enterprises, retail trades, etc. in the cities and the capital could

would be owner-managed enterprises of varying sizes in the informal sector.

Every household has two options, either to work as self-employed, or to work as a laborer with the entrepreneur and invest her capital optimally.

Consider a typical household. If she decides to be self-employed then she can operate an OME which requires at least 1 unit each of labor and capital. Whenever both the input levels are at least 1, the net return from this technology is $s(> 0)$. This technology is inefficient compared to the best practice technology available in the formal sector. Formally we assume that the aggregate output under project G is higher compared to that in the OME if both the technologies employ 1 unit each of labor and capital.

Assumption 2. $gf(1,1) > s$.

Thus we assume that the entrepreneur is more efficient than the self-employed agents. Alternatively, a household can work as a laborer in the formal sector and earn a wage of w. Since direct lending from the households to the entrepreneur is ruled out by assumption, the household deposits her 1 unit of capital with the bank and earns a rental income of r.[11] Thus the total income accruing to a household from working in the formal sector and depositing her capital in the bank is $w + r$. In order to ensure that the equilibrium involves some of the households opting for employment in the formal sector, we assume that $s > r$.

For simplicity we assume that the households have neither any disutility from working, nor any utility from leisure. Thus for a household her utility maximization exercise simplifies to income maximization. Consider a typical household. Her income from self-employment is s, whereas her effective income from working as a laborer is $w + r$. For simplicity, we assume that only earnings matter i.e. there is no disutility from self-employment or wage employment. So an agent is indifferent between wage employment and self-employment if earnings are equal. Hence, her labor supply curve is given by

run into fairly respectable amounts in some cases. These kinds of enterprises may even have extra capital that is invested in financial assets or real estate. These would also be employing labor. For the purpose of our model, we may club the employees and the employer together in the category of informal sector.

[11]Thus the implicit assumption is that the household sector does not have a storage technology for capital, or, if such a technology exists, then the return is lower compared to r.

$$
\begin{cases}
0, & \text{if } s > w + r, \\
l, & \text{where } l \epsilon \{0,1\}, \text{ if } s = w + r, \\
1, & \text{if } s < w + r.
\end{cases}
$$

Thus the aggregate labor supply is 0, if $s > w + r$, and it is 1, if $s < w + r$ since the measure of work force is 1. If $s = w + r$, then the labor supply (L) can take any value in the interval $[0, 1]$.

We use the supply curve for labor to generate the supply curve for bank deposits. Note that in this model the households who work in the formal sector are the only source of capital for the entrepreneur who borrows from the bank. The capital of the self-employed households are used up in their own OMEs. We have, for simplicity, assumed that the supply of deposits from other sources is zero. Thus the supply of deposits[12] is given by

$$
D = \begin{cases}
0, & \text{if } s > w + r, \\
L, & \text{if } s = w + r, \\
1, & \text{if } s < w + r.
\end{cases} \tag{3}
$$

Next, we describe the sequence of actions in this economy. Depending on whether it is a case of good banking or bad banking, the entrepreneur decides whether to opt for project G or project B. The households' optimization exercise generates the supply schedules of labor and capital. Given the project choice and the supply schedules, the entrepreneur's optimization yields the equilibrium level of labor and capital.

We assume that r is given exogenously. The entrepreneur chooses (w, L, K) subject to the participation constraint of the households i.e. $w + r \geq s$. In equilibrium[13],

$$
w + r = s. \tag{4}
$$

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[12]Note that there is a similarity between our model and Clower (1965). The latter had interpreted Keynes' General Theory as a case of feedback from the labor market to the goods market. Similarly, in our model, there is a feedback from the labor market to the financial sector. In Clower (1965), when unemployment is high, there is low demand for goods. In our model, when self-employment (instead of unemployment) is high, then there is low supply of deposits to the banks. Note that there is a similarity between our model and Clower (1965). The latter had interpreted Keynes' General Theory as a case of feedback from the labor market to the goods market. Similarly, in our model, there is a feedback from the labor market to the financial sector. In Clower (1965), when unemployment is high, there is low demand for goods. In our model, when self-employment (instead of unemployment) is high, then there is low supply of deposits to the banks.

[13]Let L^g and w^g denote the equilibrium level of employment and wage respectively. Suppose

From (3) and (4), it follows that in equilibrium, $D = L$. Using (1), it follows that

$$K = L. \tag{5}$$

For most of the next section, we will work with a general production function $f(L.K)$ with the only restriction that it is symmetric. Formally,

Assumption 3. $f_L(L.K), f_K(L.K) > 0, f_{LL}(L.K), f_{KK}(L.K) < 0$ and $f_{LL}(a,a) + f_{LK}(a,a) < 0, \forall a > 0$. Moreover, $f(y,z) = f(z,y), \forall y, z > 0$.

Note that the condition that $f(y,z) = f(z,y)$, for all y, z implies that $f_L(y,z) = f_K(z,y)$ for all y, z. Assumption 3 is satisfied, for example, for all production function of the form $f(K,L) = (KL)^\alpha$, where $\alpha < \frac{1}{2}$. In this paper, in some cases, we will use the following specific symmetric production function to get explicit solutions.

Assumption 3$'$. $f(K,L) = (KL)^{1/4}$.

Throughout this paper, we assume that the bank has zero NPA. Given the zero profit condition for the bank, this implies that the entrepreneur repays the loan fully. This is possible only if the verifiable income of the entrepreneur satisfies the following condition:

$$bf(K,L) - wL - rK \geq 0 \tag{6}$$

This, we will see, is true under the following assumption.

Assumption 4. $b \geq \alpha p$.

Note that the no NPA condition ensures that both the bank and the households are going to be paid in equilibrium. Thus we do not need to address the question as to who has the first claim in case of bankruptcy, labor or capital.

