

A BANK'S INTERNATIONAL LOAN POLICY AND THE SUPPLY OF DEPOSITS

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Abstract

If the supply of domestic deposits is a function of the rate on deposits and the amount of loans extended domestically, and if domestic banks maximize profits, then the interest rate differential between two countries persists despite the lack of risk or government intervention. Furthermore, each domestic bank holds a combination of domestic and foreign loans although rates abroad are higher. By extending domestic loans, the bank attracts more deposits and incurs lower interest costs on these deposits.

I. Introduction

The theory of the banking firm has been developed extensively in the financial literature. Baltensperger (1980) and Pyle (1972) provide excellent summaries of this work. Furthermore, the portfolio approach has been utilized by Hart and Jaffee (1974), and Pyle (1971) to examine the effects of diversification on the bank's loan policy. One way for a bank to pursue diversification is through both domestic and international lending. Associated with foreign loans, though, are foreign loan risks. Westfield (1978) classifies these risks as basic risk emanating from the borrower's financial condition, and country risk like sovereign risk and currency risk. But as Shapiro (1982) indicates, banks expand overseas because they expect the returns on their loans abroad to exceed those on the domestic loans.

Obviously the bank's ability to extend loans (domestic or foreign) depends on its ability to attract deposits. It is assumed in this paper that the bank raises its deposits from the home country only, it extends both domestic and foreign loans, and the rates on these loans are known with certainty.

It is demonstrated that if a perfectly competitive market for deposits exists and the supply of deposits is a function of the rate on deposits only, the bank will accept the equilibrium amount of deposits and will direct all its loans (to the higher return) abroad. In this way, the bank takes advantage of the higher rate on foreign loans and it maximizes its profits. This implies that no loans are extended domestically. But home country depositors presumably take into account the bank's ability to extend domestic loans, when they decide whether or not to deposit their money with the bank. Thus, if the bank extends no domestic credit, the domestic depositor-borrowers will withdraw their deposits and redeposit them with a bank which will extend loans domestically when needed.

In order to avoid the drain of deposits, the bank has to view the supply of deposits as a function of the rate on deposits and the amount of loans extended domestically. As a result, conditions of monopolistic competition prevail in the market for deposits. Under these circumstances it is demonstrated that the bank's profits are a

concave function of the amount of domestic loans. In other words, there is an amount of domestic loans which maximizes the bank's profits. The intuition is that although foreign loans are more profitable, the bank finds it optimal to extend some loans domestically because this increases the equilibrium amount of deposits the home country depositors supply and reduces the rate the bank pays on deposits. The bank's inability to direct all its credit abroad and take advantage of the higher rate implies that the rate differential between the two countries will persist. In this sense, this paper offers an explanation for the persistence of interest rate differentials across different countries even in the absence of risk and government intervention.

Section II introduces the assumptions and the notation underlying the present model. Section III considers the case in which a perfectly competitive market for deposits exists and the supply of deposits is a function of the rate on deposits only. Section IV analyzes the case in which the supply of deposits is a function of the rate on deposits and the amount of loans extended domestically. In this case, the demand for deposits is a function of the rate on deposits and the market for deposits is characterized by monopolistic competition. Finally, Section V summarizes the findings of this paper.

II. Assumptions and Notation

It is assumed that there are only two countries, the home country and the foreign country. The bank accepts deposits from the home country depositors only. As long as the rate on deposits abroad is greater than the domestic rate on deposits,[1] the foreign depositors will not deposit their money with the home country bank. On the other hand, domestic depositors will not have their money deposited abroad because they will not be able to obtain domestic loans when they need them.[2] In other words, in their

selection of a bank with which they will deposit their money, the domestic depositors take into account the rate offered on their deposits, as well as the bank's ability to satisfy their demand for loans. The bank's willingness to extend loans has been recognized in the banking literature as an important factor in the attraction of deposits. Cross and Hempel (1980) indicate:

"Of almost equal importance in attracting demand deposits, particularly business accounts, is the willingness to lend. . . . For this reason banks frequently offer "solicitation" lines of credit to businesses with no present need to borrow and by the same token businesses maintain deposit balances in anticipation of their possible future need to borrow."[3],[4]

The demand for (supply of) deposits is

denoted by $D^d(D^s)$. The equilibrium amount of deposits is denoted by D^* . The rate on deposits is denoted by i , while the equilibrium rate is denoted by i^* . It is also assumed that the reserve requirement per dollar of deposits is R and that reserves do not bear interest.

