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Decreasing Cost of Intermediation

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Abstract

This paper attempts to explain how cost of intermediation can be reduced. One solution we postulate is subsidizing the cost of intermediation. The model uses ex-ante identical, spatially separated agents in an overlapping-generations framework. Agents receive relocation shock when they become old. We conclude that government cannot subsidize the cost of intermediation completely but it can reduce cost partially.

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1 Introduction

Financial intermediation is a mechanism through which funds are transferred from lenders (savers) to borrowers. This is conventionally accepted to be a very important function. But most of the modern macroeconomic theory almost ignores intermediation in that changes in intermediation activity are presumed to be an outcome of changes in real economic activity. The strong correlation between financial intermediation and long-run growth has been emphasized in the intermediation literature for long time since Gurley and Shaw (1955) first postulated it. They argued that both real economic activity and financial intermediation activity influence each other and the causality runs both ways making both endogenous. But there is a scarcity of any empirical evidence except for few notable exceptions. At this point it is sufficient to say that financial intermediation is not looked at seriously by the macroeconomic profession.

This paper clsoely follows Bencivenga and Smith (2003) except in one respect, we allow for variable cost and later we analyse whether government can subsidise cost of intermediation. We use overlapping-generations framework with spatial separation and limited communication between the agents inhabiting the separate locations. We find that government can bring down the cost of inetrmediation partially.

The rest of the paper proceeds as follows. Section 1 presents the basic framework of the model. Sections 2,3,4 and 5 analyse the equilibrium in the economy. Section 6 incorporates the governemnt by allowing it to subsidise the cost of intermediation. Section 7 concludes.

2 The environment

We consider an overlapping generations framework with an infinite sequence of two-period-lived agents in each period $t \geq 1$. There are two locations across which agents are distributed.

The islands are symmetric in every respect. At each date a continuum of ex-ante identical agents with unit mass is born at each location.

In each location in each period a single final good is produced with constant returns to scale technology.The production process uses both labor and capital as inputs. The production function has the Cobb-Douglas form $F(K_t, L_t) = AK_t^{\alpha}L_t^{1-\alpha}$,with $\alpha \in (0, 1)$. Letting $k_t = K_t/L_t$,the production function becomes $f(k_t) = Ak_t^{\alpha}$. Also, we assume that capital depriciates completely in the production process.

Each agent is endowed with one unit of labor which he supplies inelastically. Agents only value consumption when they are old. Let c_t denote the consumption of agent born at t. Then the agent has lifetime utility level $u(c_t) = c^{1-\rho}/(1-\rho)$.All the agents are identical ex-ante.

Based on Bencivenga and Smith (2003),we assume that at each date an agent can trade only with agents who live at his current location and there is no communication between islands. Between dates t and $t+1$, each agent faces the probability $\pi \in (0, 1)$that he will be relocated to the other island.When agents are relocated, they lose contact with agents agents in their original location. Agents in their new location do not know the capital holdings of relocated agents. So, relocated agents need currency in the new location. On the other hand non-relocated agents have both their capital holdings and currency.Stochastc relocation poses a risk for agents: they have to convert capital holdings into currency if relocated. They will require insure to cover against relocatio shock.

Agents can hold two assets: currency and physical capital. Each unit of final good invested at period t becomes capital at period $t+1$.Capital is immobile. Agents lose all the capital assets if relocated. We assume that young agents can save through banks. Utilization of bank is costly. We assume that there are two components of cost of intermediation. There is a fixed cost and a variable cost which decreases as the savings through banks increase.