It is possible to consider an alternative model in which b and p are endogenous. In that case, the entrepreneur faces a trade off. A higher p increases the non-verifiable return, but it decreases the total return from the project. Moreover, if the entrepreneur chooses a high p, her verifiable return will be low. In

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to the contrary that $w^g > s - r$. If the entrepreneur announces a wage rate of $w^g - \epsilon$, where $w^g - \epsilon \geq s - r$, then, for the same value of L^g, the entrepreneur's profit will be strictly higher.

that case, she may not be able to repay her loan. *Ex ante*, she will not get a loan from a bank which is seriously avoiding NPAs. Clearly, the entrepreneur would like to take the loan. So it is reasonable to assume that p is chosen at an intermediate level. However, since this formulation does not add too much to the economics of the paper, we refrain from analyzing this case, either for the basic model, or in case of the later extensions.

3   Bad Banking and The Endogenous Supply of Deposits

We begin by solving for *the first best* outcome. This serves as a benchmark for the equilibrium analysis. Clearly, under the first best outcome there must be no idle capacity. Thus the whole of the capital must be invested, and all labor must be utilized. Moreover, given Assumption 1, project G must be chosen in the formal sector. Since L is the employment level in the formal sector, it follows that the volume of labor engaged in self-employment in the first best case is $(1 - L)$. Given the technology, the output in the informal sector is $(1 - L)s$. Note that the amount of capital employed in the informal sector is exactly equal to employment, i.e. $1 - L$. Thus, in the formal sector $L = K$. Thus the first best solves the following program

$$\max_{L,K} \quad gf(K, L) + (1 - L)s \text{ s.t. } K = L \leq 1. \tag{7}$$

Let (L^g, K^g) denote the first best solution. Clearly, the second order condition is satisfied, given Assumption 3. Next, let us consider the market equilibrium outcome. We begin by solving for the entrepreneur's problem. The entrepreneur prefers project G to project B since $g > b + p$. But the loan from the bad bank is available only if project B is selected since the bank management can be paid out of the non-verifiable income only. So the entrepreneur chooses the good (respectively bad) project if the bank is good (respectively bad). Given the project choice, the entrepreneur chooses w, K and L optimally so as to maximize her own profit. We assume that r is given exogenously. The households act as price-takers in both the labor and the capital market. There are two cases to consider, first when the entrepreneur chooses project G (if there is good banking), and second when she chooses project B (if there is bad banking).

Project G. Suppose that the entrepreneur employs L units of labor and borrows K units of capital from the bank. Then, the entrepreneur's optimization problem is to maximize $gf(K, L) - wL - rK$ subject to the feasibility condition and the zero NPA condition. So we may re-write the optimization problem as

$$\max_{L,K} \ \ gf(K, L) - sL \text{ s.t. } K = L \leq 1 \text{ and } \ gf(K, L) - sL \geq 0. \qquad (8)$$

In case of project G, the profit of the bank is zero and the bank management does not obtain any private benefit. Using assumptions 2 and 3, it follows that $gf(K, L) - sL \geq 0$. So the problem in (8) is essentially the same as (7). Hence, the first best outcome can be attained under good banking.

Project B. The decision problem facing the entrepreneur is similar to that in the case of the good project. We have

$$\max_{L,K} \ \ (b + \alpha p)f(K, L) - sL \text{ s.t. } K = L \leq 1 \text{ and } bf(K, L) - sL \geq 0. \qquad (9)$$

Note that the zero NPA condition involves $bf(K, L) - sL \geq 0$ and not $(b + \alpha p)f(K, L) - sL \geq 0$, because only the verifiable output can be used for repaying the bank loan. Let (L^b, K^b) denote the solution. Note that (L^b, K^b) does not lead to bankruptcy provided the verifiable income is sufficient to cover the rental and the wage bills. This simplifies to the condition that $b \geq \alpha p$, which, given Assumption 4, is satisfied. Since $(b + \alpha p) < (b + p) < g$, it follows immediately from the comparison of optimization in (8) and (9) that the solution is not the first best i.e. $x^b < x^g$. Observe that $L^b \leq L^g$, where $L^b = L^g$ is possible if the constraint $L \leq 1$ is binding. Let x^b and x^g denote the aggregate output under bad banking and under good banking respectively. We have, thus, established

Proposition 1. *Let Assumptions 1 to 4 hold. Under good banking, the first best outcome can be attained. Under bad banking, the outcome is sub-optimal i.e. $x^b < x^g$, and the equilibrium level of employment in the formal sector is less than or equal to that under the first best outcome i.e. $L^b \leq L^g$.*

It is easy to show that the first best outcome can also be attained if the entrepreneur has *direct* access to capital (and labor) from households. It is also easy to check that under Assumption $\mathbf{3}'$,

$$L^b = K^b = \min\left[\frac{(b + \alpha p)^2}{4s^2}, 1\right] \leq L^g = K^g = \min\left[\frac{g^2}{4s^2}, 1\right], \qquad (10)$$

and

$$x^b = (b + p)f(K^b, L^b) + (1 - L^b)s < x^g = gf(K^g, L^g) + (1 - L^g)s. \qquad (11)$$

We then use our model to comment on a very important question - why are some countries rich, while others are poor?

We need to introduce a few notations before we can formally address this question. It is easy to see that there exists $\hat{\alpha}$[14] such that the equilibrium level of employment in the formal sector equals 1 if $\alpha \geq \hat{\alpha}$, it is $\hat{L}$ otherwise, where $\hat{L}$ solves the equation[15] (see figure 1)

$$2(b + \alpha p)f_L(L, K) = s. \qquad (12)$$

We may interpret $(1 - \alpha)$ as *the cost of financial intermediation*. If $(1 - \alpha) > (1 - \hat{\alpha})$, then part of the labor force is employed in the informal sector. For reasons that will become clear soon, we interpret $(1 - \hat{\alpha})$ as *the threshold of vulnerability*.

