even though as a result of this lending and investing activities interest rates fall

result in the reversible under circumstances taking place

from at least some values other than the equilibrium value a process is set up which will in time lead to the equilibrium value. We will assume that the reserve ratio is r and that initially $D_0 < R/r$. We also assume that a sufficient amount of profitable loans and investments exist so that a bank with more reserves than necessary will extend its demand liabilities. With D_0 of deposits, $r D_0$ of reserves are required, which means that some bank or banks have $R - D_0 r$ of reserves in excess of the amount required. For the sake of simplicity let us assume that all of these excess reserves are in one bank.

which is deposited in

This bank's management will feel that it can acquire $R - D_0 r$ of additional earning assets. It will do this by creating a deposit equal to $R - D_0 r$ by either lending to its customers or buying securities on the open market. Assume that all of this deposit is paid by a single check to a second bank. This second bank's deposits and reserve balance increases by $R - D_0 r$, however against this additional deposit it will be constrained to keep $r(R - D_0 r)$ in reserves. As a result it will have

$$(R - D_0 r) - r(R - D_0 r) = (1 - r)(R - D_0 r)$$

will result in

of excess reserves. This second bank will create a deposit equal to $(1-r)[R + D_0 r]$, which when the drawing of a check will be deposited in a third bank. The third bank will assign $r(1-r)(R - D_0 r)$ to required reserves and increase its deposits by

that

$$(1-r)[R - D_0 r] - r(1-r)(R_0 - D_0 r) = (1-r)^2 (R - D_0 r)$$

through many banks

Carrying this process out, we get as the total deposits

$$(3)\quad D = D_0 + (R - D_0 r) + (1-r)(R - D_0 r) + (1-r)^2 (R - D_0 r) + \cdots =$$

$$D_0 + (R - D_0 r)\left[1 + (1-r) + (1-r)^2 r \cdots\right) = D_0 + \frac{R - D_0 r}{1 - (1-r)}$$

$$= D_0 + \frac{R}{r} - D_0 = R/r$$

$$= D_0 + \frac{R}{r} - D_0 = R/r$$

in which lends or invests

That is the process of each bank lending out its excess reserves results, when carried out by each bank, in the equilibrium amount of demand deposits.

through the system

We will also have to investigate whether a dynamic process which leads to the equilibrium amount of deposits is set off whenever deposits are too large for the existing reserves. Once again we assume that all of the reserve deficiency is in one bank's reserve account.

The management of the bank with insufficient reserves will have to acquire reserves to make up the deficiency. Assuming R as the reserves, r as the reserve ratio and D_0 as the initial deposits, we have that $D_0 r - R$ is the reserve deficiency. To acquire $D_0 r - R$ of reserves, the bank will either

Assuming R as the reserves and D_0 as the initial deposits in the banking system, then with r as the reserve ratio, $D_0 r - R$ will be the reserve deficiency.

(9)

sell $D_0r - R$ of earning assets or it will decrease its lending activity so that it receives a clearing gain of $D_0r - R$. As banks do not like to modify their lending activity on the basis of transitory reserve positions, we can assume that the bank with a reserve deficit will sell securities. Given that all banks but this one are fully loaned up (i.e. they have no excess reserves), we can assume that they are not willing to purchase securities. Alternatively if the initial deficit bank operates to decrease its lending activities, no other bank will make loans to those customers the deficit bank turned away.

In selling securities, the deficit banks will have to make their price low enough to attract non-bank investors. The non-bank purchasers will pay for these securities by drawing a check on their own (assumed different) banks. As a result of the sale of securities, the original deficit bank will have a clearing gain of $D_0r - R$ in reserves, and the second bank will have a simultaneous clearing loss of $D_0r - R$ in reserves accompanied by a decrease in its deposits of $D_0r - R$.

If the original deficit bank had chosen to decrease its lending activity, its loan customers would have paid in $D_0r - R$ in clearing gains by receiving and depositing checks in the deficit bank which were drawn on other banks. This too results in a clearing loss of $D_0r - R$ accompanied by an equal decrease in deposits in the "other" bank.

Whether the original deficit bank sells securities or decrease its lending activities, the end result is a decrease of $D_0r - R$ in reserves and deposits at the other bank so that the required reserves go down by $r[D_0r - R]$. With reserves down $[D_0r - R]$, there is a required reserve deficit of $[1 - r][D_0r - R]$ in this other bank. The second deficit bank (the first bank is now in a balanced position) will restrict its lending or sell securities to obtain a clearing gain of $(1-r)(D_0r-R)$. Assuming all of this clearing gain comes from a "third" bank, this third bank will now have a decrease of $(1-r)(D_0r - R)$ in its deposits and reserves. This results in a deficit reserve position of $(1-r)^2 (D_0r-R)$ in the third bank. Hence the original deficit reserve position will result in a spread of deficit reserve positions throughout the banking system. The reaction of each bank to a deficit reserve position results in a decrease in deposits. The amount of deposits in the banking system will become, through the workings of this dynamic process:

$$(4)\quad D = D_0 - (D_0r-R) - (1-r)(D_0r-R) - (1-r)^2 (D_0r-R) \text{ etc.}$$

$$= D_0 - D_0r + R - (1-r)(D_0r-R)\left(1 + (1-r) + (1-r)^2\right)$$

$$= (1-r) D_0 + R - (1-r)(D_0r-R)\frac{1}{1-(1-r)}$$

$$= (1-r) D_0 + R - \frac{(1-R) D_0 r}{r} + (1-r)\frac{R}{r}$$

$$= \frac{R}{r},$$

That is the result of the dynamic process is the equilibrium position where all of reserves are required reserves.

