

VARIABILITY OF DEMAND DEPOSITS

Chakravarthi Rangarajan

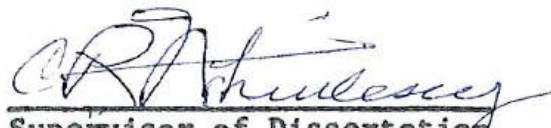
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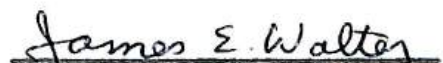
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PREFACE

Variability in demand deposits is examined in this study at two levels, first at the macro level of the banking system and second at the micro level of individual banks. The study focuses attention on three aspects of the problem, the seasonal element in deposit variation, the relationship between changes in demand deposits and changes in aggregate reserves and inter-bank differences in variability.

The hard core of this study lies in the analysis relating to the response of the banking system and of the individual banks included in the sample to changes in aggregate reserves initiated by monetary authorities. It is seen from this investigation that the response of the banking system to changes in unborrowed reserves is prompt and that it does not take more than a month and a half for the full effect of changes in reserves to be reflected in demand deposits, a finding that goes to strengthen the case for discretionary monetary policy.

Writing a preface is a pleasant task. Not because it is the last thing one has to do in relation to a dissertation but because it provides an opportunity to acknowledge publicly the author's indebtedness to others.

This study was done under the supervision of Professor C. R. Whittlesey. I owe him a deep debt of gratitude for the guidance, inspiration, and encouragement provided by him. If this dissertation possesses some clarity it is in no small measure due to his proddings.

I wish to acknowledge the assistance I have received in the course of the work from the Board of Governors of the Federal Reserve System, and

the Federal Reserve Banks of New York and Philadelphia. Special thanks are due to the Federal Reserve Bank of Philadelphia which provided data on 114 sample banks which constituted the basis of the study relating to individual banks.

Nearly all the computational work involved in the dissertation was done at the Computer Center of the University of Pennsylvania and I am thankful to the Center for the facilities provided by them.

I want to take this opportunity to thank the Goodyear International for their very generous Fellowship which enabled me to come to this country and do graduate work at this University for three years. A sentence or two does not fully express my sense of gratitude to them. Thanks are also due to the Institute of International Education which is in charge of administering the Fellowship.

This dissertation has greatly benefited by the discussions I have had on various points with Robert Shapiro, Roger Bird and C. S. Raman. I thank them all very sincerely, though none of them is in any way responsible for the errors that may be found in the thesis. Mr. Tirumalai of the English Department was patient enough to go over some parts of the dissertation and to suggest improvements in style.

During the course of the last one year when I have been continuously at work on my dissertation, I have received in an abundant measure the kindness and assistance of a large number of friends. I want to thank all and in particular Miss Eloise Wapner, Dick Gabler and Bob Parry.

The task of transforming a manuscript that was by no means legible fell to Mrs. Margaret Campbell and she did it smilingly.

After all these acknowledgements can one legitimately claim that he wrote the dissertation?

C. Rangarajan

CHAPTER I

FACTORS LEADING TO CHANGES IN DEPOSITS,

THE THEORETICAL FOUNDATIONS

In examining deposit variability, its nature and causes, the necessary point of departure must be a theoretical examination of the factors that determine the level of deposits at any given time. The subject of creation and destruction of deposits is not a new one; for half a century it has appeared and reappeared in the monetary and banking literature. The only justification for providing yet another exposition of the subject is that the development presented here, though proceeding along lines not unfamiliar, refines the assumptions underlying the process.¹

I Introduction

The level of bank deposits at any given time is the result of a multitude of decisions. But in the drama of deposit creation, it is easy to discern three principal characters. First, there are the monetary authorities whose influence is felt in two ways: their actions result in the creation and destruction of bank reserves, thereby affecting the base of deposit creation or destruction; and, by imposing a legal minimum of reserves against deposits, they limit the expansion or contraction of deposits on any given quantity of reserves. Next come the banks and the banking system. The banks' business consists of investing and lending and the

¹In the earlier part of the analysis the institutional framework of the U.S. has been primarily kept in mind.

banking system, by virtue of the swift and continuous flow of funds among banks, builds a volume of deposits that is a multiple of the change in reserves. Third, there is the general public which influences the volume of deposits in two ways: their needs and desires influence the lending policy of banks, and their preference between deposits and hand-to-hand currency affects the volume of bank reserves. To complete the dramatic personae, we must add two more characters, the Treasury and gold flows, both affecting the volume of bank reserves.

Looking at the problem from a functional standpoint, we may group the factors influencing the volume of bank deposits into those which affect the level of bank reserves and those which influence the multiplier effect.² Under the first category come the open market and discount operations of monetary authorities, the actions of the public in their choice between deposits and currency, the operations of the Treasury and, finally, the gold flows. Under the second category come the minimum reserve ratios imposed by monetary authorities and the propensity of commercial banks to lend and invest.

Among the factors that affect the level of bank reserves, it may be useful to distinguish between independent or market factors and policy decisions. Some of the factors that influence the volume of bank reserves are independent of the control of the monetary authorities; these are here referred to as market factors. They include Federal Reserve credit in the form of float, gold flows and, to some extent, changes in the Treasury balances with Federal Reserve banks. In contrast to these factors are the

²The term 'multiplier effect' refers to the process which makes the ultimate change in deposits a multiple of the initial change in reserves.

policy measures of the Federal Reserve undertaken deliberately to influence the volume of bank reserves.

The forces affecting bank reserves may be classified according to whether they are long-run forces or short-run and seasonal forces. Of course, the actions of monetary authorities are important in both short run and long run, as their policies are designed to meet both seasonal³ and long run requirements of the economy. But in the case of changes in gold stock, the long-run movements are more important than the month-to-month short-run movements, whereas in the case of Federal Reserve float or Treasury balances with Federal Reserve banks, the short run changes are much larger than long run changes.

Factors leading to changes in bank reserves have been examined at length in many places.⁴ It is not, therefore, proposed to go into a detailed account of these factors. A brief mention, however, of all of them may be in order.

The most significant factor influencing the level of bank reserves is the action of the monetary authorities. Whatever may be the ultimate objective of monetary policy, the Federal Reserve System seeks to achieve it primarily by influencing the quantity of money which, in turn, is accomplished by influencing bank reserves. Changes in bank reserves are introduced by monetary authorities through open market operations and through loans and discounts to member banks. An alteration of the reserve

³The seasonal factors account for a significant proportion of the changes in demand deposits and reserves. Chapter II is devoted to a detailed examination of the seasonal element in changes in demand deposits.

⁴For a very good account see Modern Monetary Mechanics, Federal Reserve Bank of Chicago.

requirements has a similar effect, though its influence is felt through the entire expansion process. An increase or decrease in the Federal Reserve float, which is technically an element in Federal Reserve credit has the same effect even though, as was pointed out earlier, this is not the result of a policy decision.

A few institutions besides commercial banks, like the Treasury, foreign central banks, and international institutions, maintain accounts with Federal Reserve banks. In general, when these balances rise, member bank reserves fall and when they fall, reserves rise. The most important non-member bank depositor is the Treasury and when funds are transferred to the Treasury's accounts in the Federal Reserve banks, the member bank reserves fall by the full amount.

The purchase of gold by the Treasury increases bank reserves and a sale decreases it. Mainly, sale of gold takes place at the initiative of foreign central banks and governments and is closely bound up with the balance of payments position.

The preferences of the public as between currency and demand deposits also affect the level of bank reserves.⁵ Should the public decide to

⁵Gambino, an Italian writer, charges English economists and particularly Keynes and Robertson with misunderstanding the role of the public in determining the volume of deposits. He cites in support of his contention the following passage from Robertson's Banking Policy and Price Level. "The public as a whole cannot directly determine the size of the aggregate of bank deposits which lies mainly at all events within the discretion of banks." Gambino's point is that the public can vary its relative demand for cash and thereby affect the base of deposit expansion. He writes: "The supply of deposits is determined also by the public as a whole acting as a 'creditor' of the banking system, as a 'lender' to the banks and not merely as 'borrowers' from the banks." Gambino, therefore, feels, that once bank deposits are included^{as} part of the money supply, to treat money supply as being determined exclusively by monetary authorities is open to question. Gambino has, however, overstated his case because a central bank has enough powers to keep the money stock at the level it desires. A. Gambino, "Money Supply and Interest Rate in Recent Macro-economic Conceptions," Banca Nazionale del Lavoro Quarterly Review, September, 1954, pp. 114-116. D. H. Robertson, Banking Policy and Price Level, London: P.S. King & Son, Ltd., 1932, p. 53.

reduce by a certain amount the currency they hold on hand, and transfer that amount to the banks, the bank reserves would be increased to that extent. On the other hand, an increase in the holding of currency will decrease bank reserves. The increase in currency which can occur only by conversion of bank deposits has the effect of reducing an earlier increase in reserves generated by monetary authorities. Also, this increase in currency, which is usually referred to as external drain, is at least partly a result of the increase in deposits. In what follows, the gross increase in bank reserves will be treated as the base and the cash drain as a proportion of deposits, and the minimum reserve ratios as limiting factors on the multiplier effect.

II The Process of Multiple Expansion of Deposits

Given the increase in bank reserves, how does the banking system build a volume of deposits which is a multiple of these reserves? It is this phenomenon which is usually described in banking literature as "creation" of credit or deposits. Whether or not banks can "create" credit was at one time a point of dispute among economists. In fact, much of the confusion on the subject arose out of the failure to make a distinction between the functioning of an individual bank and of the banking system. Thanks to the writings⁶ of Phillips, Crick and others, it is now a well-accepted doctrine that banks "are not merely traders in money but also in an important sense manufacturers of money."⁷

⁶C. A. Phillips, Bank Credit, New York: The Macmillan Company, 1921. W. F. Crick, "The Genesis of Bank Deposits," Economica, VII, 1927, pp.191-202; reprinted in Readings in Monetary Theory, pp. 51-53.

⁷R. S. Sayers, Modern Banking, Oxford: Oxford University Press, 1958, p. 1.

The essence of multiple expansion of deposits lies in the fact that the loans (or investments) made out of the excess reserves by a bank, except for a small leakage, gets credited either with the same bank or with other banks in the form of deposits and it is this continuing flow of funds from bank to bank that ultimately enables the system to support a volume of deposits that is a multiple of the bank reserves. The phenomenon of multiple expansion of deposits is not in any way dependent upon the minimum amount of reserves to be maintained by commercial banks. The minimum reserve ratio only sets a ceiling on the multiplier. While much of this is common knowledge⁸ now, the formulas that are introduced to explain deposit creation have been vague about the assumptions relating to cash drain. Mostly, the assumptions have not been brought out as explicitly as they need to be. The following sections, therefore, present a systematic formulation of deposit creation under varying assumptions.

A. The limits of expansion in the absence of external drain

The simplest of all formulas is the one which makes only the assumption that each bank has to maintain a ratio, "r", of deposits in the form of reserves. Under this scheme no part of the bank reserves at any stage escapes into hand-to-hand currency. The loan⁹ granted by a bank out of excess reserves is fully deposited with other banks. If there is an increase in bank reserves by ΔR , then under this system the total increase in deposits will be $\frac{\Delta R}{r}$. Bank No. 1, whose reserves initially go up by

⁸There seems to be some confusion still persisting in the minds of certain writers. See the Appendix to the chapter for a criticism of the stand taken by Gurley and Shaw.

⁹The analysis is not affected if the bank grants a loan or buys an investment.

ΔR (say, due to open market purchases by the central bank), maintains as reserves an amount equal to $\Delta R \cdot r$ and lends $\Delta R(1-r)$. All the amount that is lent goes to the other banks which maintain reserves equal to $\Delta R(1-r)r$ and lend in turn $\Delta R(1-r)(1-r)$. Thus the process goes on in an infinite series. The total increase in deposits under these conditions can be derived as the limit of a geometric series describing successive reactions of single banks to the continuous redistribution of surplus reserves. The increase in deposits (ΔD) can therefore be represented as follows:

$$\Delta D = \Delta R + \Delta R(1-r) + \Delta R(1-r)^2 + \dots + \Delta R(1-r)^{n-1}$$

since $0 < r < 1$, $\Delta D = \frac{\Delta R}{1-r} = \frac{\Delta R}{r}$, as n approaches ∞ . (1)

For the purpose of making the analysis clear, the simple assumption was made that all the loans granted by a bank reach other banks in the form of additional deposits. The possibility that a part of the loans granted by a bank may come back to the same bank in the form of additional deposits was ignored. The introduction of this assumption does not, however, affect the deposit multiplier for the banking system, even though it will affect the deposit expansion coefficient for each bank.

Let us make the Phillips assumption that a ratio, "k", of the loans granted by a bank remains with the bank in the form of deposits. Then the change in deposits for a single bank (ΔD_b) whose reserves initially changed by ΔR will be represented by the following series:

$$\Delta D_b = \Delta R + \Delta R(1-r)k + \Delta R(1-r)^2k^2 + \dots + \Delta R(1-r)^{n-1}k^{n-1},$$

since $0 < r$ or $k < 1$, this will be equal to

$$\Delta R \cdot \frac{1}{1-k+kr}, \text{ as } n \text{ approaches } \infty.$$

The deposit multiplier for each bank will be $\frac{1}{1-k+kr}$.¹⁰ Let us follow through the impact of this in the entire banking system.

The initial increase in reserves by ΔR will lead to an expansion of deposits in that bank, as we have noted just above, to the extent of $\Delta R \cdot \frac{1}{1-k+kr}$. Of this, $(1-r)(1-k)$ times will reach the second bank in the form of deposits. The total increase in deposits for the second bank will be $\frac{1}{1-k+kr}$ times what it receives and the total for the second bank will be

$$\Delta R_x \frac{(1-r)(1-k)}{(1-k+kr)} \cdot \frac{1}{1-k+kr}$$

Thus the increase in deposits for the banking system will be represented by the following series:

$$\begin{aligned} \Delta D &= \frac{\Delta R}{1-k+kr} + \Delta R \frac{(1-r)(1-k)}{(1-k+kr)^2} + \dots + \Delta R \frac{(1-r)^{n-1}(1-k)^{n-1}}{(1-k+kr)^n} \\ &= \frac{\Delta R}{1-k+kr} \times \frac{(1-k+kr)}{(1-k+kr) - (1-r)(1-k)} \\ &= \frac{\Delta R}{r}, \text{ where } r \text{ and } k < 1 \text{ and } n \rightarrow \infty. \end{aligned}$$

This is the same as the result obtained earlier without the assumption that a part of the loans granted by a bank comes back to the same bank in the form of deposits.

¹⁰ The monopoly bank situation is only a special case where $k=1$ and, therefore, the deposit multiplier is equal to $1/r$.

It is obvious that the new assumption has been introduced in a convenient and simple form. The deposits that come back to the same bank are treated as a proportion of the volume of loans granted by the bank. Angell and Ficek,¹¹ when they worked out their analysis, treated the volume of redeposits as being determined by the relative size of the expanding bank. More recently, Robert Emmer¹² classified the transactions of a bank as falling under four different categories and urged the need to build up "the balance of payments" of a bank by taking into consideration all the differing kinds of transactions. His argument primarily is that "this power to create credit depends primarily on the trading relations between the bank and its depositors and the rest of the world economy rather than primarily on the lending activity of the individual bank relative to that of other banks." All these refinements are useful to understand the behaviour of individual banks. But so long as these refinements do not affect the conversion of deposits into currency, for the banking system as a whole, the results will be just the same as under conditions where these refinements are not introduced.

One more point needs to be made before we introduce other assumptions. Several ways by which bank reserves can be increased were indicated earlier. Does the volume of deposits created differ according to the ways by which the increase in reserves occurs? Horwich¹³ made a study that was

¹¹James W. Angell and Karl F. Ficek, "The Expansion of Bank Credit," Journal of Political Economy, Vol. 41 (1933), pp. 1-32, 152-193.

¹²Emmer, "The Credit Expansion Equation of an Individual Bank," Journal of Finance, September, 1956, p. 332.