The bank extends an amount of loans to the home (foreign) country denoted by $L_H(L_A)$. The rate on domestic (foreign) loans is known and denoted by $r_H(r_A)$. Both rates are in terms of the home country currency. It is assumed that loans abroad command a higher rate[5] (i.e., $r_A > r_H$). It is also assumed that $(1-R)r_H > i$. This means that the bank finds it profitable to enter either the domestic or foreign loans market. A one period horizon is utilized in this paper.

The bank's objective is assumed to be the maximization of its profits, denoted by P , subject to the balance

sheet constraint. Given the time horizon and risk assumptions of the paper, this objective is equivalent to value maximization. The operating costs of the bank are denoted by C and they are assumed to be fixed and given exogenously. Finally, it will be noted that the bank's net worth is assumed to be zero.[6]

III. Supply of Deposits is a Function of i Only

In this section, it is assumed that the bank faces a perfectly competitive market for deposits and it pays the equilibrium rate i^* on deposits. On the other hand, it is assumed that the bank views the supply of domestic deposits as an increasing function of the rate on deposits,[7], i.e.,

$$D^S = D^S(i); \quad \frac{dD^S}{di} > 0$$

For a given level of deposits, D , the bank's balance sheet constraint is:

$$RD + L_H + L_A = D \quad (1)$$

For the same level of deposits, D , the bank's profits are:

$$P = L_H r_H + L_A r_A - D i^* - C, \quad (2)$$

or combining (1) and (2):

$$P = (r_H - r_A) L_H + [(1-R)r_A - i^*] D - C \quad (3)$$

Expression (3) indicates that the bank's profits are equal to the revenue the bank realizes if it lends only abroad; plus the opportunity losses the bank suffers by extending some loans domestically instead of abroad; minus the cost of deposits; minus the bank's operating costs.

The bank is concerned with the selection of D and L_H which will maximize P as given by (3). Since P is a

linear function of domestic loans and since loans abroad are more profitable, maximization of P requires that the bank extends no loans to the home country, but instead it directs all the loans abroad. Furthermore, since P is linear in D and since as it was assumed in Section II it is profitable for the bank to enter the foreign loans market, maximization of P implies that it is always profitable for the bank to accept all the deposits supplied by the home country depositors.

The above analysis indicates that the profit maximizing behavior which will enable the bank to reach its corner optimum will be to accept the equilibrium amount of deposits supplied, pay the equilibrium rate on deposits and direct all its credit as loans abroad. Equivalently, it can be stated that the bank's profits decrease linearly as L_H

increases, thus reaching a maximum when no credit is extended domestically. Still the bank accepts the equilibrium amount of deposits.

Implicit in the above analysis is the assumption that the bank's international loan policy does not affect the depositors' attitude towards the bank. In other words, it is assumed that the domestic depositor-borrowers will deposit their money with the bank regardless of the amount of loans extended to them. As demonstrated above, this implies that the bank will not extend any loans to the home country but instead it will extend credit only to the foreign borrowers.[8] But as indicated in Section II, the home country depositors take into account the bank's willingness to extend loans to them when they decide whether or not to deposit their money with the bank. Actually, domestic depositors expect the bank to extend domestic credit as needed. Thus, if the bank follows the policy of extending only foreign loans, the home country depositor-borrowers are unable to obtain loans when they need them. It be-

comes evident then that these depositors, after realizing the bank's loan policy, will reduce (or totally eliminate) the amount they deposit in this bank. This will result in the reduction of the basis from which the bank can create the loans it directs abroad. This implies a reduction in the bank's profits.[9] Realistically the bank must therefore recognize the dependence of the supply of deposits on both rate i and the amount of loans, L_H , extended

domestically. The demand for deposits will be a function of i only. The bank will have to determine the optimal L_H

and D which maximize P subject to the balance sheet constraint. This problem is considered next in Section IV.