and it is the reserve deficit that result from clearing looks that force him to restrict his earning assets

As stated here the fundamental theorem says that the maximum volume of earning assets the banking system can acquire is independent of the action of households or business firms, what we call the public. However, the dynamic process shows that the amount of earning assets that a particular bank can acquire depends upon the deposits it receives; and hence on the behavior of households and firms. To each banker, it is the excess reserves generated by a net acquisition of deposits that enables him to expand his earning assets. Hence bankers compete for deposits, for only by getting deposits can he acquire earning assets, and the earning assets determine the income of the bank.

To a particular banker the receipt of a deposit means an equal addition to liabilities and to reserve money. Looking only at his own operations, it seems to him that the operation is equivalent to the depositors bringing him money for safekeeping, which he then figuratively speaking separates into two piles. One pile, equal to the reserve ratio times the deposit, he keeps on hand in order to meet the expected random, seasonal and cyclical clearing losses. The second pile he lends. To the banker it seems that he has been entrusted with money for safekeeping and investing and hence bankers will sometimes claim that they cannot create money. However the fact is that the depositor does not consider his money supply decreased when the banker lends the excess reserves he brought to the bank with his deposit, and the source of the bank's earning asset (the borrower or the seller of a security) knows he has an increased amount of money. Hence looking at the operation from the perspective of the depositors, even one bank's operation does increase the money supply.

A bank when it receives a net increase in its deposits and as a result receives excess reserves does not know or care whether this represents a net change in reserves available to all banks or only a shift of reserves from one bank to another.

As a result of the fundamental theorem of banking the total volume of earning assets the banking system can acquire changes with the volume of reserves and with the reserve ratio. Whatever operates to change these variables will change the loans and investments that banks can make, so Hence it is necessary to investigate how the volume of reserves and the reserve ratio is determined.

The reserves of the banking system consist of deposits on the books of the central bank. These deposits change either through the deposit or withdrawal of specie, an emission or influx of currency through the banking system or the acquisition of earning assets by the central bank. As far as the central bank is concerned the change in reserves due to a deposit or withdrawal of specie or the emission or influx of currency is not under its direct control whereas it can by its own action determine either the volume of and the terms upon which it will acquire earning assets. To control the lending and investing activity of the commercial banks the central bank can vary the volume of its earning assets.

In the absence of regulations or conventions the reserve ratio is determined by the banker's estimate of the reserves that he needs to meet his contractual obligations, e.g., that the banker pays his debts which arises when a depositor writes a check. To do this he has to keep reserves on hand, and he has to be able to replenish his reserves when the need arises. What he keeps in the way of reserves is not independent of the ease by which he can replenish his reserves. The ease by which he can replenish his reserve account depends upon the nature of the "money market" with which he has contact. This can be examined in detail by looking at the "money position desk" of a commercial bank.

B. Modifications

The proposition that the volume of loans and investments the banking system can make depends upon the reserves, and the reserve ratio requires modifications to take into account significant institutional attributes of banking systems that were ignored in deriving the theorems. First of all, each bank has a net worth, an owner's investment. This owner's investment finances not only the purchase of the facilities needed to do banking, the buildings, desks, machines, etc., it also finances the acquisition of earning assets. Even if bank's reserves, reserve ratio and depositis do not change, but the investment of the bank's owners increases, for example by bank's retaining earnings, the loans and investments of the banks grow. Such use of increased owner's investment in banks is equivalent to the bank operating as an "investment or lending trust" for its owners. This increase in loans and investments does not mean that the money supply has increased, and it represents an investment of some previously earned income.

The theorem holds with little modifications for the British Banking System. Banking in Britain is dominated by five large national branch banking systems. As a result each bank is large enough to invest huge sums in the money market. Unless there is a very short supply of securities that the bankers are willing to acquire relative to the deposit-creating ability of the banks, these banks will always be fully lent up. In addition as the banks are large national branch systems, there is no need for one bank to use the facilities of another bank for payments or investment purposes; there are no interbank balances. Also, each bank keeps approximately the same reserve/deposit ratio, and there are no differences in these ratios among banks. (There is some dispute as to whether liquid assets or reserve money is the effective determinant of the amount of deposits in British banks, but this need not concern us here).