¹³George Horwich, "Elements of Timing and Response in the Balance Sheet of Banking," Journal of Finance, 1957, pp. 240-242.

concerned with the speed and magnitude by which "earning assets" reacted to changes in reserve holdings and introduced the concept of "effective reserves" with a view to converting different types of reserves with different capacities to be converted into earning assets to a common measure. He pointed out that an increment in reserves (ΔR) flowing to the banking system via primary deposits created by transfer of currency furnishes $\Delta R (1-r)$ in excess reserves for the purchase of earning assets. But an increment ΔR acquired by borrowing from the Federal Reserve is completely excess and fully spendable. Assuming no cash drain, the increase in earning assets for the banking system in the first case will be $\frac{\Delta R (1-r)}{r}$ and in the second case it will be $\frac{\Delta R}{r}$. To reduce both types of reserves into reserves of the same capacity, Horwich multiplied the reserves coming into banks by way of stock issues, earned surplus, and Federal Reserve borrowings by a factor $\frac{1}{1-r}$. This difference in capacity of bank reserves is valid only in relation to earning assets. The increase in deposits in both cases will be equal to $\frac{\Delta R}{r}$.

B. Cash drain as a limiting factor

Now we introduce an additional assumption that a part of the increased bank reserves leaves the banking system in the form of hand-to-hand currency. This escape in the form of currency is related to the increase in deposits, the former expressed as a proportion of the latter. The formula that is usually given to explain deposit creation with this added assumption is derived from a set of equilibrium conditions.¹⁴ The system is represented

¹⁴C. R. Whittlesey, et al., Money and Banking, Analysis and Policy, (New York: The Macmillan Company, 1963), p. 106.

as follows:

$$\begin{aligned} \Delta N &= n \cdot \Delta D & r &= \text{minimum reserve ratio} \\ \Delta R_b &= r \cdot \Delta D & N &= \text{currency in circulation} \\ \Delta N + \Delta R_b &= \Delta R & D &= \text{demand deposits} \\ \therefore \Delta D(n+r) &= \Delta R & R &= \text{total bank reserves} \\ \Delta D &= \frac{\Delta R}{n+r} & R_b &= \text{bank reserves which remain in the} \\ & & & \text{banking system} \\ & & n &= \text{the ratio between demand deposits} \\ & & & \text{and currency} \end{aligned}$$

The derivation of the formula along the lines indicated above has the advantage that the various coefficients can be estimated easily. But it suffers from two serious drawbacks. One, it does not make clear [as to] how the multiple expansion in deposits has been brought about. Second, it makes the general assumption that a certain proportion of the reserves escapes from the banking system but does not indicate at what stage or stages this leakage occurs. A more useful way would be to bring out clearly the dynamics of the multiple expansion process, indicating how the funds move and where the leakages can occur.

When the assumption of cash drain is introduced, it is useful to distinguish the drain that occurs out of primary from that which occurs out of derivative deposits. Bank deposits come into existence in two ways. In the first place, a bank creates them in favor of depositors for value received either in the form of cash or of checks drawn on other banks. These are referred to as 'primary deposits' or as Keynes called them¹⁵ "passively

¹⁵J. M. Keynes, Treatise on Money, Vol. I, (London: Macmillan & Co., 1958), p. 24.

created deposits." Secondly, deposits are created when a bank grants a loan (or buys an investment). Here the bank creates a claim against itself, i.e., a deposit in favor of a borrower on his promise to return the amount. Subsequently, These are referred to as 'derivative deposits' or as Keynes called them 'actively created deposits.' Each individual bank regards its actively created deposits as flowing out of its passively created deposits. But for the banking system as a whole, the passively created deposits are largely the result of actively created deposits. This is the crux of the multiple creation of deposits. Since the distinction between primary and derivative deposits is crucial to an understanding of the process of multiple expansion of deposits, clarity and consistency require that the distinction be maintained in the case of cash drain too.

Assume as before that the reserves of a bank are increased by ΔR and that the minimum reserve ratio is r . Then bank No. 1 lends $\Delta R(1-r)$. The amount of reserves that will be with bank No. 2 before it starts lending will be $\Delta R(1-r)$ less the amount of currency taken out by the borrowers of bank No. 1 which is here referred to as cash drain out of derivative deposits and the amount withdrawn in the form of currency by those who deposited their checks with bank No. 2 which is referred to as cash drain out of primary deposits. The chief advantage of introducing specifically the two possible sources of cash drain is that it establishes clearly the links in the chain of multiple expansion. This separation of cash drain does not imply subscribing to the view that has been put forward by some writers that the difference between 'primary' and 'derivative' deposits is the same

as the distinction between 'money reserves' and 'working capital.'¹⁶ From the point of view of business depositors particularly, the two types of deposits are indistinguishable and are treated by them in the same manner. A difference in the extent of cash drain between these two types may, however, arise because of the difference in the holders of these deposits. Since the derivative deposits are the result primarily of the lending operations, an overwhelmingly major portion of these deposits will be held by businesses while primary deposits will be held both by individuals and businesses. In any case, the need for separating the cash drain arises not out of motivation but from the necessity to spell out as clearly as possible the steps in the expansion process.

Cash drain out of primary deposits. Assume now that out of primary deposits a ratio e ,¹⁷ escapes in the form of hand-to-hand currency. The coefficient is assumed to be the same for all banks. Suppose the central bank purchases securities from a customer of a bank. As a result, the reserves of the bank as well as its deposits go up by ΔR . This is a primary deposit of

¹⁶ This distinction is made very specifically by Halm, but it really dates back to the writings of Phillips. Part of the confusion arises out of Phillips' definition of derivative deposit which is defined as "one which arises directly from a loan or which is accumulated by a borrower in anticipation of the repayment of a loan." This is very different from the definition given by Keynes or as it is normally understood. George Halm, Monetary Theory, (Philadelphia: The Blackiston Company, 1946), p. 46. Phillips, op. cit., p. 40.

¹⁷ e may be treated as the net cash drain. A part of the cash withdrawn by the primary deposits may come back to the banking system, being redeposited by some of those into whose hands the currency reached. e is, therefore, equal to the proportion of cash withdrawn, minus the proportion that came back to the banking system. The same meaning attaches to the definition of e , which is introduced under Section (2).

the bank. If a proportion, e' , of this escapes in the form of currency,¹⁸ the bank is left with $\Delta R (1-e')$, out of which it lends $\Delta R (1-e') (1-r)$. When this amount reaches the other banks these are primary deposits for other banks and what remains with the banks after the cash drain will be $\Delta R (1-e') (1-r)$. The increase in deposits can be represented by the series

$$\Delta D = \Delta R (1-e') + \Delta R (1-e')^2 (1-r) + \dots + \Delta R (1-e')^n (1-r)^{n-1}.$$

Since $(1-r)(1-e')$ is < 1 , this sum will be:

$$\frac{\Delta R (1-e')}{1-(1-r)(1-e')} = \frac{\Delta R (1-e')}{r+e'(1-r)} \text{ as } n \text{ approaches } \infty. \quad 2(1) (a)$$

The increase in currency in circulation (ΔN) that occurs in this process of expansion can also be calculated. It will be:¹⁹

$$\begin{aligned} \Delta N &= \Delta R e' + \Delta R (1-r)(1-e') e' + \dots + \Delta R (1-r)^{n-1} (1-e')^{n-1} e' \\ &= \frac{\Delta R e'}{1-(1-r)(1-e')} = \frac{\Delta R e'}{r+e'(1-r)} \text{ as } n \rightarrow \infty \quad 2(1) (b). \end{aligned}$$

The change in money supply (ΔM) as a consequence of a change in bank reserves can now be obtained by summing up the change in demand deposits and the change in currency. The increase in money supply will therefore be:

$$\begin{aligned} \Delta M &= \Delta D + \Delta N = \frac{\Delta R (1-e')}{r+e'(1-r)} + \frac{\Delta R e'}{r+e'(1-r)} \\ &= \frac{\Delta R}{r+e'(1-r)} \text{ as } n \rightarrow \infty \quad 2(1) (c). \end{aligned}$$

¹⁸It is inappropriate, however, to make this assumption if the initial primary deposit was created by the transfer of currency from the public to the bank. But the definition of e' rules out such a case. See previous footnote.

¹⁹The second term in the series is derived as follows: out of the increase in reserves, ΔR , e' of it leaked out in the form of currency. Bank No. 1 lent $\Delta R (1-e') (1-r)$. When this amount reached the second bank, e' of it leaked out in currency. Therefore, at the second stage, the leakage into currency is equal to $\Delta R (1-e') (1-r) e'$.

Cash drain out of derivative deposits. In the case of cash drain out of derivative deposits, Bank 1, whose reserves initially increased by ΔR can safely lend $(1-r) \Delta R$. The borrowers who make use of these loans withdraw " e "²⁰ times this in the form of currency and the deposits that reach the other bank will be $\Delta R (1-r) (1-e)$. The increase in deposits will be represented by the following series:

$$\begin{aligned}\Delta D &= \Delta R + \Delta R (1-r) (1-e) + \dots + \Delta R (1-r)^{n-1} (1-e)^{n-1} \\ &= \frac{\Delta R}{1-(1-r)(1-e)} = \frac{\Delta R}{r + e(1-r)} \text{ as } n \rightarrow \infty\end{aligned}\quad 2(2)(a)$$

²⁰The ratio " e " has been defined as the proportion of derivative deposits that leaks out of the banking system in the form of currency. Some writers while defining " e " in this particular way have also stated that " e " measures the preference of the community for currency out of the total money supply. For example, Erich Schneider defines this ratio "as the fraction of new credits which debtors withdraw in notes and which remains in the non-banking sector," and later, treats the same ratio as being $\Delta N / (\Delta N + \Delta D)$, ΔN representing the increase in currency and ΔD the increase in deposits.

Erich Schneider is correct within the framework of his analysis which starts with an initial increase in excess reserves, in which case the increase in money supply is equal to the increase in new credits. (An implicit assumption here is that there is no drain out of primary deposits.) If the initial increase in reserves was matched by an increase in deposits, against which reserves have to be maintained, the increase in new credit will be less than the increase in money supply. In the latter case, the ratio of cash drain to new credits will be larger than the ratio of currency to total money supply, since

$$e = \frac{e(1-r)}{1 + e(1-r)} \quad \text{and as} \quad \frac{(1-r)}{1 + e(1-r)} < 1,$$

where e = ratio of cash drain to new credits, and
 e = ratio of currency to total money supply.

Erich Schneider, Money, Income and Employment, (London: George Allen and Unwin Ltd., 1962), pp. 47-48.

The increase in currency in this case will be:

$$\begin{aligned}\Delta N &= \Delta R (1-r) e + \Delta R (1-r) (1-e) e + \dots + \Delta R (1-r)^n (1-e)^{n-1} e \\ &= \frac{\Delta R (1-r) e}{1-(1-r)(1-e)} \\ &= \frac{\Delta R (1-r) e}{r + e(1-r)} \quad \text{as } n \rightarrow \infty \quad 2(2)(b)\end{aligned}$$

The increase in money supply will be:

$$\begin{aligned}\Delta M &= \Delta D + \Delta N = \frac{\Delta R}{r + e(1-r)} + \frac{\Delta R e (1-r)}{r + e(1-r)} \\ &= \Delta R \frac{1 + e(1-r)}{r + e(1-r)} \quad \text{as } n \rightarrow \infty \quad 2(2)(c)\end{aligned}$$

Cash drain out of primary and derivative deposits. Case 2 (1) made the assumption that there was external drain out of primary deposits and case 2 (2) made the assumption that there was external drain out of derivative deposits. Now changes in deposits and in currency in circulation may be calculated with both types of drains introduced. The assumptions, therefore, are (a) a minimum reserve ratio, "r", and (b) a proportion, "e" which escapes out of increased primary deposits in the form of currency and a proportion "e'" which escapes out of increased derivative deposits in currency. Then the increase in deposits will be represented by the following geometric series:

$$\begin{aligned}\Delta D &= \Delta R(1-e') + \Delta R(1-e')^2(1-r)(1-e) + \dots + \Delta R(1-e')^n(1-r)^{n-1}(1-e)^{n-1} \\ &= \frac{\Delta R (1-e')}{1-(1-r)(1-e)(1-e')} \cdot 21 \quad \text{as } n \rightarrow \infty \quad 3(1)(a)\end{aligned}$$

²¹The cash drain that occurs between any two stages in the multiplier process has been treated as occurring partly out of derivative deposits and partly out of primary deposits. If one were to ignore this distinction, the amount of deposits at any stage will be $(1-r)(1-e_t)$ of what it was at the previous stage. "e_t" is the total cash drain that occurs between two stages expressed as a proportion of $(1-r)$ times the previous level of deposits. This means that "e_t" will be equal to $(e + e' - ee')$.

The increase in currency will be:

$$\begin{aligned}\Delta N &= \Delta Re' + \Delta R(1-e')(1-r)e + \Delta Re'(1-e')(1-r)(1-e) \\ &\quad + \Delta Re(1-e')^2(1-r)^2(1-e) + \dots \\ &= \frac{\Delta Re' + \Delta Re(1-e')(1-r)e}{1 - (1-r)(1-e)(1-e')} \quad 3(1)(b)\end{aligned}$$

The increase in money supply will be:

$$\Delta D + \Delta N = \frac{\Delta R(1-e') + e' + e(1-e')(1-r)}{1 - (1-r)(1-e)(1-e')} \quad 3(1)(c)$$

C. Leakage into time deposits

It was assumed so far that there was only one kind of deposit, namely demand deposits, and that reserves were to be maintained by banks against these deposits only. Now an additional element is introduced that bank reserves support both time and demand deposits and that the minimum reserve ratios to be maintained against these two kinds of deposits are different. What this means in effect is that, just like cash drain, a part of the change in bank reserves leaks out to be kept in the form of time deposits. But, unlike the case of cash, these reserves are only "ploughed back" into the banking system in the form of a different type of deposit. Thus these reserves are not a loss to the banking system.

While the results under this new system can be studied along the dynamic process multiplier analysis followed earlier, the analysis becomes cumbersome because of the number of feedbacks at each stage. What happens can be pictured from the following set of equilibrium conditions:

ΔN	$= m \cdot \Delta M$	DD = demand deposits
ΔR_b	$= r_1 \Delta DD + r_2 \Delta TD$	TD = time deposits
ΔTD_b	$= t \cdot \Delta DD$	r_1 = minimum reserve ratio against DD
$\Delta N + \Delta R_b$	$= \Delta R$	r_2 = minimum reserve ratio against TD
$\Delta N + \Delta DD_b$	$= \Delta M$	M = money supply
		m = ratio of total money supply held in the form of currency
		t = ratio between time deposits and demand deposits

Under these conditions:

$$\Delta DD = \frac{\Delta R (1-m)}{r_1 + m (1-r_1) + r_2 t (1-m)}$$

$$\Delta TD = \Delta R \cdot \frac{(1-m) t}{r + m (1-r_1) + r_2 t (1-m)}$$

and

$$\Delta N = \Delta R \cdot \frac{m}{r + m(1-r_1) + r_2 t (1-m)}$$

Postulating different ratios of cash drain out of demand deposits and time deposits, Equation 1 above can be replaced by the following:

$$\Delta N = m_1 \Delta DD + m_2 \Delta TD.$$

With this substitution,

$$\Delta DD = \Delta R \cdot \frac{1}{(r_1 + m_1) + t(r_2 + m_2)}$$

$$\Delta TD = \Delta R \cdot \frac{t}{(r_1 + m_1) + t(r_2 + m_2)}$$

and

$$\Delta N = \Delta R \cdot \frac{m_1 + m_2 t}{(r_1 + m_1) + t(r_2 + m_2)}$$

A leakage in the form of time deposits leads to a reduction in the total demand deposits, but an increase in earning assets. In the absence of leakage in time deposits, the total increase in demand deposits will be equal to $\frac{\Delta R}{r_1 + m_1}$, which is greater than $\frac{\Delta R}{(r_1 + m_1) + t(r_2 + m_2)}$. Given a leakage in time deposits, the increase in earning assets will be the sum of the increase in demand deposits and time deposits minus the minimum

reserves to be kept against them. In this present example, the total increase in earning assets will be

$$\Delta R \left[\frac{(1-r_1) + t(1-r_2)}{(r_1+m_1) + t(r_2+m_2)} \right].$$

With no leakage in time deposits, the increase in earning assets will be

$$\Delta R \frac{(1-r_1)}{r_1+m_1} \text{ so long as } r_1 > r_2 \text{ and } m_1 > m_2, \text{ it can be shown that the}$$

first expression is greater than the second.²²

D. Time element in the expansion process

It is important to note that after the credit expansion process has been completed, the increase in deposits will be equal to $\frac{1}{r}$ times the net reserves. The net reserves are equal to the initial change in reserves minus the change in currency in circulation. Symbolically, the change in net reserves, ΔR_b , will be equal to $\Delta R - \Delta N$. For example, under case 2 (2), the change in deposits can also be represented as:

$$\begin{aligned} & \left[\Delta R - \frac{\Delta R e(1-r)}{r + e(1-r)} \right] \times \frac{1}{r} \\ &= \Delta R \frac{r + e(1-r) - e(1-r)}{r + e(1-r)} \times \frac{1}{r} \\ &= \frac{\Delta R}{r + e(1-r)}. \end{aligned}$$

²²In order to show this, it is necessary to prove that
 $[(1-r_1) + t(1-r_2)] [r_1+m_1] > [1-r_1] [(r_1+m_1) + t(r_2+m_2)]$, i.e.,
 $(r_1+m_1)(1-r_2) > (1-r_1)(r_2+m_2)$. This is true since
 $(r_1+m_1) > (r_2+m_2)$ and $(1-r_2) > (1-r_1)$.