Insert Figure 1 about here

Consider two countries which are identical in every respect except the cost of intermediation. Let country A (respectively B) be characterized by α^A (respectively α^B). Suppose that $\alpha^A > \hat{\alpha} > \alpha^B$. Thus country B has a greater cost of financial intermediation. Note that in country A the whole of the labor force is in the formal sector, whereas in country B it is divided among the formal and the informal sectors. From figure 1 it immediately follows that the welfare level in country A is greater than that in B, i.e. $x^A > x^B$, where x^A and x^B are the aggregate output in country A and in country B respectively.

Moreover, it is often suggested that LDCs tend to be more vulnerable to deterioration in financial sector as compared to developed countries. Why? In the context of our model, in country A, if $(1 - \alpha)$ increases (up to a point i.e. $1 - \hat{\alpha}$), output is not affected. But in country B, a rise in $1 - \alpha$ affects output

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[14] Note that $\hat{\alpha}$ is given by

$$2(b + \hat{\alpha}p)f_L(1, 1) = s.$$

It is easy to check that $0 < (1 - \hat{\alpha}) < 1$ if and only if $s_1 < s < s_2$, where $s_1 \equiv 2bf_L(1, 1)$, and $s_2 \equiv 2(b + p)f_L(1, 1)$.

[15] This equation follows from the first order condition after using $L = K$ and $f_L = f_K$. Note that for $\alpha \geq \hat{\alpha}$, $L = 1$, i.e. self-employment is zero and all employment is in the formal sector.

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adversely. We will use $-\frac{\partial x}{\partial(1-\alpha)}$ as the measure of vulnerability of an economy to a deterioration in financial intermediation. Formally, $-\frac{\partial x^B}{\partial(1-\alpha)} > -\frac{\partial x^A}{\partial(1-\alpha)} = 0$. So country B is not only poor, but it is also vulnerable to deterioration in financial intermediation. Thus despite both the countries having the same endowment and technology, greater cost of financial intermediation in country B implies that it is poorer, as well as more vulnerable compared to country A.

Summarizing the above discussion, we have

Proposition 2. *Consider countries A and B which are identical in every respect except that $\alpha^A > \widehat{\alpha} > \alpha^B$. Let Assumptions 2, 3 and 4 hold. Then $x^A > x^B$. Moreover, while country B is vulnerable to any increase in the cost of financial intermediation, country A is not. Further, given Assumption* $\mathbf{3}'$, *vulnerability of B decreases as the productivity of the informal sector rises.*

The formal proofs of Proposition 2 and the remaining propositions that follow are given in the appendix.

Our model suggests that developed countries are not vulnerable unless the shock is very large (i.e. $1 - \alpha$ increases beyond $1 - \hat{\alpha}$). For example, in the context of the Great Depression of 1930s, Bernanke (1983) suggests that the weaknesses in the financial sector were large enough to affect the real sector in USA.

In what follows, we drop the superscript (A,B), where it is understood that we are dealing with the case of an LDC i.e. $\alpha < \widehat{\alpha}$. Consider now comparative statics on s. What is the effect of a change in the productivity in the informal sector on vulnerability of an economy? Formally, how does $\frac{\partial x}{\partial(1-\alpha)}$ change with respect to s? It is easy to check that $\frac{\partial^2 x}{\partial s\partial(1-\alpha)} > 0$. In other words, the magnitude of vulnerability ($-\frac{\partial x}{\partial(1-\alpha)}$) decreases as s increases. The intuition is straightforward. A shock in the financial sector adversely affects the economy. It results in a shift of allocation from the (efficient) formal sector to the (inefficient) informal sector. In such a situation, it helps to have high productivity in the informal sector. The higher is s, the less is the impact of a deterioration in financial intermediation.

We then provide a decomposition analysis of the inefficiencies involved with bad banking. Let the inefficiency be measured by $L^g - L^b$. Assuming $0 <$

$\alpha < \hat{\alpha} < 1$ and assumption $3'$, we can decompose $L^g - L^b$ as follows:

$$\begin{aligned} L^g - L^b &= \frac{g^2}{4s^2} - \frac{(b+\alpha p)^2}{4s^2} \\ &= \left[\frac{g^2}{4s^2} - \frac{(b+p)^2}{4s^2} \right] + \left[\frac{(b+p)^2}{4s^2} - \frac{(b+\alpha p)^2}{4s^2} \right]. \end{aligned}$$

Note that the first term within square brackets represents the pure inefficiency effect of a switch from a good project to a bad project, the second term within square brackets represents the inefficiency arising out of the fact that the entrepreneur does not obtain the full value of the project with both the terms being positive in sign.

One important aspect of this paper is what we call the endogenous supply of deposits. The significance of the latter is that endogeneity of deposits makes the economy more sensitive to any change in the cost of intermediation. To see why this is so, observe that any improvement in financial intermediation, in an economy characterized by $\alpha < \hat{\alpha}$, will be accompanied by an increase in output due to a shift in labor from self-employment to employment in the formal sector. This happens in several stages. First, there is a direct effect. Suppose that the level of capital is exogenously kept constant at K^b. As α increases, i.e. as the degree of bad banking falls, demand for labor in the formal sector increases. This demand can be met by a release of labor from the self-employment sector. This would be the only effect in a model where capital supply is exogenous.

Recall, however, that the self-employed agents have endowment of capital as well. When they get a job in the formal sector, they deposit their capital in a bank. The latter makes it available to the entrepreneur. Observe that this larger stock of capital with the entrepreneur will further increase the demand for labor. This is the second stage. The process continues though in each successive round, the change is smaller, till we have a new equilibrium.