IV. Supply of Deposits is a Function of i and L_H

In this section, it is assumed that the supply of deposits, D^S , is a function of both the rate i paid on deposits and the amount of loans L_H extended

to the home country. As in Section III, D^S increases with i . It is also assumed that for a given i , the amount of deposits supplied by the depositors of the home country increases with L_H .

Thus, the D^S curve shifts to the right in the (D, i) plane as L_H increases.

Furthermore, it is assumed that even if

$L_H = 0$ some deposits will be supplied by those depositors who will never ask for a loan, but who are solely interested in getting the benefits associated with the rate i on their deposits.[10]

As far as the demand for deposits, D^d , is concerned, it is assumed to be a decreasing function of i .

Given the above assumptions, the

equilibrium rate, i^* , paid on the deposits is a decreasing function of the amount of loans L_H extended to the

home country.[11] Although the equilibrium i decreases as L_H increases, it

has to be noted that it cannot become negative. Therefore, a rock-bottom minimum will exist and the equilibrium i will asymptotically tend to this minimum as L_H becomes very large.[12]

The above imply that for the equilibrium i ,

$$\frac{di^*}{dL_H} < 0 \text{ and } \frac{d^2i^*}{dL_H^2} > 0.$$

Under the assumptions about D^d and D^S , the equilibrium amount of deposits, D^* , increases with L_H . [13] It is assumed though, that the equilibrium D^* is increasing at a decreasing rate with L_H . In sum,

$$\frac{dD^*}{dL_H} > 0 \text{ and } \frac{d^2D^*}{dL_H^2} < 0.$$

The above analysis indicates that, starting with an equilibrium, an increase in L_H will cause a reduction in

i . At this new level of i there is an excess demand for deposits. The higher L_H will pull the supply of deposits curve to the right though, and a new equilibrium will prevail at a higher D^* and a lower i^* .

The fact that L_H affects the supply of deposits indicates that depositors differentiate a bank's deposits from those of its competitors in terms of the bank's L_H . Another way of

putting it is that a bank can differentiate itself from its competitors through its domestic loan policy. Hence, the case at hand can be seen as an example of monopolistic competition.

As is customary under monopolistic competition (see, for example, Chamberlin (1962)), it is assumed that the actions of an individual bank have no perceptible effect upon its competitors. As a result, the rate on deposits, i_k ,

offered by a bank k can be expressed as a function of the bank's own domestic loan policy, L_{Hk} , and the domestic

loan policies, L_{Hj} , of its $n-1$ competitors (see, for example, Hendrson and Quandt (1958), p. 192). Thus,

$$i_k = A_k - a_k L_{Hk} - \sum_{\substack{j=1 \\ j \neq k}}^n b_{kj} L_{Hj} \quad (4)$$

$$\text{where } \frac{\delta i_k}{\delta L_{Hk}} = -a_k \text{ negative, } \frac{\delta i_k}{\delta L_{Hj}} = -b_{Kj}$$

is negative but numerically small, and A_k is positive.[14] Under the symmetry

assumption,[15] a bank's (profitable) increase of L_H will be duplicated by

identical increases on the part of all the other profit maximizing banks.[16] This implies that a bank's increase of L_H will lead to a larger decline in the

bank's i when all the competing banks adopt the same change in their domestic loan policies, as opposed to the case where the competitors do not follow suit.[17] As a result of this, a bank's

demand for deposits curve, $D_e^d(i)$, for variations of its own L_H alone, is flatter than its effective demand for depo-

sits curve, $D_e^d(i)$, for identical variations of the domestic loan policies of all the competing banks. The two

curves intersect at the initial (D^*, i^*) combination of a given bank. As all

the banks increase L_H , $D_e^d(i)$ slides

along $D_e^d(i)$. The two curves always

intersect at the current (D^*, i^*) combination of the representative bank.[18]

Given L_H , the profits of the bank in equilibrium are:

$$P = (r_H - r_A)L_H + [(1-R)r_A - i^*]D^* - C. \quad (5)$$

Expression (5) is similar to (3) as developed in Section III. Notice though

that now i^* and D^* are functions of L_H

and they will both change when L_H

changes. That is, $i^* = i^*(L_H)$ and $D^* =$

$D^*(L_H)$, and therefore $P = P(L_H)$. The

bank is concerned with the selection of

L_H which will maximize its profits as

given by (5).