That the change in deposits will be equal to $\frac{\Delta R_b}{r}$ is a meaningful statement,²³ though it sheds no light on the process that leads to such an equilibrium situation.

The way in which the deposit multiplier works can be elucidated by a comparison with the working of the investment multiplier. In analysing the investment — income relationship, Hansen²⁴ drew attention to three kinds of multipliers. The first relates to the moving equilibrium or the "logical theory of the multiplier which holds good continuously without time lag." The second is the period analysis which primarily involves a consumption-expenditure lag. The third is the comparative statics multiplier which is 'timeless' in the sense that it leaps over the time interval between two successive equilibrium positions. The really interesting case is the second one and in explaining the lag in the multiplier process, Hansen showed how the marginal propensity to consume may deviate from the normal propensity to consume during the interval the multiplier process is working. Step by step, $\frac{\Delta C}{\Delta Y}$ approaches at the limit the normal marginal propensity to consume. This is true of the deposit multiplier too. For the multiplier process to be completed, it takes time. While no bank normally wants to hold excess reserves, a lag is involved because of the time it takes for the reserves to be spread over the banking system. During this interval, $\frac{\Delta D}{\Delta R_b}$ increases steadily from one period to another until it reaches at the limit to a figure equal to $\frac{1}{r}$. Suppose

²³It is this relationship which is being empirically verified in Chapter III.

²⁴A. H. Hansen, A Guide to Keynes, (New York: McGraw-Hill Book Company, 1953), p. 108.

there is an increase in bank reserves of \$1,000 and assume $r = 0.2$ and $e = 0.05$ [Case 2(2)]. The first bank lends $\$(1000 \times 0.8)$ and when it reaches the second bank, it is equal to $\$(1000 \times 0.8 \times 0.95)$, i.e., 760. At this point, the total increase in deposits is \$1,760 and the net reserves are \$960 and the multiplier is $\frac{1760}{960} = 1.8$. But this figure steadily increases until it becomes 5 at the equilibrium level.²⁵

The "logical theory" of the investment-income multiplier is based on the assumption that a change in aggregate investment has been foreseen sufficiently in advance for the consumption industries to advance *pari passu* with capital goods industries. In effect, the logical multiplier holds good continuously at all points in time. It is futile to think in terms of a logical deposit multiplier. A time lag is inherent in the process.²⁶ The formulas so far developed explain the process of change from one position to another. They show how the multiplier changes during the period of transition. Once the lag is overcome, deposits and reserves are at the desired ratio.

E. Effect of changes in the governing ratios

The purpose of developing these formulas is to bring out clearly (a) the process of multiple expansion, and (b) to emphasize the stages at which the cash drains may occur. By showing the increase in deposits as the sum of a geometric series, we have attempted to fulfill these purposes. If the functions are assumed to be continuous, the deposit expansion function can be differentiated with respect to the different variables, to show the

²⁵It is obvious why this should be so. At each successive stage, ΔD increases while ΔR decreases. With the numerator rising and the denominator falling, the ratio increases from one period to another.

²⁶This is discussed in detail in Chapter III.

CHART I

CHANGES IN THE VALUES OF DEPOSIT MULTIPLIER

$$K = \frac{1}{\eta + e(1-\eta)}$$

VALUES
OF
K

VALUES OF η

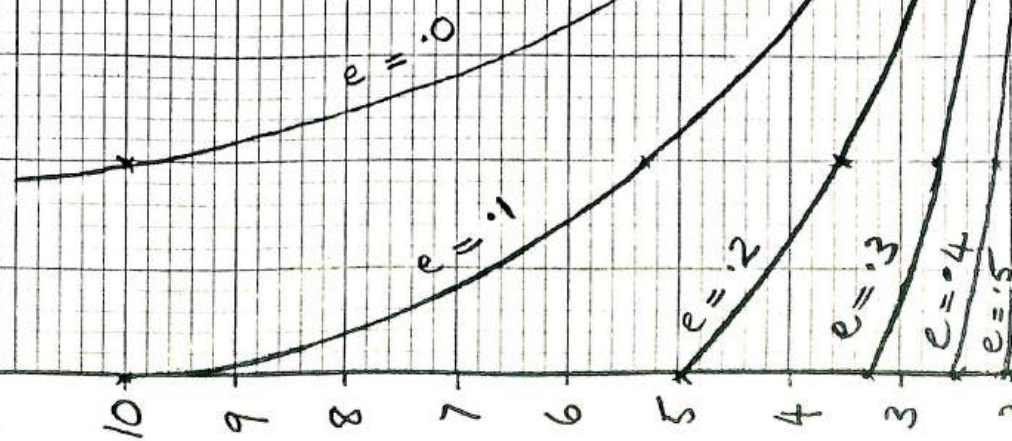
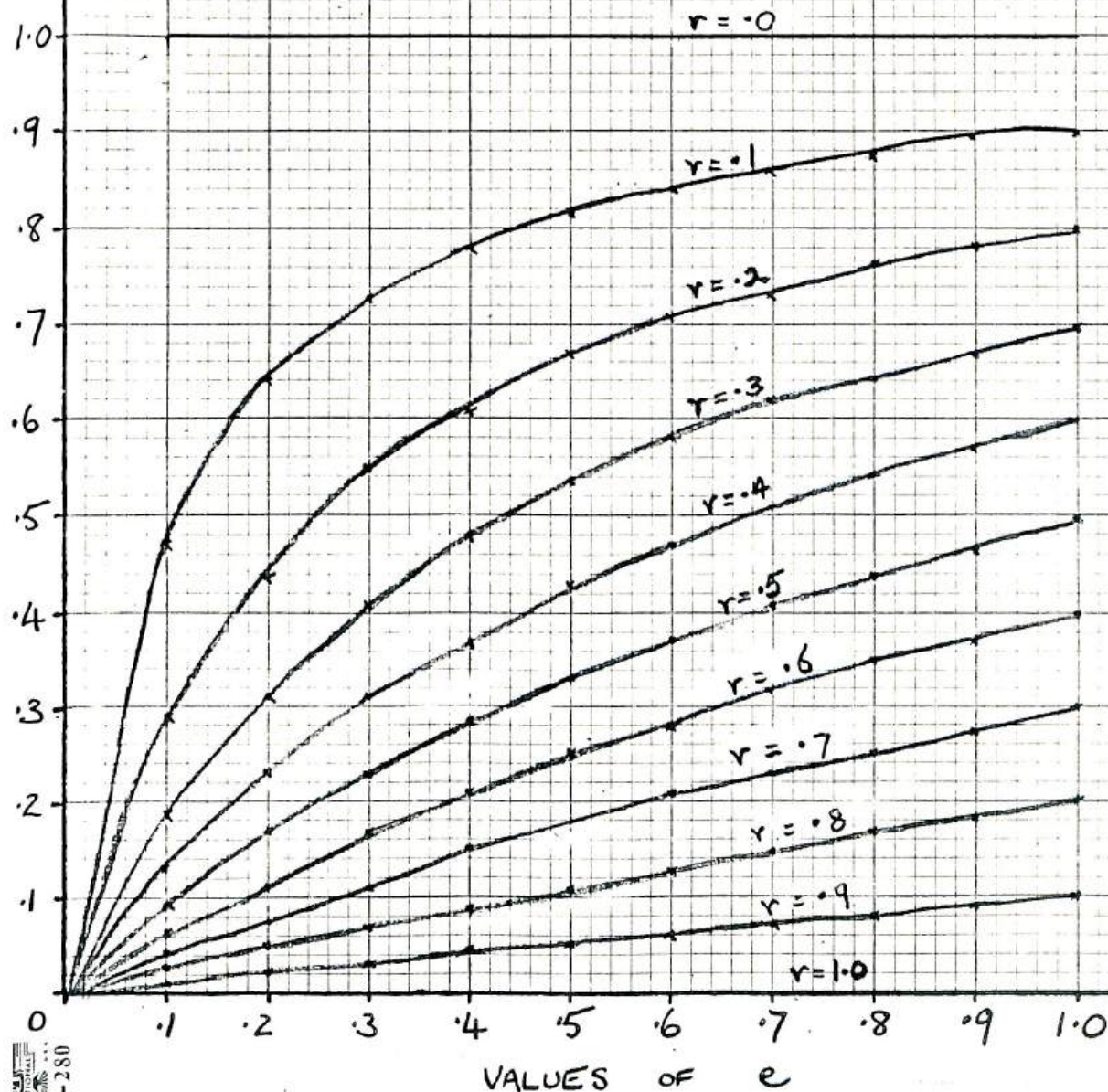


CHART III

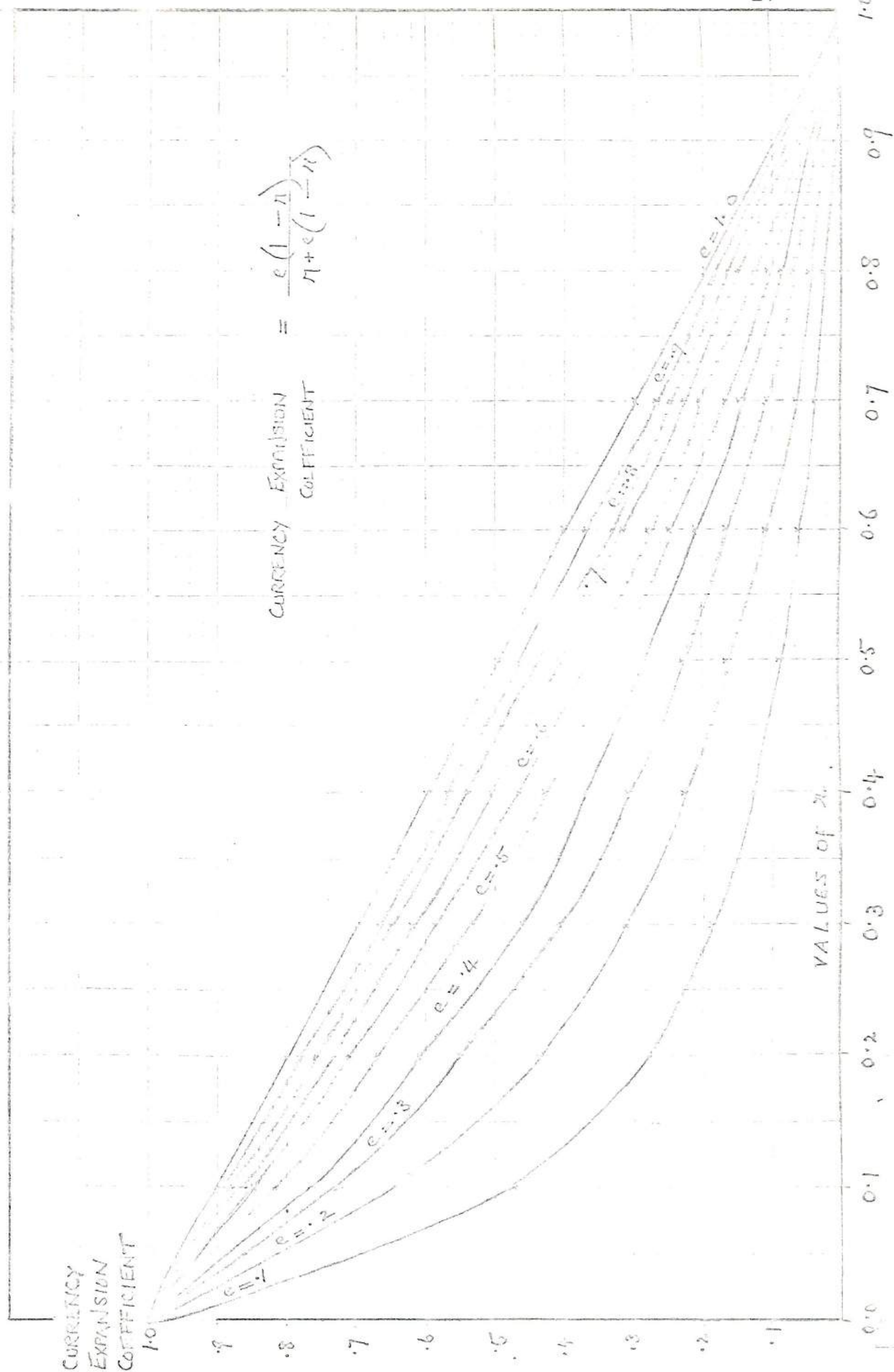
CHANGES IN CURRENCY EXPANSION COEFFICIENT A.

CURRENCY
EXPANSION
COEFFICIENT

$$\Delta N = \frac{e(1-\pi)}{\pi + e(1-\pi)}$$



CHANGES IN CURRENCY EXPANSION COEFFICIENT B.



effects of instantaneous changes in these ratios. However, as the values of the various ratios are likely to vary by discrete steps rather than continuously, the following graphical presentation is offered to afford some idea of the effect of changes in these ratios on deposit expansion.

To give a graphical presentation of the expansion process, Case 2(2) is taken. The assumptions in this case are that: (a) banks have to maintain a ratio, "r", of deposits in the form of reserves, and (b) a ratio, "e", of derivative deposits leaks out of the system in currency. Under these assumptions, the deposit multiplier is $\frac{1}{r + e(1-r)}$, and the currency expansion coefficient is $\frac{e(1-r)}{r + e(1-r)}$. Chart I gives the values of the deposit multiplier for different values of e and r. The horizontal axis in Chart I represents the values of r and the vertical axis the deposit multiplier. Each curve represents a particular value of e.²⁷ It is clear from the graph that for a given r, the multiplier decreases with an increase in e, and for a given e, the multiplier decreases with an increase in r. If either e or r is equal to 1, the multiplier will be equal to 1.

In Chart II, the horizontal axis represents r and the vertical the currency expansion coefficient. Each curve represents a different value of e. It is obvious that the highest value of the currency expansion coefficient is 1. So long as r = 0, the currency expansion coefficient is equal to 1 whatever the value of e (except, of course, when e = 0, for 0/0 is indeterminate). If r = 1, the currency multiplier is 0. Chart III differs from Chart II in that the horizontal axis represents e and each

27. It may be noted that the chart will not look different if the horizontal axis represents e. Then, of course, each curve will represent a particular value of r. This is so because $r + e(1-r) = e + r(1-e)$. See, for a similar graphical presentation, Erich Schneider, "The Determinants of the Commercial Banks' Credit Potential in a Mixed Money System," BNL Quarterly Review, September, 1955, pp. 126-127.

curve a particular value of r . The currency coefficient increases as the value of " e " increases for any given value of r . Of course, the currency coefficient is 0 when $e = 0$, which only means that there is no drain of cash.

III Actual as Contrasted with Potential Multipliers

One more element needs to be introduced in the examination of deposit multipliers. The multipliers so far discussed explain the maximum amount of deposits the banking system can build up, given the assumptions. These are, in essence, potential and not actual multipliers. Even the idea of a potential multiplier is useful because it helps to explain the working of the banking system. But if the analysis stops there, little is gained in the way of understanding the actual behaviour of banks. In order to know what is really happening in the system, one should know how the system functions and how individual banks behave, that is, it is necessary to go from a potential to an actual multiplier.

A. Precautionary reserves

The concept of actual multiplier brings into focus the existence of excess reserves. "Excess reserves" are defined as the total reserves less the amount required to be maintained as the legal minimum against deposits. In the analysis so far, it is assumed that the entire excess reserves are available to the bank for the purpose of expanding earning assets. This is not a valid assumption.