On the other hand, the theorem requires considerable modification before it can be applied to the United States. In the United States there are approximately 13,500 commercial banks of which only some 6300 are members of the Federal Reserve System. Even though the Member Banks have more than 80% of the total deposits it does mean that the regulations governing reserves applicable to some 30 billions of deposits depend upon the laws of the various states. As a result of the existence of so many banks, some of them are small and of course some of the banks have offices all over the nation. The limit to branch banking is state-wide branch banking -- such as exists in Rhode Island and California -- and in a number of states only one-office unit banking is allowed; this is true in Illinois.

As a result of both the existence of very small banks and the limitation on the geographical dispersion of offices, banks require the services of other banks. This had led to the development of a network of correspondent relations among banks which results in banks keeping deposits in other banks. In June, 1958, something like 20% of the total deposits in the New York Banks were deposits of other domestic (U.S.) banks. Variations in the amount of interbank deposits affect the amount of loans and investments the banking system can acquire, although it does not affect the total amount of deposits (counting both the deposits of the public and interbank deposits). This can be shown by examining a "T" account in which the changes due to a withdrawal of an interbank deposit are exhibited. We assume a 20% reserve ratio in both

N.Y. Bank		"Other" Banks	
(1) -100 Reserves	- 100 Interbank Dep	(1) +100 Reserves -100 Dep in NY	
(2) -80 Earning Assets +80 Reserves		(2) -80 Reserves +80 Earning Assets	
(3) Balanced		(3) +20 Excess Reserve	

the "New York" and the "Other" bank. In Step 1 the changes which take place when the other bank withdraws its deposit of 100 from New York are shown. We assume that the New York bank balances its reserve position by selling 80 of earning assets and that the other bank buys these assets. However even after transferring 80 of beserves to New York the other bank has an excess reserve of 20. This excess reserve can lead to an expansion of 100 in the public's deposits and 80 in earning assets in the banking system. A decrease in correspondent balances, with an unchanged reserve and reserve ratio in the banking system can result in an increase in the lending and investing activity of the banking system. This is true because an interbank balance is a substitute for earning assets in the other bank and requires reserves in the New York bank.

In addition the American Banking System has the peculiarity that all member banks do not have the same reserve requirement, and the reserve requirement is not the same against demand and time deposits. Member banks are divided into three classes: Central Reserve City Banks (New York and Chicago banks), Reserve City Banks and Country Banks, and the required reserves against demand deposits are not the same for these classes of banks. At the end of 1958, the required reserve ratio was 18% in Central Reserve City banks, 16 1/2% in Reserve City banks and 11% in Country banks. Hence a shift of deposits from one class to another of commercial banks will affect the efficacy of reserves in supporting deposits. For example, a shift of 100 in deposits from a Central Reserve City bank to a Country bank at the end of 1958 would result in the appearance of $7 of excess reserves in the banking system.

In addition all member banks are required to keep only 5% in reserves against time deposits. Hence an increase in total deposits in commercial banks if it is the result of time deposits increasing while demand deposits are decreasing can result in the appearance of excess reserves in the banking system.

Correspondent relations among banks, differential ~~demand~~ reserve ~~banks~~ ratios and the effect of time deposits ~~as well as exceptions~~ as well as the effects of reserve ratios can all be considered as attributes of the system that absorb reserves. We can examine what effect the various absorption ratios have upon the volume of demand deposits and earning assets ~~of~~ of commercial banks.

Let us assume that r^* is the reserve ratio that is kept against time deposits in commercial banks and that there are λ in time deposits. We will have that

$$R = rD + r^*\lambda$$

so that

$$D = \frac{R - r^*\lambda}{r}.$$

With R unchanged it follows that

$$dD = -\frac{r^*}{r}\,d\lambda$$

i.e. a rise in time deposits will lower demand deposits ($r^* = 5\%$ and $r = 20\%$ then $dD/d\lambda = -1/4$). On the other hand the amount of earning assets the banking system can have is

$$L + I = D - rD + \lambda - r^*\lambda \quad \text{and as}$$

$$rD + r^*\lambda = R$$

$$L + I = D + \lambda - R$$

$$L+I = D - rD + \lambda - r^{*}\lambda$$

$$= (1-r)\left[\frac{R - r^{*}\lambda}{r}\right] + \lambda(1-r^{*})\frac{\lambda}{r}$$

$$L+I = \frac{(1-r)}{r}R + \frac{\lambda}{r}(r - r^{*}) ,$$

With R constant we have

$$d(L+I) = \frac{r - r^{*}}{r}\, d\lambda$$

so that a rise in time deposits will result in a rise in earning assets equal to $\frac{r-r^{*}}{r}$ the change in time deposits. If $r = 20\%$, $r^{*} = 5\%$ then $\frac{r-r^{*}}{r} = .75$: a $1 increase in time deposits in commercial banks will result in a 25¢ decrease in demand deposits and a 75¢ increase in earning assets. ~~If you look at the money supply such an change is~~