Let us now examine how the bank's profits change with L_H when (as it was

assumed in Section II) it is profitable for the bank to extend loans abroad (i.e., $(1-R)r_A > i(L_H)$) at each level of

L_H . When $L_H = 0$, the profits are

given by:

$$P(0) = D^*(0)[(1-R)r_A - i^*(0)] - C. \quad (6)$$

This $P(0)$ could be positive, zero, or negative depending on the size of C .

Of course, the bank will stay in business only if $P(0) \geq 0$. Then, an increase in L_H will produce the following change

$$\text{in } P: \frac{dP}{dL_H} = (r_H - r_A) + [(1-R)r_A - i^*] \frac{dD}{dL_H} - D \frac{di^*}{dL_H}. \quad (7)$$

The direct effect of the L_H change on P , given by $(r_H - r_A)$, is negative, and it indicates that the marginal loan directed domestically instead of abroad will reduce the bank's profits by the rates differential. The indirect effect of the L_H change on P is composed from the following two parts: (i) the deposits effect, i. e., as L_H increases, D^* increases and the revenues from loans abroad increase as well. This pulls profits up by

$$\frac{dD}{dL_H}^*$$

and (ii) the interest rate (on deposits) effect, i.e., as L_H increases the interest paid on deposits declines and the bank's interest cost declines. This pulls

profits up by $-D \frac{di^*}{dL_H}$.

The bank will extend the marginal loan to the home country only if the right hand side (RHS) of (7) is positive, since this will increase its profits.[19] This will be the case if the deposits and interest rate effects together exceed the loan rates differential $r_H - r_A$. In other words, the bank

will extend the marginal loan domestically if the loss resulting from this loan is less than the profit resulting from the marginal reduction in the interest payment on deposits, plus the profit resulting from the marginal in-

crease in the revenues when the incremental deposits are directed as loans abroad.

The bank will keep extending more loans to the home country as long as $\frac{dP}{dL_H} > 0$. Notice though, that D^*

increases at a decreasing rate with L_H and i^* declines at a decreasing rate as L_H increases, while $r_H - r_A$ is fixed in magnitude. It becomes evident then

from equation (7) that $\frac{dP}{dL_H}$ will decline as L_H increases and eventually it will become equal to zero at $L_H = L_H^*$. For

an amount of home loans in excess of L_H^* , $\frac{dP}{dL_H}$ is negative and the bank's profits decline as L_H increases. [20]

The bank has no incentive to exceed the L_H^* amount.

Notice that $\frac{dP}{dL_H}$ must become negative. This is so because as L_H increases, i^* will tend toward its rock-bottom minimum and therefore, both

$$\frac{di^*}{dL_H} \quad \text{and} \quad \frac{dD}{dL_H} \quad (= \frac{dD}{di^*} \cdot \frac{di^*}{dL_H}) \quad \text{will tend}$$

toward zero. Then as (7) indicates $\frac{dP}{dL_H}$ will tend to $r_H - r_A$, which is negative.

[21] If L_H^{**} is the level of L_H for which $\frac{dP}{dL_H}$ tends to $r_H - r_A$ then $L_H^* < L_H^{**}$ and the bank maximizes profits at L_H^* .

For $L_H > L_H^*$ losses associated with the marginal domestic loan exceed the benefits of higher deposits and lower interest rate on deposits.

The main conclusion reached in this section is that the bank's profits will start increasing with L_H , reach a maximum, and then start declining as L_H keeps increasing,

$$\text{if } \frac{dP}{dL_H} > 0 \text{ at } L_H = 0. [22]$$

The intuition is that although foreign loans are more profitable than domestic loans, the bank will extend loans domestically because this will increase the amount of deposits left with the bank and will also reduce the interest rate the bank pays on these deposits. [23]

At some level L_H^* , profits will be maximized. Corresponding to this level of domestic loans, there is an equilibrium amount of deposits $D^*(L_H^*)$. So in contrast to Section III where profits were continuously increasing with the amount of deposits, in the present section, profits initially increase along with the amount of deposits left with the bank, they reach a maximum $D^*(L_H^*)$, and then decline as deposits exceed the $D^*(L_H^*)$ level.