Banks hold, in addition to the legal minimum, some reserves which may be described as precautionary reserves.²⁸ These are reserves held as

²⁸For an emphasis on the maintenance of precautionary reserves, see Allen H. Meltzer, "The Behaviour of the French Money Supply, 1938-54," Journal of Political Economy, June, 1959, p. 280.

protection against probable net drain, both internal and external. The net drain in reserves faced by each bank is the difference between the outflow and inflow of reserves during a given period. Given the distribution of deposits between time and demand, the amount of precautionary reserves held by each bank is based on a probability distribution (most often implicit) of expected drain.²⁹ This probability of distribution will differ from bank to bank depending on factors such as the banks' location, its size, and the composition of depositors.

The amount of precautionary reserves held by a bank will again depend upon its access to short-term borrowings, the composition of its assets and its aversion to risk. A bank with a high component of short-term assets may carry less precautionary reserves because of its ability to convert its very liquid assets into reserves. This is also true of banks with access to the Federal funds market. Finally, a bank's attitude to risk bearing governs the amount of precautionary balances to be held. More adventurous banks may hold less balances and be willing to bear the cost of cash drain

²⁹At least on an analytical level, the implications of the different types of probability distributions of cash drain have been examined. Based upon a "loss function" that is normal, Daniel Orr and W. G. Mellon worked out the conditions for an optimal lending policy for a bank. Richard Porter's analysis of bank portfolio selection is based upon a distribution function relating each of the various "deposit-losses" during the ensuing period to the probability of its occurrence. He assumes in the main a "triangular distribution" because it is believed to be the best simple approximation to the actual distribution of banks. James Pierce builds his analysis on the assumption that the deposit level of each depositor at the end of the period is a random, lognormally distributed variable. Both Porter and Pierce are concerned with the distribution of deposit levels but such a distribution has immediate relevance to the holding of precautionary balances. Daniel Orr and W. G. Mellon, "Stochastic Reserve Losses and Expansion of Bank Credit," *AER*, September, 1961; Richard C. Porter, "A Model of Bank Portfolio Selection," Cowles Foundation Paper, No. 168, 1962; James L. Pierce, "The Monetary Mechanism: Some Partial Relationships," Cowles Foundation Discussion Paper (mimeo.).

if it occurs. Abstracting from seasonal and other systematic influences, banks normally decide their precautionary balances on the basis of their past experience.

The need to hold precautionary balances over and above the minimum reserves stems from the fact that the latter are in effect frozen. But as the minimum reserve requirement is to be met only on the average over the reporting period, there is a certain amount of flexibility in the day-to-day management of precautionary balances.

B. Propensity to lend and invest

The total reserves available to the banker for being converted into earning assets will, then, be equal to total reserves less the required and precautionary reserves. Of these available reserves, a bank may like to utilize part or the whole of it, depending chiefly on the level and expectation of interest rates. Thus it is necessary to introduce the additional factor that a bank at any given time has a particular marginal propensity to lend and invest out of available resources. Then the unutilized part of the available reserves is a residual left after the banks have lent and invested to the desired level set by this marginal propensity.

Alternatively, the bank may be looked upon as determining the excess reserves it desires to hold and of utilizing the balance of the total reserves in converting into earning assets. This approach focuses

directly on the liquidity requirements of commercial banks.³⁰

While admitting the possibility that the marginal propensity to lend and invest out of available resources may be < 1 , some may question if it is in accord with facts. The experience of the 1930's may be regarded as exceptional. Karl Brunner regards the existence of "desired excess reserves" as unlikely because of the market in government securities in which banks operate competitively with other economic units. The presence of such surplus reserves, according to him, is possible only if there is "some arrangement to prevent banks from competing for assets by

³⁰Sidney Weintraub referred to the omission of commercial banks "own demand" for liquidity as one of the shortcomings of the usual presentation of the liquidity preference theory of interest. He wrote, "commercial bank motives for liquidity as exemplified in vault cash and excess reserves ought not to be put on a plane different from the self-same urges of non-bank institutions." An Approach to the Theory of Income Distribution, p. 163.

Karl Brunner made a distinction between "available reserves", v , and surplus reserves, s . The variable " v " is the difference between a bank's total cash assets and its required reserves. The magnitude " s " is defined in terms of " v " and a bank's desired amount of reserves or cash assets " v^d ".

$$v^d = w_0 + w_1 d_1 + w_2 d_2$$

$$w_0 = w_0(r, b, a),$$

where d_1 are demand deposits, d_2 are time deposits, w_1 and w_2 are the marginal propensities to hold cash assets with respect to d_1 and d_2 , respectively. " r " is an index function of loan rates and bond yields, b is the amount borrowed by the bank from the central bank and a is a loan-investment ratio in the bank's portfolio. The surplus reserves can now be defined as:

$$s = v - v^d,$$

and it is this surplus reserve banks desire to eliminate through asset expansion or to acquire via asset contraction. See Karl Brunner, "A Scheme for the Supply Theory of Money", International Economic Review, Vol. II, No. 1 (January 1961).

appropriate adjustments in pertinent prices." But this argument overlooks the fact that banks may think in terms of capital losses.³¹ As Edward Shaw pointed out,

The fixed price asset (reserves) may be preferable to the variable price asset (securities) because the prospects of loss on earning assets may outweigh the prospects of profit.³²

The amount of desired excess reserves would, therefore, depend on the level of interest rate and the expectations thereof. In addition, there is also the transaction cost in investing in short bills. Hicks pointed out:

To convert this money into bills requires a separate transaction and the trouble of making that transaction may offset the gain in interest . . . There is no reason to suppose that the cost of such investment will be the same to different lenders.³³

While this transaction cost may be so negligible as to be ignored by big banks, it may be an element in the decisions of small banks to hold excess reserves. However, even on the basis of these arguments, it becomes obvious that the holding of desired excess reserves will be sensitive to changes in the interest rates only within a short range.³⁴

³¹The argument of capital loss has one limitation; it does not apply to lending in the Federal funds market. It may, however, be pointed out that the argument still applies to a majority of banks since only a small number of banks operate in the Federal funds market.

³²Edward S. Shaw, Money, Income, and Monetary Policy, (Chicago: Richard D. Irwin, Inc., 1950), p. 132.

³³J. R. Hicks, Value and Capital, (Oxford: Oxford University Press, 1946), pp. 164-165.

³⁴While these economic arguments may provide the rationale for holding excess reserves, one factor contributing to the presence of excess reserves may be the inertia of banks. Country banks tend to hold a fairly substantial amount of excess reserves most of the time while Reserve city banks hold a relatively small amount of excess reserves. This difference in behaviour between the two classes of banks cannot be wholly explained in terms of economic arguments.

Given the amount of available reserves, it may be assumed that all of it will be converted into earning assets above a particular level of interest rates and all of it will be kept as excess reserves below a particular level. Between these two limits, there is a range in which the holding of excess reserves may be sensitive to changes in interest rates.³⁵

Taking Case 2 (2), analysed earlier, the additional assumption may be introduced that the marginal propensity to lend and invest out of available reserves (available reserves here refer to the total reserves less the required reserves -- we are ignoring precautionary reserves in this example) is ℓ , with $\ell \leq 1$. Then the increase in deposits will be the limit of the following series:

$$\begin{aligned} \Delta D &= \Delta R + \Delta R(1-r) \ell (1-e) + \Delta R(1-r)^2 \ell^2 (1-e)^2 + \dots \\ &\quad + \Delta R(1-r)^{n-1} \ell^{n-1} (1-e)^{n-1} \\ &= \Delta R \cdot \frac{1}{1 - \ell(1-r)(1-e)} \end{aligned}$$

Case 2 (2) is a special case of the above system where $\ell = 1$.

³⁵ Stressing more or less the argument that has been advanced here, Tobin writes: "The redundant reserves of the Thirties are a dramatic reminder that economic opportunities sometimes prevail over reserve calculations. But the significance of that experience is not correctly appreciated if it is regarded simply as an aberration from a normal state of affairs in which banks are fully 'loaned up' and total deposits are tightly linked to the volume of reserves. The Thirties exemplify in extreme form a phenomenon which is always in some degree present; The use to which commercial banks put the reserves made available to the system is an economic variable depending on lending opportunities and interest rates." James Tobin, "Commercial Banks as Creators of 'Money'," Cowles Foundation Discussion Paper, No. 159, (mimeo.), p. 13.

There is also a possibility that a bank may not be able to convert into earning assets all the reserves it desires to convert. This possibility again may arise more in the case of country banks far removed from the financial centers than in the case of city banks. The total amount of bank reserves (R_T) at any given time may be decomposed into four parts. The first part is the legal reserves to be maintained against deposits (R_L). The second part consists of protective reserves maintained by banks to safeguard themselves against possible cash drain (R_p). The third part consists of the desired excess reserves (R_d), and the fourth part is the undesired excess reserves (R_{ud}), i.e., reserves that remain with the banks because of the lag involved in the conversion of reserves into loans and investments. Symbolically,

$$R_T = R_L + R_p + R_d + R_{ud}.$$

If the expansion process has worked itself to the full, i.e., if the new equilibrium consistent with the desired deposit-reserve ratio has been attained, then $R_{ud} = 0$.

C. Conclusion

The analysis presented above brings together the factors that have a bearing on the determination of deposits. It explains the nature of the decisions involved and also the process of creation and destruction of deposits. As pointed out at the outset, the level of deposits at any given time is the result of a multitude of decisions. However, on occasion some writers have emphasized one factor to the exclusion of others. For example, Crick³⁶ concludes his well-known article on the genesis of bank deposits

³⁶ Crick, op. cit., p. 53.

as follows:

Summing up then it is clear -- or at least we must hope so -- that the banks, so long as they maintain steady ratios of cash to deposits are merely passive agents of Bank of England as far as the volume of money in the form of credit is concerned. The proviso being substantially true, so therefore is the principal statement.

To assume that banks maintain absolutely steady ratios of cash to deposits is to ignore the fluctuations in desired excess reserves. As has been already noted, though the increase in reserves together with the minimum reserve ratio may set the ceiling on expansion of deposits, the actual expansion is determined actively by the lending and investing policies of the banks. R. S. Sayers³⁷ presented an exhaustive list of factors that influence the volume of deposits, though he did not integrate them into a model.

The analysis presented so far is best summarized in the form of the following set of equilibrium conditions. Most of these equations have already been explained. The additional symbols used refer to:

- G = the stock of gold held by the Treasury,
- T_B = Treasury balances with the Federal Reserve,
- Q = central bank credit,
- P_r = proportion of demand deposits held as precautionary reserves,
- P_2 = proportion of time deposits held as precautionary reserves,
- v = the marginal propensity to lend and invest out of increased reserves.

³⁷R. S. Sayers, "The Determination of the Volume of Bank Deposits in England," BNL Quarterly Review, December, 1955.

$$\Delta R = \Delta G - \Delta T_B + \Delta Q \quad (1)$$

$$\Delta R = \Delta N + \Delta R_b \quad (2)$$

$$\Delta R_b = \frac{(r_1 + P_1)}{v} \cdot \Delta DD + \frac{(r_2 + P_2)}{v} \cdot \Delta TD \quad (3)$$

$$\Delta TD = t \cdot \Delta DD \quad (4)$$

$$\Delta N = n_1 \Delta DD + n_2 \Delta TD \quad (5)$$

$$\Delta M = \Delta DD + \Delta N \quad (6)$$

Equation 1 states that the changes in bank reserves are brought about by changes in gold stock or in Treasury balances with the Federal Reserve or by central bank credit to banks. Equation 3 implies that banks maintain against demand and time deposits protective reserves in addition to the legal minimum of reserves. Also, their marginal propensity to lend and invest out of reserves is v , where v is < 1 . Under these conditions, the increase in demand deposits will be:

$$\Delta DD = \frac{(\Delta G + \Delta T_B + \Delta Q) v}{vn_1 + vn_2 t + r_1 + P_1 + r_2 t + P_2 t}.$$

It is necessary to note what this analysis has not probed into. The factors that go to determine the ratios e , e' , P_1 etc., have not been explored. But, given the ratios, it has been possible to show through a set of equilibrium conditions how money supply and more particularly demand deposits will change in response to changes in reserves.

APPENDIX TO CHAPTER I

A CRITIQUE ON THE GURLEY-SHAW THESIS*

As late as the early Twenties of this century, Edwin Cannan and other economists were denying with great vehemence the capacity of banks to create credit. The well-known "cloak room analogy"¹ was considered to be a sufficient defense of their position. The pendulum now seems to have swung to the opposite extreme. We find Professors Gurley and Shaw claiming that every financial institution "creates" its own "unique form of debt" and that multiple expansion is a phenomenon common to all financial institutions. For example, Gurley writes:

We conclude therefore, that there is multiple creation in the general sense everywhere. This is simply a way of saying that it generally takes more than one ingredient to make a cake, the value of the cake being a multiple of the value of any one of the ingredients.²

The "cloak room analogy" has given place to the "pancake analogy." But at least part of the fallacy is still the same -- the failure to make a distinction between the individual bank and the banking system.

Gurley and Shaw start off by emphasizing the right point. It is perfectly true that whenever anyone or any institution purchases money

*This is an abridged version of a paper jointly written by Robert Shapiro and the author.

¹Edwin Cannan, "The Meaning of Bank Deposits," Economica, I (1921), pp. 28-36.

²John G. Gurley, "Financial Institutions in the Saving-Investment Process," Money and Economic Activity, ed. Lawrence S. Ritter, (Boston: Houghton Mifflin Co., 1961), p. 321.

with some form of IOU, there is the creation of a "unique form of debt." However, they slip into error when they say that this action in itself results in multiple expansion of liabilities. Multiple expansion of deposits or liabilities refers to a phenomenon occurring in the entire banking system or among a group of economic units. But the discussion of Gurley and Shaw is in terms of a single institution. They write:

Nonmonetary intermediaries initially purchase currency and demand deposits when creating nonmonetary indirect securities. In the same way, then, these intermediaries can create liabilities by some multiple of either their currency or their deposit balances. And since the intermediaries can then sell money for primary securities, they can create liabilities by some multiple of any one type of asset they hold. If intermediaries were subject to quantitative controls, they, too, would create liabilities by a multiple of their "legal reserves" -- by a multiple of the one type of asset they were required to hold.³

Gurley and Shaw, who have shown a great deal of insight into the creation and role of financial assets, unfortunately miss the fact that multiple expansion of liabilities is the result of a process based on the flow of funds from one economic unit to another.

The essence of multiple expansion of deposits, as pointed out in the course of the chapter, lies in the fact that the loans or investments made out of the excess reserves of a bank, except for a small currency leakage, get credited either with the same bank or with other banks in the form of deposits and it is this continuing flow of funds from bank to bank that ultimately enables the system to support a volume of deposits that is a multiple of the initial increase in reserves. This process was illus-

³John G. Gurley and Edward S. Shaw, Money in a Theory of Finance, (Washington: The Brookings Institution, 1960), pp. 198-199.

trated by showing the total increase in deposits as the limit of a geometric progression that summed the successive reactions of individual banks to their changes in reserves. Assuming no external drain, the total increase in deposits (dD) was represented as follows:

$$dD = dR + dR(1-r) + dR(1-r)^2 + \dots + dR(1-r)^n, \quad (1)$$

where dD approached $dR/(1 - 1-r) = dR/r$ as n approached ∞ .⁴

This formulation clearly shows the unique process that differentiates banks from other types of financial institutions. It will be argued that this process of Commercial Banking activity, which culminates successive reactions into the creation of demand deposits, is in addition to the commercial banks' role as a financial intermediary channeling the savings of surplus units to borrowers, and that this additional process does not arise from the lending activity of non-bank financial institutions. The commercial banks are more than just financial intermediaries; they are, in short, "banks." The efforts of Gurley and Shaw to equate all non-bank financial institutions with commercial banks can be sustained only if it can be shown that there exists among non-banks the same kind of interlocking flows that are characteristic of commercial

⁴This sequence is equivalent to the solution of a linear homogeneous difference equation involving a one-period lag between the receipt and creation of deposits in discontinuous time. That is, if $dD_t = (1-r)dD_{t-1}$, the solution implies

$$dD = \sum_{t=0}^n dD_t = \sum_{t=0}^n (1-r)^t dD_0,$$

which is the same as (1) where $dR = dD_0$. Of course, $r < 1$ implies a convergent series. This series does not imply a constant period lag since t , as an indicator of a period may be of variable size.

banks. Is the capacity, let us say, of the insurance companies to create their own "unique form of debt" in any way augmented by an increase in the liabilities of any other non-bank financial institution? The answer is, probably, No. As with the banks above, the sequence of flows that arise out of a placement of a sum of money (dR) at a non-bank financial institution can be analyzed. These institutions will also lend a proportion of the receipts, but for a different reason. Assuming sufficient demand for loans, they will lend $(1-c) dR$, where c represents the proportion desired as reserves. As with the banks, this lending flow will go out to the private sector. It is here that the analogy abruptly ends. There is no plausible reason why this flow of funds should directly return to the non-banking sector. In short, there is no geometric series of successive reactions as occurred in the banking sector.⁵ Rather, the funds are used for expenditure and do not return to the non-banks until the lending generates greater income, more savings, and a renewed flow of savings into the non-banks. Commercial bank deposits are also affected via this stream of income and new saving. The banks are exposed, however, to an additional process of deposit creation beyond this savings flow. This process is unique to commercial banking because borrowers, from either non-banks or banks, or payees of these borrowers, keep their funds at commercial banks. Even when a borrower of the bank uses his

⁵The pancake analogy of Gurley and Shaw forces them to argue that non-bank intermediaries would also create liabilities by a multiple of their required reserves if they were compelled to hold such reserves. It is important to note that the existence of multiple creation is in no way dependent on or related to reserve requirements. Reserve requirements only diminish the size of the commercial bank deposit multiplier and reduce the proportion of income-earning assets held by banks. Gurley and Shaw, op.cit.

funds to buy the liabilities of a non-bank financial intermediary, the reserves are not lost to the banking system, as the financial intermediaries initially place their funds with the banks in the form of demand deposits. The significant difference, as the early writers recognized, is the important institutional characteristic that demand deposits of commercial banks are widely used as a means of payment. Reserves of the bank stay within the banking system precisely for this reason. In fact, the analogy of the game of "hot potatoes" does apply to the funds supplied by banks.