Formally, it is shown in the appendix that the total increase in employment in the formal sector due to a one time initial increase in α is given by

$$\begin{aligned} d\hat{L} &= \left[\frac{-f_L}{\alpha f_{LL}} d\alpha \right] + \left[\frac{-f_{LK}}{f_{LL}} \right]\left[\frac{-f_L}{\alpha f_{LL}} d\alpha \right] + \left[\frac{-f_{LK}}{f_{LL}} \right]^2 \left[\frac{-f_L}{\alpha f_{LL}} d\alpha \right] + ... \\ &= \frac{-f_L}{\alpha[f_{LL} + f_{LK}]} d\alpha > 0. \end{aligned}$$

Observe that

(1) The first term represents the straightforward effect of an improvement

in financial intermediation. The larger the α i.e. the lower the cost of financial intermediation, the larger is the formal sector.

(2) The second term is the new effect. This arises due to the endogeneity of deposits. The latter expand because employment in the formal sector expands (see the first term).

(3) The remaining terms represent repercussions of the endogeneity of deposits. For example, the third term represents the effect on deposits due to expansion in employment which is covered in the second term.

(4) We have a convergent geometric progession series and the sum of the effects is given in the last expression.

(5) If financial intermediation and employment were unrelated, then capital would have been given exogenously, in which case the process would have stopped at the first term in the above series.

Proposition 3. *Suppose Assumptions 3 and 4 hold, banking is bad, and $0 < \alpha < \hat{\alpha} < 1$. Then an increase in the cost of financial intermediation has a greater adverse effect on welfare if deposits are endogenous than if they are exogenous.*

So far we have seen how bad banking leads to inefficiency. Apart from the fact that project B is chosen, bad banking has the effect that it reduces the size of the formal sector. Can we have a tax policy that can correct this distortion, at least partially? We turn to this question in the next section.

4 Tax Policy and Bad Banking

In this section, we incorporate taxes on profits. Let t be the tax rate on profits. We assume that only the verifiable income can be taxed. There is no tax on the income of the self-employed agents, or on the capital or labor income of the employees. Thus the entrepreneur must pay a tax of $t \max\{b(KL)^{\frac{1}{4}} - wL - rK, 0\}$. Observe that in case of bankruptcy the firm does not have to pay any taxes. We will use a variant of Assumption 4 to ensure that in equilibrium, the bank does not have any non-performing asset.

Assumption 4$^{'}$. $b(1 - t) \geq \alpha p$.

In the previous section, we considered the general case i.e. $L \leq 1$. In the context of a developed country, it is reasonable to consider a corner solution whereas in an LDC, typically, $L < 1$. Henceforth, we focus on the interior solution. Formally, we will need the following parametric restriction for an interior solution.

Assumption 5. $b + \frac{\alpha p}{1-t} < 2s$.

The entrepreneur's decision problem is the same as before except that the objective function in (9) is replaced by $(1-t)[b(KL)^{\frac{1}{4}} - wL - rK] + \alpha p(KL)^{\frac{1}{4}}$. Let t^* denote the optimal tax rate. Let the equilibrium level of capital and labor be denoted by $K^b(t)$ and $L^b(t)$ respectively.

Proposition 4. *Let Assumptions $\mathbf{3}', \mathbf{4}'$ and 5 hold. The volume of financial intermediation $K^b(t)$ is increasing in the tax-rate t. Furthermore, $t^* = 1 - \alpha$ and $x^b(t^*) < x^g$.*

A higher tax rate tends to increase formal sector employment. Since there is a tendency for formal sector employment to be low, up to a level, an increase in taxes serves to counteract this effect.

Thus we have the somewhat surprising result that an increase in taxes may increase the size of the formal sector. The intuition is as follows. Note that after simplification the entrepreneur's maximization problem simplifies to $\max_L$ $(1-t)[(b + \frac{\alpha p}{1-t})L^{\frac{1}{2}} - sL]$. Thus as the tax rate increases, the private benefit becomes relatively more attractive for the entrepreneur (since the private benefit is not taxed). This leads to greater formal sector employment.

This result, however, needs to be treated with caution. First, note that if the tax rate is too high (i.e. $t > 1 - \alpha$) then the welfare level is decreasing in t. Second, note that taxes can only rectify the problem of less than optimum employment in the bad project. It can never ensure that the good project is selected. Third, suppose that we consider a weaker definition of bad banking. Suppose the bank management is bad in the sense that it does not prevent the entrepreneur from choosing the bad project if she so desires, but the bank management does not force the entrepreneur to choose the bad project. In such a setup it is straightforward to show that if the tax rate is below a certain cut-off, then the entrepreneur chooses the good project, otherwise she opts for the bad

project. The intuition is that the bad project has some private benefits which are non-taxable. With the tax-rate becoming high, the bad project becomes relatively more attractive.

5 Employment in Illegal Activity

In the previous section, we saw that taxation can not fully overcome the adverse effects of bad banking. In this section, we will argue that not only is tax not able to overcome adverse affects of banking, it may even make matters worse. Why? This is because typically tax enforcement in LDCs is weak. This results in the entrepreneurs shifting some economic activity to the informal sector where it will not be taxed. To the extent that there is a social cost of operating illegally, a tax policy can add to the distortion due to bad banking.

In this section, there are two differences with the earlier model. The first one lies in the way production is organized in the bad project. The bad project consists of two sectors, legal and illegal. The production function in the legal sector is denoted by $B(K_1 L_1)^{\frac{1}{4}}$, where L_1 and K_1 denote, respectively, the labor and capital employed in the legal sector. The production function in the illegal sector is denoted by $P(K_2 L_2)^{\frac{1}{4}}$, where L_2 and K_2 denote, respectively, the labor and capital employed in the illegal sector. The bank manager gets her private benefit out of the output produced in the illegal sector. Her return is given by $(1 - \alpha)P(K_2 L_2)^{\frac{1}{4}}$.