The interest rate parity theory (see, for example, Rodriguez and Carter (1979)) indicates that in the absence of risk or government intervention, real rate differentials will not persist across different countries. Actually, the same real rate will prevail across all countries (i.e., $r_A = r_H$). The present paper though, indicates that the rate differential will persist because profit

maximizing banks cannot direct all their loans abroad to take advantage of the higher rate. Their inability to do so is due to the behavior of the domestic depositors who require that loans be extended to them in order for them to be willing to keep their deposits with the domestic banks. Thus, the present paper offers an explanation for the persistence of different rates across countries even under certainty.

Furthermore, notice that the existence of an interior solution to the bank's international loan policy problem implies diversification in a sense different from the one introduced by Markowitz (1952). Markowitz diversification is utilized to minimize, for a given level of expected return, the variability of return of a portfolio of international loans, when the rates on these loans are uncertain. In the present paper, the rates on these loans are certain. The resulting diversification, or combination, can be thought of as one induced by the domestic depositors-borrowers. The bank has to attract the domestic deposits. In order to do so, it has to extend some domestic loans (i.e., "diversify") although foreign loans are more profitable. The bank will carry this process on up to the point where the benefits associated with it (more deposits, lower rate on deposits) become equal to the corresponding opportunity losses (the rate on domestic loans is lower than the rate on foreign loans). The bank's failure to do so will result in attracting only those depositors who are not interested in obtaining domestic loans. In other words, the bank faces a reduction in deposits and thus, in profits.

Finally, the model developed in this section can be utilized to explain the behavior of some U.S. banks at the domestic level. According to an article which appeared in *The Wall Street Journal* (1984), banks in small towns paid low or no interest at all on the deposits they attracted from the residents of those towns. At the same

time, these banks satisfied the local loan demand[24] at loan rates well below the national prime rate. This enabled the banks to retain the local deposits instead of losing them to the higher yielding money market accounts available at the nearby urban center banks. Rural people presumably accepted the lower interest rate on their deposits with the local banks because their demand for loans was satisfied at rates below those charged by the urban banks.

V. Summary

This paper has examined, under certainty, the international loan policy of a bank which provides loans to two different countries but obtains its deposits from only one of them, the home country. It was also assumed that loans abroad yield more than domestic loans.

It was demonstrated that when the market for deposits is perfectly competitive and the supply of deposits is a function of the rate on deposits only, the bank will supply the equilibrium amount of deposits and it will maximize its profits by extending loans only abroad.

Such a policy though, causes adverse behavior on the part of the home country depositors, resulting in a reduction of the deposit base and the bank's profits. Hence, the supply of deposits can be viewed as a function of the rate on deposits and the amount of loans extended domestically. The demand for deposits is a function of the rate on deposits. As a result, the market for deposits is characterized by monopolistic competition implying that the equilibrium amount of deposits

(interest rate on deposits) increases (decreases) as the amount of domestic loans increases. This implies that an increase in the amount of domestic loans will cause (i) an increase in the revenues from loans abroad, and (ii) a reduction in the interest paid on deposits. If these two effects together exceed the loan rates differential when the bank has no domestic loans outstanding, there is an interior optimum for the bank's profits as a function of the amount of domestic loans. In any other case, the bank's optimal loan policy will be a corner solution where all the loans will be directed abroad. In such an event, the bank will attract only those depositors who are not interested in obtaining loans from the bank.

The existence of an interior solution for the bank's loan policy problem implies that the bank is not in a position to direct all its credit as loans abroad and take advantage of the higher loan rates. Thus, the differential between the rates of the two countries will persist despite the lack of risk and government intervention. It was indicated that the persistence of this differential, as well as the resulting diversification in the international loan policy of the bank (i.e., the bank holds a combination of domestic and foreign loans) under certainty, is induced by the domestic depositor-borrowers. The bank, in its effort to raise more deposits, will have to extend domestic loans, although foreign loans are seemingly more profitable. This process is driven to the point where the benefits associated with it (more deposits, lower rate on deposits) become equal to the associated opportunity losses (the rate on domestic loans is lower than the rate on the foreign loans).