Gurley and Shaw have further confused the issue by comparing the medium of exchange quality of demand deposits with the quality of other assets, say the security derived from insurance, arguing that the two assets are substitutes in the investor's portfolio and differ only in the type of service they render. To the investor, demand deposits and insurance may well be competitive assets. As a medium of exchange, however, currency is the only substitute for demand deposits. That there exists a pattern of preference among spending units for a wide variety of financial assets is true and Gurley and Shaw have been right to emphasize this. But it is not legitimate to deduce from this proposition that the liabilities of banks and non-banks come into existence in the same way. The printing presses are different from the fountain pens of the commercial banks, but commercial banks can, unlike non-banks, generate a multiple expansion of deposits because demand deposits are means of payments.

This Appendix has tried to show that the liabilities of banks are not primarily limited by the wealth and asset preferences of savers. The existence of multiple expansion in the banking sector alone explains why bank liabilities are only secondarily determined by savings, while non-

bank liabilities are determined primarily through the savings flow. Gurley and Shaw have made important contributions to monetary theory in their emphasis upon the substitute nature of a large class of financial assets. But in their zeal to show the similarity between demand deposits and other financial assets they have ignored major institutional differences between banks and non-banks.

CHAPTER II

THE SEASONAL ELEMENT IN DEPOSIT VARIABILITY

Variations in demand deposits which recur from year to year in approximately the same form are treated as seasonal variations. The factors that tend to produce such variations are termed seasonal influences. It is customary to divide demand deposits into three categories, viz., inter-bank deposits, U.S. Government deposits and 'other' deposits; in focusing attention on the recurring intra-yearly changes in deposit levels, we shall deal separately with each of these categories for all banks taken together and for different classes of banks.

The seasonal influences that operate in economic activities in general are of two types, primary and derived. Activities directly affected by climate or convention are characterised by primary seasonal influences. However, in an integrated society seasonal influences from such activities radiate to other activities which may be described as being subject to derived or induced seasonal influences.¹ Banking is a typical example of an economic activity characterised by induced seasonal influences. There is nothing inherent in banking operation, unlike

¹Induced seasonal influences, according to Simon Kuznets, bring the seasonality of two inter-related economic activities into closer conformity with each other and therefore play the role of an adjustment mechanism in the economy. See for a detailed discussion of the economic problems caused by seasonal variations, Simon Kuznets, *Seasonal Variations in Industry and Trade*, New York: National Bureau of Economic Research, 1933, pp. 10-22. Also, Wesley C. Mitchell, *"Business Cycles"*, New York: National Bureau of Economic Research, 1927, pp. 237-238.

say construction, that should make it seasonal. But it exhibits seasonal variations because of its links with other economic activities that are subject to seasonal variations.

Seasonal variations in the demand deposits of banks can be traced to the seasonal variations in the factors that bring about a change in deposits. To draw on the analysis presented in the last chapter, these factors are changes in reserves (ΔR), the marginal cash drain (e or e') and the propensity to lend and invest (m). Changes in reserves are brought about primarily by monetary authorities and the definite seasonal pattern observable in their actions are designed to help the banks meet the seasonal variations they may experience in cash drain or demand for loans.² Since deposits are created both by income-savings flow and by the lending and investing activities of banks themselves, the seasonals in these activities will be reflected in the deposit levels of banks. Finally, the community's desire for cash as against demand deposits exhibits a clear seasonal pattern and this introduces an additional element of seasonality in demand deposits when it has not been fully offset by the actions of monetary authorities. In analysing the characteristics of the seasonal pattern in demand deposits, an attempt will be made to find the degree of association between the seasonal pattern in them and the patterns in some of the factors that bring about a change in deposits.

In measuring the seasonal variation in demand deposits, attention must be paid to two elements, the seasonal pattern and the extent of seasonal variability. The seasonal pattern describes the behaviour of the

²To the extent that the authorities succeed in offsetting the seasonal movements in cash drain the net reserves held by the banks will reveal less of a seasonal pattern.

periodic movement. More specifically it shows by how much the periodic movement in each month is above or below the average level. By computing the seasonal index according to statistical methods that are well known now, one can obtain a numerical estimate of the seasonal pattern.³

The extent of seasonal variability, on the other hand, measures the proportion of total variability in the series accounted for by seasonal influences. Besides seasonal influences, there are secular, cyclical and random factors that produce fluctuations. The extent of seasonal variability indicates the relative strength of seasonal influences in causing changes in deposit levels.⁴

³It must be borne in mind that although it is possible to make a rough separation of seasonal fluctuations into a specific type of variation, the remaining seasonally adjusted time series is by no means capable of indicating how the time series would have behaved had there been no seasonal fluctuations. Burns and Mitchell drew attention to this point when they said, "Seasonally adjusted figures no more show what the behaviour of time series would have been in the absence of a seasonal force than indexes of physical production show what production would have been in the absence of changes in relative prices, or than figures on per capita income show what income would have been in the absence of income inequalities." Burns and Mitchell, *Measuring Business Cycles*, New York: National Bureau of Economic Research, 1946, p. 44.

⁴One can suggest several ways to measure the extent of seasonal variability. In this chapter it is done by comparing the standard deviation of the seasonally adjusted series with that of the original series. Symbolically, the measure is: $(1 - \frac{\sigma_A}{\sigma_U}) \times 100$ where σ_A and σ_U are respectively the standard deviations of the seasonally adjusted and the original series.

I Demand Deposits Adjusted

A. General characteristics

'Demand deposits adjusted'⁵ constitute the bulk of total demand deposits. At the end of 1962 there were 85.2 per cent of total demand deposits. A distinct seasonal pattern was observable from the seasonal index for 1962 (Table I). The low was reached in August and the peak in December-January. From March through September, except for April, the deposit levels were below normal. Another significant feature was

Table I

Seasonal index for 'demand deposits adjusted,' 1962

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
103.0	100.0	99.0	100.4	98.4	98.8	98.9	98.3	99.4	100.0	100.6	103.3

Source: Courtesy of the Board of Governors of the Federal Reserve System

the small size of the seasonal swing as measured by the amplitude of the seasonal index. At its lowest point the seasonal index was 98.3 and at its highest point 103.3. The range of the index was only 5 points and the standard deviation 1.5. However, the variability accounted for by seasonal forces was quite high. The standard deviation of the seasonally adjusted figures was 25% of the standard deviation of the original

⁵The category 'demand deposits adjusted' is used in preference to 'other deposits' because of the greater availability of data. 'Demand deposits adjusted' refer to total demand deposits less deposits due to U.S. Government and to domestic commercial banks and cash items in the process of collection.

series.⁶ Thus, 75% of the total variability may be attributed to seasonal influences.

B. Comparison with other seasonal patterns

It was pointed out earlier that a comparison between the seasonal pattern in demand deposits and the patterns in certain bank assets would be instructive. In what follows, the seasonal pattern in demand deposits adjusted is compared with the patterns in loans (bank credit), loans and investment and currency in circulation.

Loans. There was little similarity between the seasonal pattern for loans and that of demand deposits adjusted (Table II and Chart IV). Both in timing and magnitude, the two patterns differed. The amplitude of the seasonal index for 1962 was greater in demand deposits adjusted than in loans. The standard deviation of the former index was 1.54 while that of loans was only .93. Except in the last two months of the year when both indexes were above normal and in February and March when both of them were below normal, the two series moved in the opposite direction in relation to the mean level. The rank correlation coefficient between the two indexes was zero indicating a complete lack of correspondence between them in the ordering of months in relation to seasonal influences. The linear correlation coefficient between them was .316 and the coefficient of determination (R^2) was .01, i.e., only 1 per cent of the variance in the seasonal index for demand deposits adjusted was accounted for by the relationship with the seasonal index for loans.

⁶For the year 1962, the standard deviation of the unadjusted monthly levels of 'demand deposits adjusted' was \$1.61 billion and the standard deviation of the seasonally adjusted series was \$.41 billion.

Seasonal Index

SEASONAL MOVEMENTS OF CURRENCY IN CIRCULATION, DEMAND DEPOSITS ADJUSTED, LOANS, INVESTMENTS, AND LOANS AND INVESTMENTS, 1962

105

95

105

100

105

100

105

100

95

105

100

95

CURRENCY IN CIRCULATION

DEMANDS DEPOSITS ADJUSTED

LOANS

INVESTMENTS

LOANS AND INVESTMENTS

D J F M A My J Jy A S O N D

Source: see reference for Table II

Table II

Seasonal indexes for demand deposits adjusted for
certain select bank assets and for currency in circulation, 1962

Name of the series	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Demand deposits adjusted	102.1	99.7	98.4	100.2	98.5	98.3	99.8	98.7	99.1	101.2	101.2	103.3
Loans	99.0	98.8	99.0	99.6	100.0	100.9	100.0	100.0	100.7	99.9	100.1	102.4
Investments	102.3	99.8	97.4	100.2	98.3	96.7	100.1	98.3	100.0	102.2	101.5	103.3
Loans and investment	100.1	99.2	98.7	99.9	99.5	99.5	100.0	99.4	100.5	100.6	100.4	102.4
Currency in circulation	98.0	98.0	98.4	98.4	99.7	103.2	99.7	100.1	99.7	100.4	101.1	103.4

Source: Federal Reserve Bulletin. Seasonal indexes derived from end of month figures for each category.

The one striking feature of the seasonal pattern for loans was that there was very little seasonal variation in it. Nor did the seasonal pattern in it conform to the pattern in any one type of economic activity like industrial production, production in manufacturing and mining or department store sales. Total bank loans are an aggregate of different types of credit. Though this total exhibits little seasonality, particular types of bank credit do have a strong seasonal component as evidenced by the seasonal index for instalment credit (Table III).

Table III

Seasonal index for instalment bank credit, 1962

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
95.1	86.3	100.7	105.2	110.0	108.2	104.7	105.6	90.4	104.8	93.8	94.9

Source: Federal Reserve Bulletin

Loans and investments. There is a closer parallel between the seasonal pattern in demand deposits adjusted and the seasonal pattern in the composite item 'loans and investment' than that between demand deposits adjusted and loans (Table II and Chart IV). One would expect to find such a closer association as the level of deposits in the banking system is influenced both by banks' lending and investment. The linear correlation coefficient between the two series was .813 and the coefficient of determination .661.

It may also be appropriate at this stage to make a comparison between the seasonals for loans and those for investments in Government

securities. The seasonal pattern for Government securities fluctuates much more widely than for loans, as can be seen from Table II and Chart 1. It is claimed "that the investment operations of commercial banks straddle their lending operations" and that "the investment process employs such residual funds as cannot be employed in loan operations."⁷ The implication of this argument is that as loans constitute the most profitable form of asset from the point of view of the banker he seeks to maintain a fairly uniform level of loans and that as the factors operating on the level of deposits fluctuate, investments in Government securities act as a buffer. A comparison of the seasonal index for loans with that of investment in Government securities did not reveal a consistent inverse relationship between the two in terms of deviation from the average. In the months of January, April and November when loans were below the normal level, investments were above the average level. In the months of May, June, August and September when loans were above normal, investments were below the average level. But in the remaining five months, the movements were in the same direction.

Loans and investment and currency in circulation. Besides loans and investment, another factor influencing the seasonal pattern in demand deposits is the change in currency in circulation as the latter can occur only by a conversion of deposits into currency. However, this change in currency holding will have an effect on demand deposits only if the monetary authorities do not completely offset the seasonal movements in currency by the regulation of the flow of gross reserves through open

⁷ Roland I. Robinson, The Management of Bank Funds, 2nd ed. New York: McGraw-Hill Book Company, Inc., 1962, p. 327.

market operations. In fact, it is found that the association between the seasonal pattern in demand deposits adjusted and those of loans and investment and currency in circulation was only slightly higher than that between demand deposits and loans and investment. The linear correlation coefficient among the series with currency included was .838 and the R^2 .703.

It appears that a greater part of the variation in the seasonal index for demand deposits adjusted is accounted for by the relationship with the seasonal indexes for loans and investments and currency in circulation. However, there are other bank assets, the seasonal movements of which will also be reflected on the seasonals in demand deposits adjusted, though the exact degree of association between them is difficult to measure. Chief among these asset items is Federal Reserve float which has a very high seasonal component.⁸

C. Variability among different classes of banks

The focus so far has been on the seasonal variability in demand deposits adjusted of the banking system as a whole. The next task is to see if there are significant differences in the seasonal variability for this type of deposit among country banks, Reserve city banks and the banks which were formerly classified as central Reserve city banks.

⁸ Besides monthly seasonal patterns, there are distinct seasonal variations within each month in Federal Reserve float. It increases moderately during the first week of each month reaching the peak about the 18th or 19th and declining toward the end of each month. A study by the Federal Reserve Board found that the average weekly change (ignoring sign) in Federal Reserve float during 1957 was \$200 m and this was reduced to \$85 m after seasonal adjustment. (See "Seasonal Factors Affecting Bank Reserves," Federal Reserve Bulletin, February, 1958.)