The second difference lies in the way tax is modelled in this version. Tax evasion is a fact of life in many LDCs. We wish to model this aspect. For analytical tractability, we choose the following formulation. We assume that the entrepreneur can over-report the amount of labor and capital employed in the verifiable sector, up to the aggregate capital and labor employed by her. Since output is verifiable by assumption, she cannot under-report the output produced in the legal sector. Let $L = L_1 + L_2$ and $K = K_1 + K_2$. Thus the total tax-liability of the entrepreneur is given by $\min\{t[B(K_1 L_1)^{\frac{1}{4}} - wL - rK], 0\}$. To ensure an interior solution (i.e. $L < 1$), we will impose the following condition.

Assumption $5'$. $B + \frac{\alpha P}{(1-t)} \leq 2s$.

We will see that the parametric restriction required to ensure zero NPAs is $(1 - t)B > \alpha P$. Formally, this is equivalent to

Assumption 4″. $t < \bar{t} = 1 - \frac{\alpha P}{B}$.

Thus the tax rate is below a cutoff level. This assumption will also ensure that the taxable income is non-negative.

Unlike in the previous sections, now we need to consider employment and capital in the legal, as well as in the illegal sector. Formally, given the choice of bad project, the entrepreneur's maximization problem is Formally, given the choice of bad project, the entrepreneur's maximization problem is

$$\max_{L_1,L,K_1,K} \ (1-t) \left[B(K_1 L_1)^{\frac{1}{4}} \ - \ wL - rK \right] + \alpha P(K-K_1)^{\frac{1}{4}}(L-L_1)^{\frac{1}{4}} \quad (13)$$

$$\text{s.t.} \ \ L \ = \ K \leq 1,$$

$$w + r \ \geq \ s,$$

$$B(K_1 L_1)^{\frac{1}{4}} - wL - rK \ \geq \ 0.$$

where the feasibility condition $L = K \leq 1$ has been written as an inequality to ensure that doing comparative statics is meaningful.

Proposition 5. *Let Assumptions* $3', 4''$ *and* $5'$ *hold. Then output is produced by the entrepreneur partly in the legal sector and partly in the illegal sector. The input use in the legal sector is independent of t, whereas input use in the illegal sector is increasing in t.*

Note that the above proposition uncovers another problem of using fiscal policies to compensate for bad banking. Since tax enforcement is weak, a higher tax rate encourages the entrepreneur to shift production to the illegal sector to evade taxes.

Moreover, as in the previous section we can consider a weak form of bad banking where the bank management allows the entrepreneur to choose the project independently. Again there is a cutoff value of t such that the good project is selected if and only if the tax rate is less than the cutoff level.[16]

The policy implication is clear. In the short run, given the weakness in the enforcement machinery, it is optimal to tax at a low rate. A higher rate will only induce the entrepreneur to shift operations to the illegal sector. But in the long run, the emphasis has to be on improving tax administration and enforcement

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[16]This requires the condition that the bad project should not be too bad in the sense that $2B^2 > g^2$.

so that it is possible to shift to a high tax rate (if required) without impairing efficiency.

6 The Effect of Labor Laws

Our focus, in this paper, is on the role of financial intermediation in the context of employment in the formal sector. But any discussion of employment is incomplete without the labor laws. The small size of the formal sector is often attributed to labor laws. We turn to this issue in this section.

We will use a simple formulation of labor laws. Formally, let the wage rate in the legal sector be $\overline{w}$. We assume that $\overline{w} > s - r$. Clearly, in equilibrium, $s - r = w$, where w is the wage in the illegal sector, so that this condition ensures that $\overline{w} > w$. Labor laws decrease the profits in the legal sector. So there is an incentive to shift some activity to the illegal sector. But there is a trade-off. There is a cost of operating in the illegal sector. This may be due to the cost of hiding, bribing, and so on. So the entrepreneur seeks an optimal allocation between the legal and the illegal sector. Let the solution be denoted by $(K_1^b, L_1^b, K_2^b, L_2^b)$. We assume that there are zero NPAs and that there exists an interior solution i.e. $\left[B(K_1^b L_1^b)^{1/4} - \overline{w} L_1^b - rK^b\right] \geq 0$, $L_1^b, L_2^b, K_1^b, K_2^b > 0$ and $L^b, K^b \leq 1$, where $L^b = L_1^b + L_2^b$ and $K^b = K_1^b + K_2^b$. Observe that those laborers who get a job in the legal sector are better off than other workers who get a job in the illegal sector. Assume that there is rationing of jobs in the legal sector and workers are chosen at random for the legal sector. Recall that the participation constraint for the workers is $w + r \geq s$. In equilibrium, this holds with equality for the workers in the illegal sector, whereas for workers in the legal sector, $\overline{w} + r > s$.

In the previous section, we considered the case in which the government imposed tax laws and the entrepreneur operated in both the legal and the illegal sector, but she included *all* the costs in the legal sector. So labor and capital were treated symmetrically. Here again we assume that the entrepreneur pretends that she is using all the capital in the legal sector. However, instead of pretending that she is using all the labor in the legal sector (as in the previous section), now she does not overstate the use of labor in the legal sector since $\overline{w} > w$. Ideally, she would like to understate the use of labor. But we assume that she does not understate the use of labor in the legal sector though she does

overstate the use of capital. This asymmetric formulation is motivated by the following considerations. Firstly, there is a risk that laborers may leak out the information if number of workers is understated in the legal sector. In the case of capital, on the other hand, there is no similar risk. Secondly, it is easier to overstate the use of capital because typically what is relevant is not the number of machines but the value of machines. The latter is easier to overstate than the number of machines. In the case of labor, on the other hand, it is the number of laborers, which is relevant. And that is not easy to hide. So there is a rationale for asymmetric treatment of labor and capital. Formally, the optimization problem is as follows:

$$
\begin{aligned}
\max_{L_1, K_1, L_2, K_2} Z \;\; = \;\; & [B(K_1 L_1)^{\frac{1}{4}} - \overline{w} L_1 - r(K_1 + K_2)] \\
& + [\alpha P(K_2 L_2)^{\frac{1}{4}} - w L_2] \\
& \text{s.t.} \;\; K_1 + K_2 = L_1 + L_2. \qquad (14)
\end{aligned}
$$