Footnotes

* I would like to thank R. Cohn and M. Long for helpful comments.

1. This will be the case in the present paper because, as indicated below, the rates on loans abroad are higher than the domestic loan rates.
2. Transaction costs and lack of information could be other factors responsible for the absence of direct lending abroad by the home country savers.
3. H. D. Crosse and G. H. Hempel (1980, p. 130).
4. Hempel and Yawitz (1977) and Robinson (1962) make similar comments about the banks' interest in meeting the loan needs of customers who normally can provide them with large deposit balances.
5. Higher growth opportunities abroad can be seen as a factor that causes r_A to be higher than r_H .
6. As Hart and Jaffee (1974) indicate, this is equivalent to assuming that the net worth is a variable amount and it is treated like any other liability.
7. The supply of deposits is also a function of the depositors' income. Changes in their income will cause shifts in the supply of deposits function. It is assumed in this paper that income will remain unchanged and therefore, it can be omitted from the supply function.
8. As a result of the bank's behavior, the interest rate differential between the two countries will vanish.
9. In the U.S. banking system, at least a part of the deposits withdrawn by these depositors whose loan needs are not served by the bank, will be recaptured by the bank. The recaptured deposits will have a higher interest cost (for example, time deposits will increase at the expense of demand deposits) and profits will be reduced.
10. These depositors could actually invest abroad directly and take advantage of the higher rates. It is assumed, though, that they are a small percentage of the domestic depositors' population and their activities will not affect seriously the bank's loan policy.
11. In equilibrium $D^S(i^*, L_H) = D^D(i^*)$; hence $i^* = i^*(L_H)$. Applying the implicit-function theorem, $\frac{di^*}{dL_H} = \frac{\delta D^S / \delta L_H}{\delta D^S / \delta i^* - dD^D / di^*} < 0$.
12. This rock-bottom rate can be seen as the rate domestic depositors will require on their deposits when the domestic demand for loans has been fully satisfied. Even if this rock-bottom becomes zero, the results of this paper will still hold.

13. In equilibrium, $D^* = D^d(i^*)$. Then, $\frac{dD^*}{dL_H} = \frac{dD^d}{di^*} \frac{di^*}{dL_H} > 0$.
14. Note that $i_k(L_{Hk})$ is identical with $i(L_H)$ as defined in Section II. The subscript k was introduced to distinguish a bank k from its competitors j . The subscript k will not be used in the rest of the paper which just considers the behavior of a representative bank.
15. Under this assumption the revenue and cost functions of all the competing banks, as well as their maximizing behavior, are identical. As a result, the industry can be described by the activities of a representative bank.
16. As Chamberlin (1962) indicates, no modification of the analysis is necessary when the symmetry assumption is relaxed.
17. The expression for i_k in equation (4) can be easily used to verify this result.
18. From this point on, the analysis presented in footnotes 11 and 13 can be thought of as utilizing $D_e^d(i)$ instead of $D^d(i)$.
19. $L_H = 0$ if the RHS of (7) is always negative, while the bank is indifferent as of what the size of L_H is if the RHS of (7) is always equal to zero.
20. It is assumed that the second order condition sufficient for an interior maximum is satisfied.
21. It is obvious then that if $\frac{dP}{dL_H} > 0$ at $L_H = 0$, the bank's profits will reach an interior maximum. This can be seen as an alternative to the second order condition sufficient for an interior maximum.
22. If $\frac{dP}{dL_H} \leq 0$ at $L_H = 0$, the bank's profits will reach a corner maximum at $L_H = 0$. In such a case the bank will attract the depositors who are not interested in obtaining loans from the bank. All loans will be directed abroad.
23. Recall that in Section III profits were a linearly decreasing function of L_H .
24. One bank in this article was reported to lend 91% of its funds locally.

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