The seasonal patterns. A certain similarity in the pattern among the three classes of banks can be observed from Table IV. In December the deposit levels were above normal in all the series and they were below normal in the months of March, May, July and August. The amplitude of the seasonal factors was more or less the same. The seasonal indexes for central Reserve city banks, Reserve city banks and country banks had a range of 5.7, 5.1 and 4.8, respectively. The seasonal pattern in central Reserve city banks was, however, closer to that of Reserve city banks than to country banks (Table IV and Chart V). The Reserve city banks had

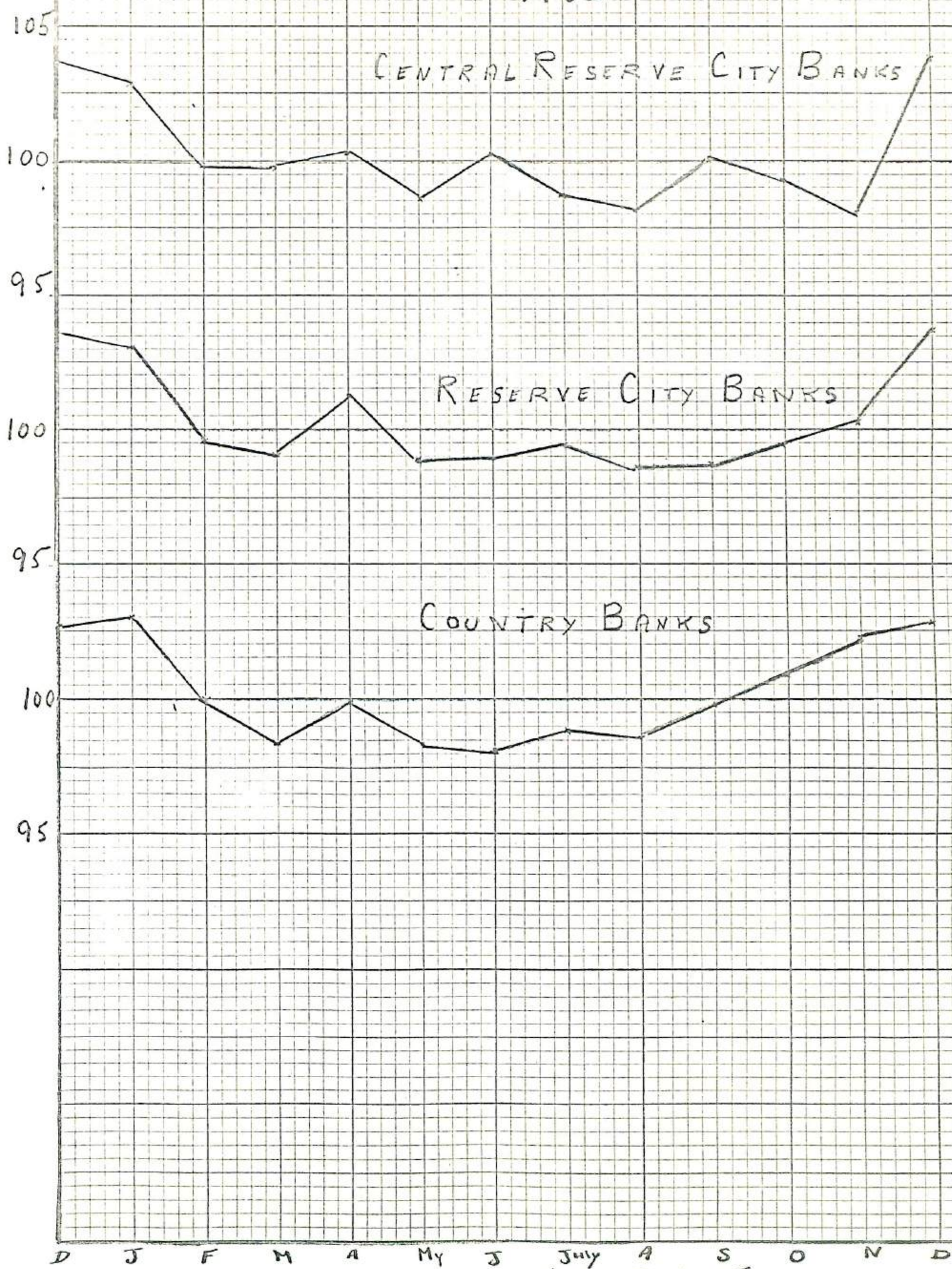
Table IV

Seasonal indexes for 'demand deposits adjusted' for
different classes of banks, 1962

Class of bank	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Central Reserve city banks	102.9	99.9	99.8	100.3	98.6	100.2	98.7	98.3	100.0	99.2	98.4	103.8
Reserve city banks	103.1	99.6	99.0	101.2	98.8	98.9	99.4	98.6	98.8	99.5	100.3	103.7
Country banks	103.0	100.0	98.4	99.8	98.4	98.2	98.8	98.6	99.8	100.8	102.3	102.7

Source: Courtesy of the Board of Governors of the Federal Reserve System

a seasonal pattern which was a kind of midway between that of country banks and that of central Reserve city banks. All this is evident from the correlation coefficients (R) and the coefficients of determination (R^2) given on the following page. (The subscripts 1, 2 and 3 refer to central Reserve

Seasonal
IndexSeasonal Movements of Demand Deposits
Adjusted for Different Classes of Banks,
1962

Source: see Reference for Table IV

city, Reserve city and country banks respectively.)

$$R_{12} = .846$$

$$R^2_{12} = .716$$

$$R_{13} = .590$$

$$R^2_{13} = .348$$

$$R_{23} = .835$$

$$R^2_{23} = .697$$

Extent of variability. Though the range of seasonal factors did not differ very much from one class of bank to another, seasonal influences accounted for differing proportions of the total variability among the different classes. They had the least influence on central Reserve city banks. They accounted for approximately 19.1%, 60.4% and 48.1% of the total variability in the central Reserve city, Reserve city and country banks respectively.⁹

II Inter-bank Deposits

Inter-bank deposits are deposits held by banks with other banks.¹⁰ A well-marked seasonal pattern is observable in these deposits though there

⁹These percentages were derived by using the formula given earlier for computing the extent of seasonal variability. The standard deviations of the monthly levels of demand deposits adjusted both for the original and seasonally adjusted series for 1962 are given below.

Class of bank	Standard deviation of the original series (in Billions of \$)	Standard deviation of the seasonally adjusted series (in Billions of \$)
Central Reserve city banks	.585	.475
Reserve city banks	.960	.380
Country banks	1.050	.545

¹⁰Inter-bank deposits are otherwise known as 'balances due to banks'. The corresponding contra-entry will be 'balances due from banks'. Inter-bank deposits held by all member banks are larger than balances due from banks of all member banks because of the deposits held with the member banks by non-member banks and foreign banks.

are differences in the pattern between the deposits held by New York banks and those held by other Reserve city banks. Seasonal forces account for approximately half of the total variability. Before proceeding to analyse in detail the seasonal pattern in these deposits, it may be worthwhile to refer briefly to the factors that have led to the practice of maintaining correspondent balances on a large scale because these factors in part explain the seasonal behaviour of these deposits.

A. Factors leading to the development of correspondent banking systems

Institutional factors. The absence of a central bank till 1914 left the banking system without a centralized mechanism for collection of cheques. The country banks were therefore obliged to maintain correspondent relationship with city banks for the purpose of collection of out-of-town cheques and also to facilitate the transfer of funds to and from the financial centers.¹¹ The relative decline in the importance of bankers' balance since 1914 is primarily accounted for by the fact that the Federal Reserve has taken over to a great extent the function of clearing cheques performed earlier by the correspondent banks. A second factor that has led to the growth of correspondent banking relationship is the basic structure, namely, the unit banking system. Even in the absence of a central bank, had there been extensive nationwide branch banking, the need for maintaining balances with banks in other centers would not have arisen. But, with no system of branch offices through which out-of-town cheques could be collected, the banks were thrown back to the necessity of maintaining correspondent balances.

¹¹ For an account of the earlier development, see Leonard L. Watkins, 'Bankers' Balances.' (Chicago: A. W. Shaw Company, 1929).

Motives for maintaining correspondent balances. There are three main motives for banks to maintain balances with other banks. The correspondent balances, first and foremost, facilitate the collection of checks and the transfer of funds.¹² In this sense, inter-bank deposits serve in part as transaction balances. During months in which the pace of business activity is rapid, a high volume of check payments requires maintenance of a larger balance to provide for the possibility of a large unfavorable clearing balance on any given day. To this extent, therefore, seasonal changes in demand balances due from banks of country banks (or inter-bank deposits at Reserve city banks) would reflect the tempo of activity experienced by country banks, these balances increasing during busy seasons and declining during slack seasons.

It is claimed that inter-bank deposits serve as a kind of reservoir.¹³ This means that these deposits are increased when country banks experience a surplus of reserves over their requirements for lending and are drawn

¹²The continued use of correspondent banks for collection purposes was brought out by a study on check collection patterns of commercial banks in 1952. This study found that about one-third of all items received for collection were sent for local clearing; about one-third were sent to Federal Reserve banks and about one-fifth to correspondent banks. Small banks as a whole tended to rely heavily upon their correspondents for collection of checks drawn on out-of-town banks. "Study of Check Collection System, Report of Joint Committee on Check Collection System to American Bankers' Association," quoted by Katherine Finney, Inter-Bank Deposits, New York: Columbia University Press, 1958, p. 3.

¹³Beckhart and Smith list this as one of the motives for the maintenance of bankers' balances in New York City banks before the establishment of the Federal Reserve System. Benjamin H. Beckhart and J. G. Smith, The New York Money Market, Volume II, New York: Columbia University Press, 1931-32, p. 195. Katherine Finney seems to think that this motive is still operative. Katherine Finney, op. cit., pp. 75 and 80.

down when they need the reserves for their own purposes.¹⁴

Thirdly, inter-bank deposits can be treated as a type of compensatory balances, that is, balances maintained by country banks in order to compensate the city correspondent banks for the benefits they get from the latter. The advantages that accrue to country banks are several. They include such services as safe keeping of securities, access to files of credit information, assistance in the purchase of securities and in the placement of surplus funds on the call loan market, etc. In addition, there is the increased possibility of being able to borrow from city banks. Since non-member banks have no access to Federal Reserve banks, they borrow from their correspondent banks in times of need. Even country member banks find it convenient to borrow from their correspondent banks when they do not have eligible assets to discount.¹⁵

In addition to these motives, correspondent banks serve as reserve depositories for non-member banks since balances with other banks count as legal reserves for such banks.

¹⁴ Since correspondent banks cannot pay interest on inter-bank deposits, this motive does not explain why country banks would want to maintain such balances. But this motive explains rather why these balances are higher in certain parts of the year or in certain periods than in certain other times.

¹⁵ The extent of inter-bank borrowings, however, is not large. As on the last Wednesday of December 1962, of the total loans of \$84 Billion granted by all 'leading cities' loans to domestic commercial banks amounted to \$2.1 Billion, that is, 2.3% of total loans. For New York City alone, of the total loans of \$20.9 Billion, loans to domestic commercial banks amounted to \$.67 Billion. But this amount of \$.67 Billion included transactions on the Federal Funds market also.

Seasonal Movements of Inter-bank Deposits,
1959Seasonal
Index

110

100

90

110

100

90

110

100

90

110

100

90

COUNTRY BANKS

RESERVE CITY BANKS

NEW YORK CITY BANKS

ALL MEMBER BANKS

D J F M A M J J A S O N D

Source: see Reference for Table V

CHART IV

SEASONAL MOVEMENTS OF DEMAND BALANCES,
DUE FROM BANKS, AND TOTAL DEMAND DEPOSITS
OF COUNTRY BANKS, 1959

SEASONAL
INDEX

SOURCE: SAME AS FOR TABLE VI

110

100

90

110

100

90

110

100

90

TOTAL DEMAND DEPOSITS OF
COUNTRY BANKS

DEMAND BALANCES DUE FROM BANKS
OF RESERVE CITY BANK

DEMAND BALANCES DUE FROM
BANKS OF COUNTRY BANKS

D. J. F. M. A. M. J. J. A. S. O. N. D.

MONTH

358-5D
MADE IN U.S.A.

10 X 10 TO THE INCH
KEUFFEL & ESSER CO.

K&E

B. Seasonal pattern

General characteristics. The inter-bank deposits at all member banks and those held by Reserve city banks showed an easily describable U-shaped seasonal pattern (Table V and Chart 3).¹⁶ They started declining from February and continued to do so until the end of June and then rose steadily to reach the peak in January. The seasonal pattern of these deposits in New York banks followed a zig-zag path. The seasonal peak was reached, however, in January. The amplitude of the seasonal index in the total inter-bank deposits was larger than that noted in demand deposits adjusted. The seasonal indexes of inter-bank deposits at all member banks, at New York banks, at Reserve city banks and at country banks had a range of 7.3, 6.2, 9.1 and 14.1, respectively.

Comparisons among the patterns.

'Demand balances due from banks with 'inter-bank deposits'.

There was a strikingly close similarity between the seasonal pattern in inter-bank deposits at Reserve city banks and the 'demand balances due from banks of country banks (Tables V and VI and Charts VI and VII). The two series followed the same U-shaped pattern declining from February to June and rising from there on to reach the peak in January. The linear correlation coefficient between the two series was .97 and the R^2 was .94. This strong similarity between the two series only indicates that the bulk of inter-bank deposits at Reserve city banks are held by country banks and non-member banks which are likely to be subject to the

¹⁶The patterns traced by all member banks and the Reserve city banks are very close to each other as bulk of the total inter-bank deposits are held by Reserve city banks. As of December 26, 1962, 88% of the total inter-bank deposits was held by Reserve city banks.

Table V

Seasonal indexes of inter-bank deposits, 1959

Class of bank	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
All member banks	103.5	96.2	96.5	99.2	96.5	98.4	101.4	100.5	101.9	101.9	101.7	102.2
N.Y. city banks	103.7	100.5	97.5	100.0	99.4	100.5	102.2	97.7	98.4	100.1	100.4	99.4
Reserve city banks	104.0	94.9	95.9	98.7	94.7	97.5	100.5	100.6	103.4	103.1	103.0	103.6
Country banks	108.8	97.3	96.1	99.0	94.9	94.7	99.0	98.5	100.8	102.2	104.5	104.8

Source: Through the courtesy of the Federal Reserve Bank of New York the X-9 seasonal adjustment program was used to obtain the indexes.

Table VI

Seasonal indexes of demand balances due from banks
and inter-bank deposits, 1959

Name of the series	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Demand balances due from banks	102.5	94.4	94.9	99.6	95.5	97.9	101.2	101.4	104.1	102.9	103.5	102.4
of country banks												
Inter-bank deposits at Reserve city bank	104.0	94.9	95.9	98.7	94.7	97.5	100.5	100.6	103.4	103.1	103.0	103.6

Source: Through the courtesy of the Federal Reserve Bank of New York the X-9 seasonal adjustment program was used to obtain the indexes.

same seasonal influences as the country banks. The inter-bank deposits at New York banks did not, however, follow closely the seasonal pattern traced by demand balances due from banks of Reserve city banks as evidenced by Tables V and VI and Charts VI and VII). The correlation coefficient between the series was .6 and the R^2 was .36. The lack of a close parallel between the two series is explained by the fact that the inter-bank deposits at New York are not held exclusively by Reserve city banks. Larger country banks, as well as foreign banks, maintain balances at New York. Thus, more than one type of influence is operative on inter-bank deposits at New York banks unlike in the case of inter-bank deposits at Reserve city banks.

Total demand deposits of country banks with their demand balances due from banks. There was a strong similarity between the seasonal pattern in demand balances due from banks of country banks and that in their total demand deposits. Except for July and August in all the other months the two seasonal indexes were above or below normal in the same direction (Table VII, Chart VII). The amplitude of the seasonal index for demand balances due from banks was, however, greater than that for total demand deposits. The correlation coefficient between the two series was .67 and the R^2 .46. This similarity between the series calls for a comment because this throws light on the motives for keeping correspondent balances.

Katherine Finney on observing a similar resemblance remarks: "This behaviour which contrasts with that of Reserve city banks tends to bear out the suggestion made earlier that balances in part serve as reservoir and that they are drawn down under the pressure of heavy credit demands

Table VII

Seasonal indexes of total demand deposits and demand balances

due from banks, of country banks, 1959

Name of the series	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Total demand deposits	102.4	99.5	98.1	99.5	98.5	98.4	99.0	98.7	100.1	101.0	102.4	102.6
Demand balances due from banks of country banks	102.5	94.4	94.9	99.6	95.5	97.9	101.2	101.4	104.1	102.9	103.5	102.4

Source: Through the courtesy of the Federal Reserve Bank of New York the X-9 seasonal adjustment program was used to obtain the indexes.

in the spring when deposits fall and are built up when seasonal inflow and payments occur."¹⁷ Emphasizing the same point at another place she says, "The U-shaped pattern of country banks' balances reflects the general downturn of gross demand deposits in the early months of the year as farm income drops sharply and the upswing of deposits as farm receipts rise sharply in August, September and October."¹⁸ The logic of these statements is open to question. Only in the case of individual banks can a period of seasonally high loan demand coincide with a period of seasonally low deposits. For the banking system as a whole, though to a lesser degree for any segment of it like all country banks, loans and deposits move in the same direction. This is the essential difference between the micro and macro behaviour in the banking system. The fact that 'demand balances due from banks' of country banks followed the same path as their total demand deposits did not warrant the inference that these balances served as a repository of surplus funds, since deposit changes could be caused both by income flows and lending activity.¹⁹ If deposit

¹⁷Finney, op.cit., p. 80.

¹⁸Ibid., p. 75.

¹⁹The cyclical movement in inter-bank deposits lends support to the hypothesis that these balances are a kind of surplus. Between 1934 and 1940 when economic activity was at a low ebb inter-bank deposits as a percentage of total deposits rose from 12 to 17. Recent evidence also tends to support this view. In all the three recessions between 1946 and 1959 without exception, the demand balances due from banks of country banks increased.