Proposition 6. *Let Assumption $3'$ hold. With labor laws, the actual capital intensity of production is higher in the legal sector as compared to that in the illegal sector but it is less than the reported intensity of production in the legal sector $\left(\frac{K_2^b}{L_2^b} < \frac{K_1^b}{L_1^b} < \frac{K^b}{L_1^b} \right)$, where it is assumed that $\left[B(K_1^b L_1^b)^{1/4} - \overline{w} L_1^b - r K^b \right] \geq 0$, $L_1^b, L_2^b, K_1^b, K_2^b > 0$ and $L^b, K^b \leq 1$.*

The capital-labor ratio for the entrepreneur, K/L, always equals 1. Since the actual capital intensity of production is higher in the legal sector as compared to that in the illegal sector, clearly, we have $\frac{K_2}{L_2} < \frac{K}{L} = 1 < \frac{K_1}{L_1}$. So the formal sector is more capital intensive than the informal sector. But the reported capital intensity is $\frac{K}{L_1}$. The latter is greater than $\frac{K_1}{L_1}$, the actual intensity. So while it is true that the formal sector is more capital intensive, this is possibly exaggerated in the data.

In this paper, we have tried to examine an important issue viz. why is employment in the formal sector small? The purpose of this section is to demonstrate that in the context of employment, there are some wrong perceptions. High capital intensity is one of them. In the earlier sections, we have attempted to show how it may be more meaningful to look for a solution to the employment problem in, what may seem to many, an unrelated factor viz. financial intermediation, rather than blame factors like capital intensity or even labor laws beyond a point.

7   Conclusion

The effect of a banking crisis on the real sector is a familiar theme in the recent literature. In our model, we do not have the so called banking crises but there is, nevertheless, a relationship between the banking sector and the real sector. We demonstrate that an increase in the cost of financial intermediation may result in a shift of factors away from the (efficient) formal sector to the (inefficient) informal sector. There is an *ongoing* misallocation of resources due to bad banking (which is not connected with the more familiar moral hazard due to deposit insurance in commercial banks). This problem, however, receives little attention from the media and the policy makers. We hope this paper contributes to the research on a persistent problem that is possibly even more serious than the banking crises problem.

In this paper, we asked the question - Why is financial intermediation low despite safe banking? Our answer is as follows. An agent opts for the formal sector if she has both a safe outlet for her wealth and a job. Safe banking only ensures that there is a safe outlet for her wealth, but it does not ensure the availability of a job. Clearly only those agents will participate in the formal sector for whom both conditions are satisfied. But jobs are few. This is because public sector banks have officials who are not really accountable and select bad projects since they have opportunities for private benefit from bad projects. Thus banking may be safe but that is not enough. It also has to be sound banking. The latter will increase formal sector employment which will in turn increase deposits. The improvement has to go beyond ensuring that banks do not have NPAs, which has been the focus recently. The government needs to ensure that bank officials in public sector banks are competent, honest and accountable. That will not only increase financial intermediation, it will also lead to more employment in the formal sector.

Our analysis suggests that it is important to reform the banking sector itself rather than try to use some corrective tax policy. In fact, tax policy can make matters worse. Typically, in LDCs, tax enforcement is weak. This can have perverse effects. Taxation can encourage entrepreneurs to shift economic activity underground. This results in an expansion of the informal sector.

We assumed that the entrepreneur is more efficient than the self-employed agents. The rationale is very clear. If it was the opposite, then, in equilibrium,

we would have no financial intermediation and no wage employment. All agents would be self-employed and that would be an efficient allocation. However, in developed countries, typically there is considerable financial intermediation and formal sector employment. Going by the experience of these countries, it is clear that the assumption, that self-employment is more efficient than entrepreneurial activity, is unrealistic. Hence it is meaningful to assume, as we have, that self-employment is inefficient relative to economic activity under an entrepreneur.

In this paper, we have tried to examine an important issue viz. why is employment in the formal sector small in LDCs? In this context, there are some wrong perceptions. High capital intensity in the formal sector is one of them. We have attempted to show how it may be more meaningful to look for a solution to the employment problem in, what may seem to many, an unrelated factor viz. financial intermediation, rather than blame factors like capital intensity or even labor laws beyond a point.

Appendix

Proof of Proposition 2. Since $K = L$, the first order condition is $(b + \alpha p)[f_L(L, K) + f_K(L, K)] \geq s$. Using Assumption 3 and $K = L$, we get $2(b + \alpha p)f_L(L, L) \geq s$. Define $\hat{\alpha}$ by the condition

$$2(b + \hat{\alpha}p)f_L(1, 1) = s. \tag{15}$$

Clearly, the solution is given by

$$L^b = \begin{cases} 1, & \text{if } \alpha > \hat{\alpha} \\ \hat{L}, & \text{if } \alpha \leq \hat{\alpha}, \end{cases}$$

where $\hat{L}$ is the interior solution, given implicitly by the condition $2(b + \alpha p)f_L(L, L) = s$. It is easy to check the following comparative statics result after using assumption 3:

$$\frac{\partial L^b}{\partial \alpha} = \frac{f_L}{\alpha[-(f_{LL} + f_{LK})]} > 0, \alpha < \hat{\alpha}. \tag{16}$$