For simplicity, we assume the cost that the agents have to face is $(\phi - gs_t)$, where ϕ is a positive fixed cost. There are various ways in which one can justify the decreasing cost of intermediation. The most plausible arguement, however, in the context of developing countries is that higher savings makes bank penetration better, reducing the costs associated with accessing the intermediaries. Agents can also choose to save autarkically. This prevents them from sharing the relocation risk.

the timing of events is as follows: beginning of the period, production takes place. Rental rate on capital and wages are disbursed. Agents get the prevailig wage rate as they are supplying labor inelastically. Agents don't consume when they are young so they save everything (their real wage). Agents make two set of choices whether to save the money autarkically or to save it through banks. If he chooses autarky, he has to decide how to allocate them between cash and capital assets. If banks are used they make the portfolio choices. The goods market clear: old agents consume, government makes purchses and final goods are invested. Later some young agents suffer relocation shock.[1]The young relocated agents have to leave the island immediately. They withdraw cash from the banks and leave. They cannot liquidate the physical capital they hold. Therefore, relocated agents who save and invest autarkically lose the value of their capital invetsment. Agents who are fortunate to have escaped the relocation shock do not take any action until the beginning of next period. Both relocated and non-relocated agents make purchases for consumption when they enter next period.

Thre is a governmemt in each island which prints money and purchases final good. Let M_t be the nominal money supply per young agent at t. M_t evolves acoording to $M_{t+1} = \sigma M_t$, with σ being chosen once and for all at the beginning of time. Letting p_t denote the price

[1]Note that not all the agents receive the relocation shock but all of them have common prior probability about the shock.

level in period t, the seignorage revenue of the government at t is:

$$\left(\frac{\sigma-1}{\sigma}\right)\frac{M_t}{p_t}$$

Government uses this money to purchase final good. We consider a case where government does not run contractionary policy.

3 Factor Markets

As noted in the previous section the production takes place at the begiinning of period t and rental rate of capital and wage income is paid. Let w_t and r_t denote the real wage and real rate of return on capital.Letting the firms behave competitively gives us following factor market equilibrium conditions:

$$r_t = f'(k_t) = \alpha A k_t^{\alpha-1} \tag{1}$$

$$w_t = f(k_t) - k_t f'(k_t) = w(k_t) = (1-\alpha)Ak_t^{\alpha} \tag{2}$$

4 Economy with Intermediation

As mentioned earlier, when young agents save through banks they incur cost which is a decreasing function of their saving. Since agents save all the income through intermediaries the cost of intermediation will be $(\phi - gw_t)$. So, effectively they deposit $[w_t(1+g)-\phi]$ in the bank.Banks,in turn, assure them gross real return of c_t if they are relocated and gross real return of a_t for per unit of the final good deposited, if they are not relocated.[2]Banks allocate

[2]Relocated agents are withdrawing early and non-relocated agents are withdrawing late.

their deposits between currency holdings and capital investment before the relocation shock occurs. Let γ_{bt} be the fraction of total deposits held as currency and $(1-\gamma_{bt})$ be the fraction of total deposits invested in capital assets. A bank chooses reserve to deposit raio (γ_{bt}) to maximize the expected utility of the representative depositor. The bank faces the following constraints:

$$\pi c_t \leq \gamma_{bt}\left(\frac{p_t}{p_{t+1}}\right) \tag{3}$$

The left hand side of this constraint is the expected cost of the bank where π is the probability of receiving the relocation shock. And the right hand side is the retuns that the bank gets from holding currency. Note that bank has to hold cash assets in order to pay to the relocated agent.And p_t/p_{t+1} is simply the gross real rate return of currency.

$$(1-\pi)a_t \leq (1-\gamma_{bt})r_{t+1} \tag{4}$$

The left hand side is again the expected returns that have to be paid to the non-relocated depositor and right hand side is the returns that bank gets from investment in capital assets.

The prices and real rate of return on capital are decided in goods and factor markets respectively. For bank they are exogenous. Then the bank's problem is to maximize expected utility of the depositor by choosing γ_{bt}, c_t and d_t. More specifically, bank solves the following problem:

$$\mathop{max}_{\gamma_{bt}} \frac{(w_t(1+g)-\phi)}{1-\rho}\left[\pi(c_t)^{1-\rho}+(1-\pi)(a_t)^{1-\rho}\right] \tag{5}$$

subject to the constraints (3) and (4) and non-negativity.