A study of the changes in correspondent balances following the 1953 and 1954 reductions in Reserve requirements disclosed that after the 1953 reduction, almost half of the banks with deposits of less than \$10 million increased their correspondent balances by amounts equal to 50% or more of their freed funds. After the 1954 reduction, almost a third of the smaller banks followed this pattern. This again supports the hypothesis that country banks increase their deposits with the city banks when they find themselves with surplus funds. (See Robert Black, Fifth District Member Bank Responses to Reductions in Reserve Requirements, Federal Reserve Bank Richmond Monthly Review, December 1955.)

increases were caused by the lending activity of banks the need to maintain larger correspondent balances could well be traced to the transaction motive rather than to the reservoir motive.

Bank debits and deposit turnover rates. A study by Beckhart and Smith in 1932 found that "as far as seasonal fluctuations are concerned, bankers' balances increase with seasonal increases of trade and decrease with seasonal decreases in trade."²⁰ They took bank debits as a measure of trade activity and found that seasonal variations in bankers' balances correlated positively, not negatively, with the district indexes of business activity."²¹

Following this approach, a similar comparison was made for 1959. A positive correlation was noted between the seasonal index of demand balances due from banks of country banks and the index for demand deposit turnover rates in 334 centers. But the relationship was not strong.²² The linear correlation coefficient between the series was .4 and the coefficient of determination .17. The 334 centers cover mostly Reserve city banks and the deposit turnover rates can be treated as an index of activity in these centers. The implication of comparing demand balances due from banks of country banks with the deposit turnover rates at these centers is that these balances are influenced more by the activity in the centers where the country banks keep funds than by local activity. There was a stronger relationship between the demand balances due from banks of Reserve city banks and the demand deposit turnover rates in New York City.

²⁰Beckhart and Smith, op. cit., p. 268.

²¹Ibid., p. 267.

²²A comparison with the seasonal index in bank debits did not show a stronger relationship.

The correlation coefficient between the series was .753 and the R^2 .56. The relationship between these balances and the demand deposit turnover rates in 334 centers was less strong. The coefficient of determination between them was .384 reflecting a less strong relationship between the flow of local activity and the need for funds in New York.

C. Extent of seasonal variability

Over the years 1955-59 on the average, seasonal factors accounted for 51% of the total variability in inter-bank deposits held by all member banks. The impact of seasonal factors on New York banks was quite small. The seasonal forces accounted for only 19% of the total variability. In the case of Reserve city banks 45% of the total variability was due to seasonal factors.²³ The extent of variability accounted for by seasonal factors had not, however, been the same from year to year for any category of banks.

²³These percentages were derived by using the formula given earlier for computing the extent of seasonal variability. The standard deviations of the original and the seasonally adjusted series for the years of 1955-59 are given below.

Standard deviations of inter-bank deposits
(in millions of \$)

<u>Year</u>	<u>All member banks</u>		<u>New York banks</u>		<u>Reserve city banks</u>	
	<u>Original</u>	<u>S.A. series</u>	<u>Original</u>	<u>S.A. series</u>	<u>Original</u>	<u>S.A. series</u>
1955	374	220	87	69	183	158
1956	477	225	98	58	272	129
1957	395	97	82	74	230	95
1958	418	175	90	82	311	152
1959	374	269	93	80	238	124

III U.S. Government Deposits

Fluctuations in U.S. Government deposits, both seasonal and otherwise, affect the banking system differently from fluctuations in other types of deposits. An attempt on the part of the Treasury to maintain at a stable level their deposits at commercial banks, far from being an advantage would result in great inconvenience to the banks. In order to appreciate this difference, a brief description of the Treasury's technique of cash management is necessary

A. Technique of cash management²⁴

Description of the mechanism. The Treasury maintains deposit balances with Federal Reserve banks and with approximately 11,000 commercial banks spread throughout the country.²⁵ The Treasury keeps the major part of

²⁴There are several places in which a detailed discussion of this technique is found. See, for example, Nadler et al, "The Money Market and Its Institutions," Chapter 7; Modern Money Mechanics, Federal Reserve Bank of New York; "Treasury Operations and Bank Reserves;" Monthly Review of Federal Reserve Bank of Kansas, March, 1954.

²⁵The practice of Treasury maintaining balances with commercial banks is uniquely American. In most other countries except where the state itself owns commercial banks, the practice is for the Treasury to keep its balances only with the central bank. Even in this country the early draft of the Federal Reserve proposal as well as the bill that first passed the House stipulated the transfer of all funds in Government's general account balance to the Reserve Banks after a fixed period of time. It was feared in those days that discretionary authority to make deposits with banks might lead to an abuse of power to achieve some political purpose. The opponents to the deposit arrangements with commercial banks labelled it the 'obnoxious pet bank system.' See for a discussion of this controversy Irving Auerbach, "United States Treasury Cash Balances and the Control of Member Bank Reserves," Fiscal and Debt Management Policies, (Commission on Money & Credit), Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963, pp. 319-323.

these balances with the commercial banks maintaining only minimum working balances with the Federal Reserve banks. The Treasury accounts with the commercial banks are called Tax and Loan Accounts. Initially, tax and loan proceeds are channeled largely into commercial bank depositories.²⁶ As disbursements of Treasury funds can, however, be made only by drawing cheques on balances at the Reserve banks, the funds on deposits at commercial banks are transferred to the account at the Federal Reserve banks as the need arises. When such transfers are effected, the commercial banks experience a loss of deposits and consequently a loss of reserves. On the other hand, when funds are disbursed from Treasury balances at the Reserve banks, the reserves and deposits of commercial banks are increased as these cheques are deposited with them.

Policy of the Treasury. It is obvious from the above description that the coincidence of disbursements from the accounts at Reserve banks and the calls on commercial bank depositories is an important factor in dampening fluctuations in commercial bank reserves.²⁷ The greater the

²⁶The type of funds that can be credited to tax and loan accounts and the procedure relating to such deposits have been changing over time. As of now, the collection of withheld taxes (like income tax, social security) and specified excise duties can be channeled through such accounts. Another source of credit to these Accounts is the quarterly payment of income and profit taxes in amounts of \$10,000 and over. Savings bond collections go into these accounts. Whether or not the proceeds arising out of sales of Government securities can be credited to these accounts is decided by the Treasury at the time of each financing. In fiscal year 1961, about 45% of Government budget and trust cash receipts went into Tax and Loan Accounts. Of the year's total credits to Tax and Loan accounts, deposit of taxes constituted 78%. Proceeds from marketable security issues accounted for 17% while the balance of 5% came from savings bond sales.

²⁷What is true of the banking system is not true of individual banks. For the latter, the withdrawals from Tax and Loan Accounts need not necessarily match the reserve gains that may occur through Treasury spending.

stability in Treasury balances at the Reserve banks, the smaller the change in the reserves of commercial banks. By a deliberate policy of permitting Government balances at commercial banks to fluctuate instead of sharply altering the balances at Reserve banks, the Treasury reduces the disturbance to the reserve position of commercial banks.²⁸ It is in this sense that the effect of volatility in Treasury deposits at commercial banks differs from that of volatility in other type of deposits.

There is another aspect of Treasury practice which also helps banks. The banks are usually informed in advance of intended withdrawals by the Treasury. Calls are made upon the Group A banks relatively infrequently -- usually twice a month. The B and C depositories are usually notified each Monday and Thursday of withdrawals scheduled during the week ahead.

Empirical evidence of policy. That fluctuation in the balances at Treasury Tax Loan Accounts are greater than those in the balances at Federal Reserve banks can be seen from Table VIII. The coefficient of variation of end-of-month balances for 1962 at commercial banks was .26 and that in the balances at the Federal Reserve banks was .17.

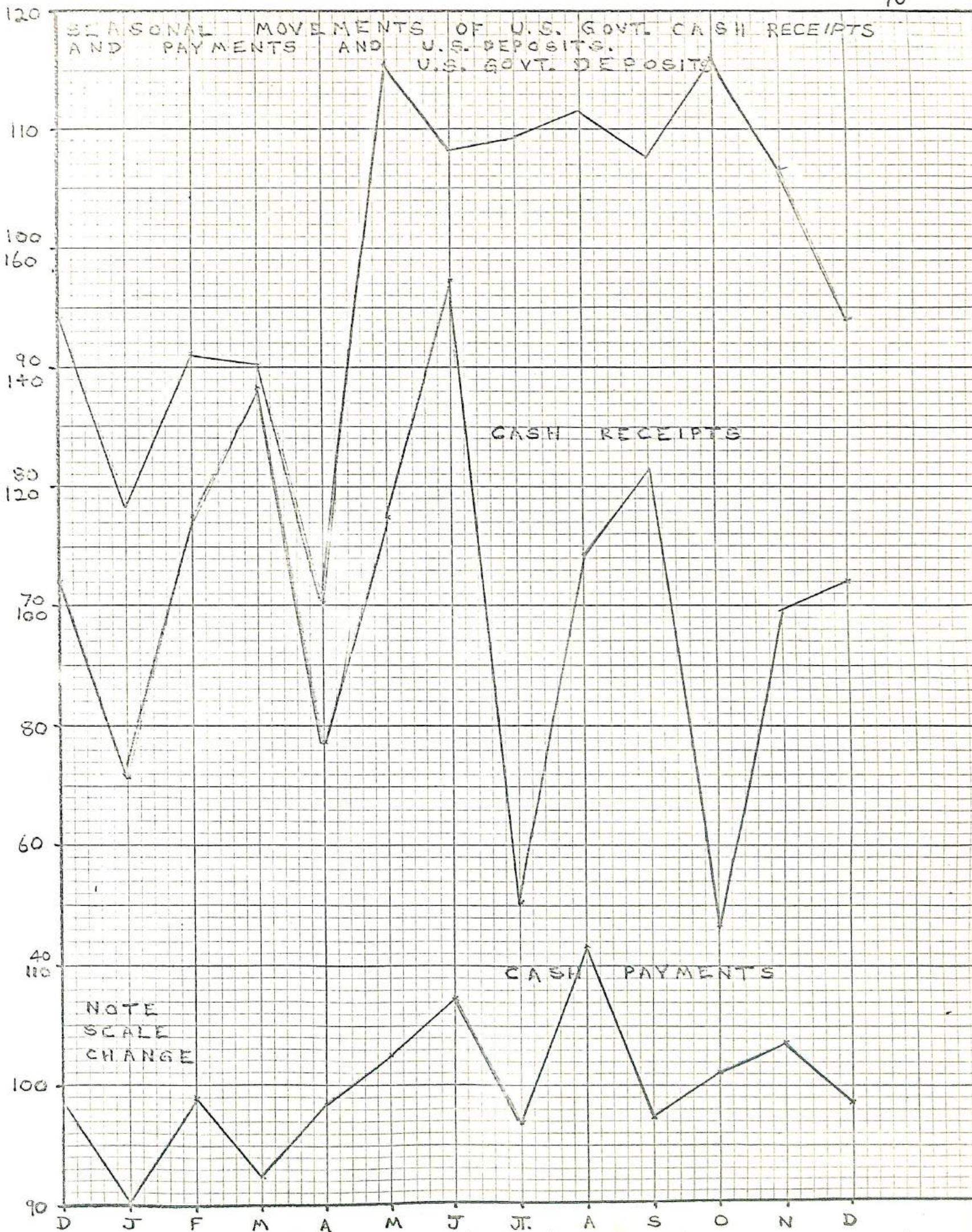
²⁸It is quite clear that 'cash balance management' can very well be used as a monetary weapon, i.e., to influence the availability of reserves with commercial banks for the purpose of achieving a desired monetary goal. However, this has rarely been done. But as a device of affecting bank reserves, it has high potentialities though this could create a conflict of authority in relation to monetary management. For a discussion of the problems that arise in this regard see Irving Auerbach, op. cit., pp. 366-389.

Table VIII
Operating balances of the Treasury, 1962
(in millions of \$)

<u>End of month</u>	<u>Balances at Federal Reserve Bank</u>	<u>Balances in the Tax and Loan Account</u>
January	362	3552
February	449	4172
March	403	5568
April	569	4150
May	526	6623
June	612	8815
July	390	5089
August	478	7210
September	400	7919
October	513	5131
November	585	5728
December	597	6092

Source: Federal Reserve Bulletin.

A comparison of the balances held by the Treasury at commercial banks and Federal Reserve banks with Government's expenditures and receipts for the various months throws interesting light on the technique of cash management. In the months of March, June and September, the receipts exceeded expenditures (See Table IX), resulting in a net flow of cash to Treasury. As Table VIII shows, these were the months which recorded the sharpest rises in Tax and Loan Accounts. The commercial banks would have been subject to severe losses of deposits and reserves had not the increase



Source: See reference for Tables X and XI

in deposits been allowed to remain with the commercial banks. In the months of July and October when expenditures exceeded receipts by a large amount, the Tax and Loan Accounts recorded the sharpest decline. This was intended to prevent an abnormal increase in the reserves of commercial banks.

Table IX

Budget receipts and expenditures, 1962

(in millions of \$)

<u>Month</u>	<u>Receipts</u>	<u>Expenditures</u>	<u>Surplus (+) or deficit (-)</u>
January	5357	7395	-2038
February	6729	6858	- 129
March	9104	7749	1356
April	5754	7289	-1535
May	7024	7229	- 205
June	11615	8102	3513
July	3566	7252	-3686
August	7089	8541	-1452
September	10053	7327	2727
October	3030	8524	-5459
November	7027	8070	-1042
December	8360	7572	788

Source: Federal Reserve Bulletin.

B. Seasonal pattern

General characteristics. There are undoubtedly wide swings in the seasonal pattern for U.S. Government deposits (Table X, Chart VIII). The range of the seasonal index for 1962 was 45.9, much larger than in any index seen so far. It is, however, necessary to bear in mind the significant difference in impact between variations in these deposits and variations in other types of deposits. The deposit levels were below normal from December to April, going anti-clockwise. May, August and October recorded the sharpest seasonal increases.

Table X

Seasonal index for U.S. Government deposits
in commercial banks, 1962

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
78.2	91.1	90.6	70.5	115.9	108.7	109.7	111.8	107.9	116.4	106.8	94.0

Source: Courtesy of the Board of Governors of the Federal Reserve System.

Comparison with the seasonals in Federal cash flows. Since the balances at the Tax and Loan Accounts are in the first instance affected by the flow of cash into and from the Treasury, it will be worthwhile to compare the seasonal indexes for these series. It is, however, difficult to link directly the seasonal patterns in cash receipts and payments to the pattern in U.S. Government deposits because of the actions of the Treasury in transferring funds between Tax and Loan accounts and their accounts at Federal Reserve banks. Some basic links can, nevertheless, be seen.

The wide swings in U.S. Government deposits can generally be traced to the strong seasonal influences in cash payments and receipts. The range of seasonal index in cash receipts was 108.3²⁹ (Table XI and Chart VIII). In the months of March and December, receipts were above normal and as payments were below normal, the combined effect was to lead to a fall in Government deposits as revealed by the seasonal index of Government deposits. However, in the month of June, since both payments and receipts were above normal, the index for U.S. Government deposits was slightly above normal.

C. The extent of seasonal variability

For the year 1962, seasonal forces accounted for approximately three-fourths of the total variability in U.S. Government deposits. The standard deviations of monthly deposit levels for the original and seasonally adjusted series were respectively \$1.53 Billion and \$.36 Billion. The latter was 33.6% of the former. Thus, the seasonal influences may be said to have accounted for 66.4 per cent of the total variability.

The extent of seasonal variability is likely to vary much from year to year in these deposits. A study by the Federal Reserve found that between 1953 and 1957 seasonal factors accounted for only 33.3% of the

²⁹On the receipts side, the seasonal derives primarily from the fact that Federal taxes are not collected on a uniform basis throughout the year. Collections tend to be concentrated on the quarterly tax dates. On the payments side, seasonal variations stem primarily from certain types of expenditures like interest payments, housing outlays, and highways and public works expenditures, as well as unemployment benefits. The bulge in payments in June may be to prevent the lapse of appropriations.

Table XI

Seasonal indexes for Federal cash payments
and receipts, 1962

Name of the series	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Federal cash pay- ments to public	90.2	99.0	92.4	98.8	102.7	107.5	96.9	111.7	97.2	101.1	103.8	98.8
Federal cash receipts from public	71.6	114.9	136.7	77.4	115.0	154.8	50.2	108.7	122.3	46.5	99.4	104.0

Source: Business cycle indicators.

total variability.³⁰ Besides tax receipts, another important source of receipts is the contribution to Government debt which is likely to vary in magnitude from year to year. Seasonal variability will be a higher proportion of total variability in years in which debt receipts are a smaller proportion of total receipts than in years where they are a larger proportion of total receipts.