It is also obvious that $\frac{\partial L^b}{\partial \alpha} = 0, \alpha > \hat{\alpha}$. From equation (15), it follows that $\hat{\alpha} = \frac{s - 2bf_L(1,1)}{2pf_L(1,1)}$. Clearly, $0 < \hat{\alpha} < 1 \Leftrightarrow s_1 \equiv 2bf_L(1,1) < s < 2(b + p)f_L(1,1) \equiv s_2$. Consider next the output in the economy. It is the sum of output produced in the formal and in the informal sector. Formally, in equilibrium,

$x^b = (b + p)f(L^b, K^b) + (1 - L^b)s$

Since $L^b = K^b$ and $f_L = f_K$, we have

$\frac{\partial x^b}{\partial \alpha} = [2(b + p)f_L(L^b, K^b) - s]\frac{\partial L^b}{\partial \alpha} \geq [2(b + p)f_L(1, 1) - s]\frac{\partial L^b}{\partial \alpha} > 0$

where the first inequality holds after using assumption 3 and the second inequality follows from $s < s_2$. So

$$\frac{\partial x^b}{\partial \alpha} = \begin{cases} 0, & \text{if } \alpha > \hat{\alpha} \\ \frac{[2(b+p)f_L(L^b, K^b) - s]f_L}{\alpha[-(f_{LL} + f_{LK})]} > 0, & \text{if } \alpha < \hat{\alpha}, \end{cases}$$

After using Assumption **3′**, it is easy to check that $\frac{\partial x^b}{\partial \alpha} = \left[\frac{b+p}{b+\alpha p} - 1\right]\frac{(b+\alpha p)p}{2s}$. This implies that $\frac{\partial^2 x^b}{\partial s \partial \alpha} < 0, \alpha < \hat{\alpha}$. Finally, Assumption 4 ensures that the zero NPA condition (6) is satisfied. ∎

Proof of Proposition 3. Given that $\alpha < \hat{\alpha}$, the first order condition is $2(b + \alpha p)f_L(L, L) = s$. Suppose that K is fixed at K^b to begin with. Then a simple comparative statics exercise shows that the (first round) effect on labor, as a result of a change in α, equals $\left[\frac{f_L}{\alpha(-f_{LL})}\right]d\alpha > 0$ where the inequality sign

follows from Assumption 3. But clearly this is not equilibrium since capital is now less than labor. In equilibrium, we require that the change in capital is equal to the change in labor (since $K = L$). But an increase in capital will further increase the demand for labor. From the first order condition, for a given (b, α, p, s), we have $f_{LL}dL + f_{LK}dK = 0$. This implies that the (second round) change in labor due to a change in K is given by $\left[\frac{f_{LK}}{(-f_{LL})}\right]$ $dK = \left[\frac{f_{LK}}{(-f_{LL})}\right]\left[\frac{f_L}{\alpha(-f_{LL})}\right] d\alpha$, since the change in capital is equal to the change in labor in the previous round. Observe that the process does not stop at this. The second round increase in employment in the formal sector leads to a further increase in deposits since deposits come from agents that have jobs. But deposits are passed on by the bank to the entrepreneur who has larger capital to use in production. So we have a further increase in capital which again increases the demand for labor. This process gets repeated *ad infinitum*. Note that this is a geometric series since $0 < \left[\frac{f_{LK}}{(-f_{LL})}\right] < 1$ by assumption 3. The total increase in employment in the formal sector due to a one time initial increase in α is given by

$$
\begin{aligned}
d\hat{L} &= \left[\frac{-f_L}{\alpha f_{LL}}d\alpha\right] + \left[\frac{-f_{LK}}{f_{LL}}\right]\left[\frac{-f_L}{\alpha f_{LL}}d\alpha\right] + \left[\frac{-f_{LK}}{f_{LL}}\right]^2\left[\frac{-f_L}{\alpha f_{LL}}d\alpha\right] + \dots \\
&= \frac{f_L}{\alpha[-(f_{LL} + f_{LK})]}d\alpha. \blacksquare
\end{aligned}
$$

Proof of Proposition 4. Since $K = L$ and $w + r = s$, the entrepreneur's maximization problem simplifies to

$$
\max_L \ (1 - t)[bL^{\frac{1}{2}} - sL] + \alpha p L^{\frac{1}{2}} \ \text{s.t.} \ \ b(KL)^{\frac{1}{4}} - sL \geq 0. \tag{17}
$$

To begin with assume that there is no bankruptcy in equilibrium. In that case the entrepreneur's problem simplifies to the following

$$
\max_L \ (1 - t)[\widehat{b}L^{\frac{1}{2}} - sL], \tag{18}
$$

where $\widehat{b} \equiv b + \frac{\alpha p}{1-t}$. Solving we obtain $L^b = K^b = \frac{\widehat{b}^2}{4s^2}$ and $\pi^b(t) = \frac{\widehat{b}^2(1-t)}{4s}$, where $\pi^b(t)$ denote the optimal profit. The bank management has a private benefit of $(1-\alpha)\frac{p\widehat{b}}{2s}$. Note that the profit of the bank is zero and that L^b, K^b does not lead to bankruptcy provided the verifiable income is sufficient to cover the rental and the wage bills i.e. if $b(L^b)^{\frac{1}{2}} - sL^b \geq 0$. This simplifies to the condition that $b \geq \frac{\alpha p}{1-t}$, which, given assumption $\mathbf{4}'$, is satisfied.