Defining gross nominal interest rate $I_t = r_{t+1}(p_{t+1}/p_t)$, the optimal reserve-to-deposit ratio of a bank at time t is[3] :

$$\gamma_{bt} = \frac{1}{\left(\frac{1-\pi}{\pi}\right) I_t^{(1-\rho)/\rho} + 1} \equiv \gamma_b(I_t) \tag{6}$$

We can now derive the returns that bank can can offer to relocated and non-relocated agents using (3),(4)and (6). More specifically, $a_t = I_t^{\frac{1}{\rho}} c_t$ will be the optimum return. When the nominal interest rate is $I_t > 1$, the relocated agent does worse than the non-relocated agent. Bencivenga and Smith(2003)various properties of the function$\gamma_b(I)$, we are simply restating those properties here:

(a)$\gamma_b(I) = \pi$

(b)$\lim I \rightarrow \infty = 0$

(c)$\frac{I\gamma_b'(I)}{\gamma_b(I)} = -\left(\frac{1-\rho}{\rho}\right)[1-\gamma_b(I)] < 0$

Several important conclusions can be drawn from these properties. First of all setting nominal interest rate equal to unity will not make agents (through banks)to hol only currency. Finally, the last property shows that increase in nominal interest will cause banks to move away from holding currency.

5 Equilibrium with Intermediated Saving

Let us first look at the money market. Banks will want to hold a fraction(γ_b) of their total deposits in the form of currency. This gives us the per capita demand for real balances. The money market will clear if

$$\frac{M_t}{p_t} = m_t = \gamma_b(I_t)\left(w(k_t)\left[1+g\right] - \phi\right) \tag{7}$$

[3]Bencivenga and Smith(2003) derive the same expression for γ_{bt} with fixed cost of intermediation.

Given that banks will hold rest of their total deposits $(1-\gamma_{bt})$in capital assets, we get the following per capita rate of capital accumulation

$$k_{t+1} = [1-\gamma_b(I_t)]\,[w(k_t)\,(1+g)-\phi] \tag{8}$$

Following condition determines the evolution of gross nominal interest rate.As defined previously,

$$I_t = r_{t+1}\left(\frac{p_{t+1}}{p_t}\right) = r_{t+1}\sigma\left(\frac{m_t}{m_{t+1}}\right) \tag{9}$$

Substituting (1) and (7) into (9) gives

$$I_t = \frac{\sigma f'(k_{t+1})\gamma_b(I_t)\,[w(k_t)(1+g)-\phi]}{\gamma_b(I_{t+1}\,[w(k_t(1+g)-\phi)])} \tag{10}$$

or,

$$\gamma(I_{t+1}) = \frac{\sigma f'(k_{t+1})\gamma_b(I_t)}{I_t} \equiv \Omega(k_{t+1}, k_t, I_t) \tag{11}$$

This completes our discussion of equilibrium.

6 steady state

The steadys state solution will have $I_t = I_{t+1} = I$ and $k_t = k_{t+1} = k$. Substituting it in (10) gives

$$I = \sigma f'(k) \tag{12}$$

which implies

$$k = \left(\frac{\sigma\alpha A}{I}\right)^{1/(1-\alpha)} \tag{13}$$

Now we can express the amount deposited in the bank as

$$w(k)[1+g]-\phi = (1-\alpha)(1+g)A\left(\frac{\sigma\alpha A}{I}\right)^{\alpha/(1-\alpha)} \tag{14}$$

Substituting (14) into (8) and using other conditions we get

$$\frac{1}{1-\gamma_b(I)} = (1+g)\left(\frac{1-\alpha}{\alpha}\right)\left(\frac{I}{\sigma}\right) - \nu\left(\frac{I}{\sigma}\right) \equiv H(I) \tag{15}$$

where $\nu = \phi(\alpha A)^{1/(1-\alpha)}$. Again, we restate the properties of the function $H(I)$ from Bencivenga and Smith (2003) with some obvious variations.[4]

(a') $H'(I)$ holds if and only if

$$I \leq \sigma\left[\frac{(1-\alpha)^2(1+g)}{\alpha\nu}\right]^{(1-\alpha)/\alpha} \equiv \hat{I}$$

(b') $H(I) \geq 0$ holds if and only if

$$\left[\frac{(1-\alpha)(1+g)}{\alpha}\right]^{(1-\alpha)/\alpha} \geq I$$

(c') $H(I)$ is a concave function of I.

These properties will yield the steady state solutions which are discussed in detail Bencivenga and Smith (2003).

7 Subsidized Intermediation

Till this point we have largely followed Bencivenga and Smith(2003). We know that the cost of intermediation has fixed and variable component. Now we argue that governemnt subsidises the agent by making a lumpsum transfer equal to ϕ while he receives his real wage. Note that we are now allowing only fixed cost of intermediation. We consider two cases. In the first case, government subsidises the agent completely by making a trasfer equal to the

[4]The properties of $H(I)$ are slightly different as we use the variable costs.

fixed cost he has to incur in order to save through bank. While in other case government subsidises the agent by offsetting only a fraction of fixed cost.

7.1 Complete Subsidization

In this case we assume that government uses all its seignorage revenue to subsidise a represetative agent who incurs the fixed cost of going to bank. This will imply

$$w(k_t)g = \left(\frac{\sigma - 1}{\sigma}\right)\frac{M_t}{p_t} = \phi \tag{16}$$

Given the above balanced budget constraint, government can solve for σ or the money growth rate which offsets the fixed cost of intermediation. We get

$$\sigma = \frac{m_t}{mt - \phi} = \frac{M_t}{M_t - \phi P_t} < 1 \forall \phi > 0 \tag{17}$$

Since p_t is subject to change in every time period, we will violate the condition that σ is constant. Even if we relax the constant σ assumption, we still have to deal with a deflationary situation.The nominal inetrest rate will be less than one and most importantly since $a_t = I_t^{1/\rho} c_t$, the non-relocated agents will have to suffer. Hence, complete subsidization is not feasible.

7.2 Partial Subsidization

Now we look at the situation whether government can offset the fixed cost partially. Here we assume that governemnt does not try to set σ to offset cost but simply passes on whatever seignorage revenue it makes given a predetermined value of σ. This will imply that government will be able to reduce some of the fixed cost. The exact amout of deposit made by agent will be then $\left[w(k_t) + \left(\frac{\sigma-1}{\sigma}\right) m_t - \phi\right]$. The new money market equilibrium will be

$$m_t = \frac{\gamma_b(I_t)\left[w(k_t) - \phi\right]}{1 - \gamma_b(I_t)\left(\frac{\sigma-1}{\sigma}\right)} \tag{18}$$

Also, the evolution of gross nominal interest rate will change. We get

$$I_t = \sigma f'(k_t) \left(\frac{\gamma_b(I_t) \left[w(k_t) - \phi \right]}{1 - \gamma_b(I_t) \left(\frac{\sigma-1}{\sigma} \right)} \right) \left(\frac{1 - \gamma_b(I_{t+1}) \left(\frac{\sigma-1}{\sigma} \right)}{\gamma_b(I_{t+1}) \left[w(k_{t+1}) - \phi \right]} \right) \tag{19}$$

The currency-to-deposit ratio will be

$$\gamma_b(I_{t+1}) = \frac{\sigma f'(k_{t+1}) \gamma_b(I_t) \left[w(k_t) + \left(\frac{\sigma-1}{\sigma} \right) m_t - \phi \right]}{I_t \left[w(k_{t+1}) + \left(\frac{\sigma-1}{\sigma} \right) m_{t+1} - \phi \right]} \tag{20}$$

The steady state value of gross nominal interest rate will remain unchanged. Here increasing the growt rate of money will increase capital stock and output as in Bencivenga and Smith(2003).[5] However, one can set σ in such a way that it rules out the bad steady state.

8 Conclusion

It is often remarked that in developing countries low level of intermediation is caused due to high cost of intermediation. The argument is based on the lack of penetration of banking activity. Here we presented a case where the cost of intermediation can be subsidised by the government. Also, we analysed the case where cost of intermediation is a decraesing function of the amount of savings.

There are various directions in which the present analysis can be extende. One important issue is why do the banks hold excess reserves of currency when the required reserve level is low. This issue is important even in case of developed countries. One can also try a more sophisticated game-theoretic approach to analyse this. There is also the possibilty that both agents and banks receive exogenous shocks. The issue of why agents only deposit a fraction of their income in the banks is also important.

[5]Their results are restricted to only certain steady states

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