Next we use $L^b = K^b = \frac{\hat{b}^2}{4s^2}$ in $x^b = (b+p)f(K^b, L^b) + (1 - L^b)s$ (see (11)) and take $\frac{\partial x^b}{\partial t} = 0$. It is easy to check that this last condition gives the optimal tax rate to be $(1 - \alpha)$. Using $t = 1 - \alpha$ in $L^b = K^b = \frac{\hat{b}^2}{4s^2}$, and thereafter using the latter in $x^b = (b+p)f(K^b, L^b) + (1 - L^b)s$, we get $x^b(t^*)$. It is easy to check that $x^b(t^*) < x^g$, where x^g is given by (11).∎

Proof of Proposition 5. To begin with we ignore the feasibility condition that the taxable income is non-negative. Let the Lagrangian be

$$\max_{L_1, K_1, L_2, K_2} Z = [B(K_1 L_1)^{\frac{1}{4}} - wL_1 - rK_1] + [\alpha P(K_2 L_2)^{\frac{1}{4}} - wL_2 - rK_2]$$
$$-t[B(K_1 L_1)^{\frac{1}{4}} - wL_1 - wL_2 - rK_1 - rK_2]$$
$$-\lambda[\ L_1 + L_2 - K_1 - K_2].$$

From $\frac{\partial Z}{\partial L_1} = 0$ and $\frac{\partial Z}{\partial L_2} = 0$, it is easy to check that

$$\frac{(1-t)BK_1^{\frac{1}{4}}}{L_1^{\frac{3}{4}}} = \frac{\alpha PK_2^{\frac{1}{4}}}{L_2^{\frac{3}{4}}}. \tag{19}$$

Similarly, from $\frac{\partial Z}{\partial K_1} = 0$ and $\frac{\partial Z}{\partial K_2} = 0$, it is easy to check that

$$\frac{(1-t)BL_1^{\frac{1}{4}}}{4K_1^{\frac{3}{4}}} = \frac{\alpha PL_2^{\frac{1}{4}}}{4K_2^{\frac{3}{4}}}. \tag{20}$$

From (19) and (20), we get $\frac{L_1}{L_2} = \frac{K_1}{K_2}$. Given that $L_1 + L_2 = K_1 + K_2$, it now follows that in equilibrium $L_1 = K_1$ and $L_2 = K_2$. Thus the entrepreneur's decision problem (ignoring the non-negativity constraint on taxable income) simplifies to the following:

$$\max_{L_1, L_2} (1-t)[BL_1^{\frac{1}{2}} - sL_1] + [\alpha PL_2^{\frac{1}{2}} - s(1-t)L_2].$$

Solving, we find that in equilibrium $L_1 = K_1 = \frac{B^2}{4s^2}$ and $L_2 = K_2 = \frac{\alpha^2 P^2}{4s^2(1-t)^2}$. Thus the equilibrium profit level of the entrepreneur is given by $\pi^B(t) = \frac{(1-t)B^2}{4s} + \frac{\alpha^2 P^2}{4s(1-t)}$. It is easy to check that in equilibrium the taxable income is non-negative provided $t < 1 - \frac{\alpha P}{B}$, which, given assumption $\mathbf{4}''$, is always satisfied. Clearly, given Assumption 5′, $L < 1$.∎

Proof of Proposition 6. The Lagrangian is

$$\max_{L_1,K_1,L_2,K_2} Z = [B(K_1L_1)^{\frac{1}{4}} - \overline{w}L_1 - rK_1]$$

$$+[\alpha P(K_2L_2)^{\frac{1}{4}} - wL_2 - r\ K_2]$$

$$+\lambda[\ K_1 + K_2 - L_1 - L_2].$$

From $\frac{\partial Z}{\partial K_1} = 0$ and $\frac{\partial Z}{\partial K_2} = 0$, it is easy to check that

$$\frac{B}{\alpha P} = \frac{K_1^{3/4}.L_2^{1/4}}{L_1^{1/4}.K_2^{3/4}}. \tag{21}$$

Similarly, from $\frac{\partial Z}{\partial L_1} = 0$ and $\frac{\partial Z}{\partial L_2} = 0$, it is easy to check that

$$\frac{B}{\alpha P} > \frac{L_1^{3/4}.K_2^{1/4}}{K_1^{1/4}.L_2^{3/4}}. \tag{22}$$

after using $\overline{w} > w$. From (21) and (22), we get $\frac{K_2}{L_2} < \frac{K_1}{L_1}$. Finally, since the reported use of capital in the formal sector is $K = K_1 + K_2$, it follows immediately that $\frac{K_1}{L_1} < \frac{K}{L_1}.\blacksquare$

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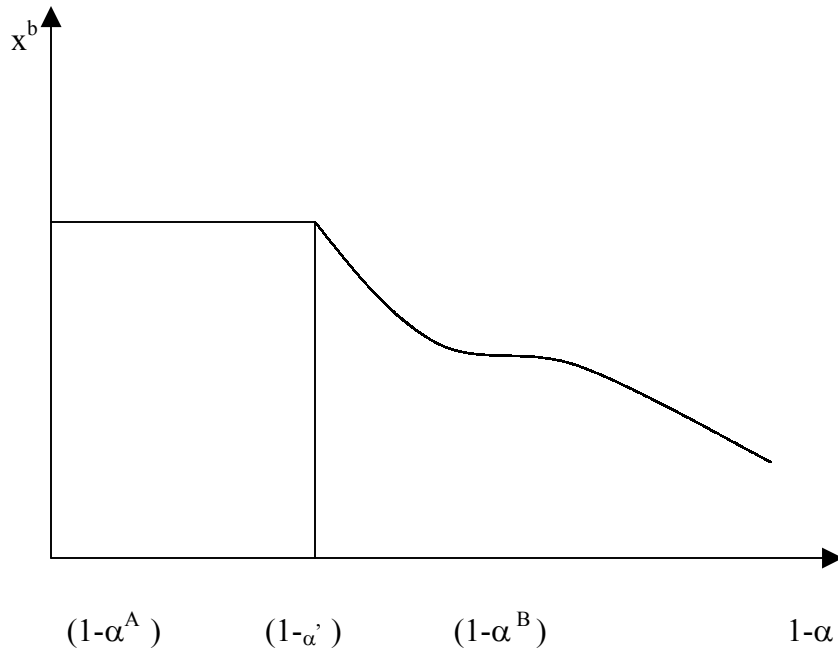
Figure 1