IV Conclusion

Thus far the analysis has dealt with the seasonal pattern and the extent of seasonal variability in each category of demand deposits. The amplitude of the seasonal index was the highest in U.S. Government deposits, followed by inter-bank deposits and demand deposits adjusted in that order. For the year 1962, seasonal forces accounted for approximately three-fourths of the total variability in U.S. Government deposits and demand deposits adjusted. While this separate analysis has been useful, particularly in focusing attention on the factors that produce seasonal variations, it is necessary because of the inter-dependence among the components to examine the extent of seasonal variability in total demand deposits.³¹

³⁰The average semi-monthly changes (ignoring sign) in Government deposits between 1953 and 1957 were \$740 m and \$500 m before and after seasonal adjustment. See "Factors Affecting Bank Reserves," Federal Reserve Bulletin, February 1958, p. 126.

³¹The term 'total demand deposits' refers to the sum of U.S. Government deposits, inter-bank deposits, and 'other' deposits. Variability in total demand deposits is not necessarily equal to the sum of the variability of the components. It will be equal, higher, or lower, depending on the nature and magnitude of the inter-correlation among the components. If total demand deposits (D) is given as the sum of U.S. Government deposits (G), inter-bank deposits (B), and 'other' deposits (O), then the variance of D is

$$\sigma_D^2 = \sigma_G^2 + \sigma_B^2 + \sigma_O^2 + 2r_{GB}\sigma_G\sigma_B + 2r_{BO}\sigma_B\sigma_O + 2r_{OD}\sigma_O\sigma_D$$

where σ^2 and r stand for variance and correlation coefficient respectively. Negative correlation between any two components reduces the total variance. Looking at seasonal variability alone, the seasonal variation in total demand deposits will be reduced to the extent that there is a negative correlation in the seasonal pattern of any two components.

Over the years 1955-59 seasonal forces accounted, on the average, for approximately 60 per cent of the variability in total demand deposits held by all member banks. Seasonal factors were less dominant in New York banks than in others. The extent of seasonal variability was more or less of the same order in Reserve city and country banks (Table XII).

The seasonal pattern for all the categories of banks showed little change over these years despite minor variations in timing and magnitude, particularly in demand deposits held by New York banks. The extent of seasonal variability was found to vary over these years for all categories of banks. There was some consistency, however, in the interrelationship among the different categories. In four out of five years, seasonal factors accounted for a lesser proportion of total variability in New York banks than in others. In three out of five years, seasonal variability was slightly higher in Reserve city banks than in country banks. On the average, seasonal factors accounted for 42%, 60%, and 59% of the total variability in the New York Reserve city and country banks respectively.

This chapter has been concerned with the operation of seasonal influences in different types of deposits for the banking system as a whole and for some segments of it. From the point of view of the policy decisions which an individual banker has to make, what is relevant is the seasonal pattern in the deposit levels of his bank, which may or may not synchronize in timing and magnitude with that of the system. But an understanding of the seasonal movement of deposits in the entire system is relevant from the point of view of the monetary authorities whose actions

Table XII

Standard deviations of the original and seasonally adjusted series on total demand deposits
and the extent of seasonal variability for different classes of banks, 1955-59

	<u>All member banks</u>				<u>New York banks</u>				<u>Reserve city banks</u>				<u>Country banks</u>			
	<u>Standard</u>		<u>Extent of</u>		<u>Standard</u>		<u>Extent of</u>		<u>Standard</u>		<u>Extent of</u>		<u>Standard</u>		<u>Extent of</u>	
	<u>Deviation</u>	<u>S.A.</u>	<u>Seasonal</u>	<u>ity</u>	<u>Deviation</u>	<u>S.A.</u>	<u>Seasonal</u>	<u>ity</u>	<u>Deviation</u>	<u>S.A.</u>	<u>Seasonal</u>	<u>ity</u>	<u>Deviation</u>	<u>S.A.</u>	<u>Seasonal</u>	<u>ity</u>
	<u>Orig.</u>	<u>S.A.</u>	<u>Orig.</u>	<u>ity</u>	<u>Orig.</u>	<u>S.A.</u>	<u>Orig.</u>	<u>ity</u>	<u>Orig.</u>	<u>S.A.</u>	<u>Orig.</u>	<u>ity</u>	<u>Orig.</u>	<u>S.A.</u>	<u>Orig.</u>	<u>ity</u>
1955	15.82	6.16	61.1%	42.3%	6.92	2.97	47.1%	7.12	3.17	55.5%						
1956	18.78	6.19	67.1%	54.0%	7.55	2.29	69.7%	7.86	3.00	61.8%						
1957	14.77	3.84	74.1%	64.9%	6.32	2.53	60.0%	5.79	1.88	67.5%						
1958	25.94	19.50	24.7%	26.8%	15.69	10.15	36.3%	11.06	5.95	46.2%						
1959	15.68	4.82	69.3%	33.2%	10.15	1.46	77.1%	7.50	2.86	61.9%						

(In the case of standard deviations move decimal two places right for millions.)

The seasonal indexes for the four categories of deposits for the years 1955-59 were obtained by using the X-9 seasonal adjustment program. The computer facilities were made available by the Federal Reserve Bank of New York.

are in the phraseology of Roosa not only 'dynamic' but also 'defensive.' ³²

³²The defensive side of central banking, according to Roosa means "defending against those seasonal, regional or perhaps accidental causes of sudden stringency that arise in the process of issuing currency or clearing checks, or meeting net flow of funds among regions (or vis-a-vis other countries), for example, and which might by unhappy coincidence aggravate or ignite a financial and economic crises." The dynamic bids of central banking is the "use of the latent potential of a practical reserve banking system in resisting inflation and deflation and facilitating economic growth." Robert V. Roosa, Federal Reserve Operations in the Money and Government Securities Markets, Federal Reserve Bank of New York, 1956, p. 8.

CHAPTER III

DEPOSIT VARIATION IN RELATION TO CHANGES IN AGGREGATE BANK RESERVES

The object of this chapter is to study the impact of the actions of monetary authorities on the demand deposits of commercial banks. More specifically it will examine (a) the time lag involved in the process of expansion or contraction of deposits and (b) the magnitude of the deposit multiplier. The reactions of different classes of banks to changes in aggregate reserves will be studied separately.

The lagged response of banks to changes in reserves is one among the many time lags that intervene between the making of monetary policy and its ultimate impact on the economy. Following Thomas Mayer,¹ these lags may be classified into four types. First, there is the lag between the occurrence of the need for a new policy and the time it is adopted. The second is the time it takes to apply the policy. Third, some time may pass before the new monetary policy changes the availability of credit to the borrower and fourth, there is the lag between changes in the availability of credit and change in GNP. The focus of attention in this chapter is on the time it takes for the full effect of changes in reserves to be reflected in the level of demand deposits which is roughly the third lag mentioned above.

¹Thomas Mayer, "The Inflexibility of Monetary Policy," Review of Economics and Statistics, November, 1958, p. 353. Other writers have described these lags by different names, but the basis of classification is more or less the same. See Milton Friedman, "A Monetary and Fiscal Framework for Economic Stability," American Economic Review, June, 1948, p. 255; Albert Ando, et al., "Lags in Fiscal and Monetary Policy," Stabilization Policies, (Englewood Cliffs: Prentice Hall, Inc., 1963), pp. 3-4.

I Previous Studies on Timing and Magnitude of Deposit Expansion

A fairly stable relationship between bank reserves and deposits is regarded as a key factor in the implementation of monetary policy. A reasonably steady ratio between the two helps the monetary authorities since this enables them to forecast with some precision the effects of their actions as they make their policy decisions. On the premise that "banks would seldom or never maintain idle reserves in excess of their conventional or legal proportions," Keynes came to the conclusion in 1930 that "in the banking conditions which now exist in England and the United States the aggregate of bank deposits . . . is a multiple as nearly as possible a constant of the reserves of member banks."² This contention was sufficiently contradicted by the banking experience during the Thirties, though one may regard that period as exceptional.

Among the recent studies that have been made on the relationship between bank reserves and deposits or earning assets, a brief reference to those of Edward Simmons, Allan Meltzer, George Horwich, Robert Black, Ira Scott, James Meigs, and Robert Solow and John Karaken³ may be made here.

² Keynes, A Treatise on Money, Vol II, (London: Macmillan & Co. Ltd., 1950), p. 64

³ Edward C. Simmons, "The Monetary Mechanism since the War," Journal of Political Economy, LVII (April, 1950), pp. 124-141; Allen H. Meltzer, "The Behaviour of the French Money Supply: 1938-54," Journal of Political Economy, LXVII (May, 1957), pp. 238-255; Robert P. Black, "An Analysis of the Impacts of the 1953 and 1954 Reductions in Federal Reserve Member Bank Reserve Requirements," (Ph.D. dissertation, Graduate Faculty of the University of Virginia, 1955); Ira O. Scott, Jr., "The Regional Impact of Monetary Policy," Quarterly Journal of Economics, LXIX (May, 1955), pp. 269-284; A. James Meigs, Free Reserves and the Money Supply; John Karaken and Robert Solow, "Lags in Monetary Policy," Stabilization Policies, (Englewood Cliffs: Prentice Hall, 1963).

Except for Simmons, others found a close relationship between the two, though each was focusing attention on a different aspect of the problem.

Edward Simmons, in an analysis of the operation of monetary mechanism in the United States after World War II, came to the conclusion that "because it is composed of a large number of banks operating on the fractional reserve principle, the banking system of the U.S. is inherently unstable."⁴ In his opinion, the structural peculiarities of the system, such as differing reserve requirements for different types of banks and the practice of maintaining inter-bank deposits on a large scale produce autonomous changes in money supply and thwart the efforts of monetary authorities to bring about a desired alteration in the aggregate money stock. He compared the rate of change of bank reserves with the rate of change of bank deposits during the six half-year intervals between December 31, 1941, and December 31, 1948. He found that in all six periods the changes in the two series were consistently in the same direction but the magnitude did not correspond. In coming to the conclusion of an instability in the relationship between reserves and deposits, Simmons did not separate the periods according to the phase of the business cycle to which they belonged to see if the cyclical factor was responsible for the difference in the magnitude. Nor did he attempt to study the lagged response of one series to another.

Meltzer's work covered a longer time horizon. He studied the behaviour of the French money supply during 1938-54, attempting to show "the way in which the stock of money varies with the size and composition of

⁴Edward Simmons, op. cit., p. 124.

the central bank's monetary liabilities." He arrived at the conclusion that "from a knowledge of the monetary base and the expansion ratio or from a knowledge of the monetary base and the regression equation it is possible to 'predict' the money supply with a reasonable degree of accuracy."⁵

Ira Scott's study was centered on the question whether significant lags existed in the transmission of the effects of credit policy from New York to the rest of the country. The period studied was from June, 1951, to May, 1953. He made the assumption that a policy of credit restraint tended to have its initial effects on the central reserve city banks. The time pattern of free reserves of other groupings of banks was compared with that of central reserve city banks to measure the transmission lag. He found that the reserve city banks "reveal a pattern similar to that of central reserve category with somewhat milder reversal in trend during the latter part of the period,"⁶ while there was a "significant lag in the country bank component."⁷ He also found that New York city banks showed an earlier and more pronounced tendency to shift the composition

⁵Applying the method of least squares to sixty-eight quarterly observations, Meltzer obtained the equation:

$$M_1 = -112.42 + 2.03 B \quad r = 0.99,$$

(22.80) (.02)

where M_1 = money supply excluding time and savings deposits, and
 B = the monetary base which is the sum of the expansive and contractive forces (both in billions of francs).

Meltzer, op. cit., p. 281.

⁶Ira Scott, Jr., op. cit., p. 270.

⁷Ibid., p. 272.

of their portfolios from investments to loans than did banks outside New York City. In his words,

...the data showed a considerable lag as compared with the weekly reporting member banks, revealing a more tenuous connection between the non-reporting commercial banks and the money market.⁸

While the Scott study indicates a substantial lag in the transmission of the effects of open market operations, it does not show whether this lag was due to delay in the transmission of reserves themselves from the money market centers to the interior or because underlying non-monetary factors had differential regional impacts. Scott also made no effort to measure the duration of the time lags.

George Horwich attempted to measure both the speed and magnitude by which earning assets reacted to changes in reserve holdings. A monthly series on total earning assets of commercial banks was drawn up for the period 1953-55 and examined for its functional relationship to "effective" reserves. Horwich found that the two series changed in the same direction, both up or both down, in 26 out of a total 36 movements. The linear correlation coefficient between them was 0.95. He then related the first differences in two series and found the correlation coefficient to be 0.59. He found that 26 out of 35 pairs of increments were in the same direction. But of the nine occasions of disagreement, seven of the earning asset increments were in the same direction as the change in reserves of the previous month. His conclusions were:

- (1) The response of bankers to changes in effective reserves was fairly immediate; it usually occurred in an interval which is no greater than a month and probably much less.

⁸Ibid., p. 280.

But there was some lag in the response of earning assets to changes in reserves;

- and (2) the rate of interest -- or the whole complex of interest rates -- was reflected in banking behaviour in that intensive use of reserves was highly correlated with rising interest rates and less intensive use with falling interest rates.⁹

Horwich made no attempt to study separately the response of country banks and city banks. And, since he used monthly data, he could not arrive at a definite finding as to whether the response lag was less than a month or not.

The response of member banks in the Fifth District to large discrete additions in reserves caused by the reductions in reserve requirements in 1953 and 1954 was the subject of a study by a member of the research staff of the Federal Reserve Bank of Richmond. He chose as a principal measure of banks' response the level of excess reserves relative to deposits and studied the time taken by the banks after the decrease in reserve requirements in returning to the ratio of excess reserves to deposits which they maintained before the change was made. His conclusion was:

In the case of large banks, three-fourths had reduced their excess reserves as a percentage of deposits subject to reserves to or below the level existing before the change by the end of the second period (semi-monthly). Nearly all of those remaining had completed their adjustments by the end of the third period. In contrast, a substantial number of the medium and small size banks did not achieve their pre-reduction relationship between excess reserves and deposits in any of the five periods analysed.¹⁰

⁹ George Horwich, Journal of Finance, (May, 1957), p. 254.

¹⁰ Robert Black, "Fifth District Member Bank Responses to Reductions in Reserve Requirements," Federal Reserve Bank of Richmond Monthly Review, December, 1955, p. 5. This article is based on the study by Black cited earlier.

In general the adjustment process was found to be prompt, though there was a difference between the bigger and smaller banks.

A recent work on the relationship between money supply and the reserve base is the exhaustive study made by James Meigs. The principal hypothesis of his study is:

...that banks seek to maintain certain desired ratios of excess reserves and borrowings (or free reserves) to total deposits and that these desired ratios are functionally related to market interest rates and the discount rate. As interest rates and the supply of unborrowed reserves change, the actual ratios depart from the desired ratios. In attempting to adjust the actual reserve ratios to the desired ratios, the banks increase or decrease their holdings of earning assets, thus causing deposits to change. The more the actual ratios diverge from the desired ratios the greater is the rate at which the banks attempt to adjust reserve positions and hence the greater is the rate of deposit change.¹¹

The empirical evidence for his thesis is presented in the form of two sets of equations. The first group of equations has as its dependent variable the rate of change of deposits and the explanatory variables include the free reserve ratio and certain select interest rates. Meigs tried several variations of this form, employing various deposit series, interest rates and time periods. But the results he obtained did not establish the free reserve ratio as the main factor influencing the rate of change of deposits. As one reviewer pointed out, his results cast "... a serious doubt on the usefulness of the free reserve ratio as a gauge for purposes of monetary policy."¹² Meigs, however, had greater

¹¹ James Meigs, Free Reserves and the Money Supply, (Chicago: University of Chicago Press, 1962), p. 4.

¹² Matityahan Marcus, National Banking Review, September, 1963, p. 154.

success with his second set of equations where he was concerned with estimating the level or rate of change of free reserve ratios by relating them to interest rate, discount rate and the rate of change of unborrowed reserves. Generally the explanatory variables seemed to explain most of the observed variance in the free reserve ratio. In relation to lagged response, he found that the rate of change of unborrowed reserves in the month in which the free reserve ratio was predicted had little influence, but introducing it with a lag of one month or using the average of it for the current month and one month preceding roughly tripled its influence.¹³ Meigs focused his attention on the rate of change of deposits ($1/D \cdot dD/d_t$). From the point of view of the impact of monetary policy, let alone purely from the banks' view, the factor which needs to be explained is more the absolute change in deposits than the percentage change. Also, as is shown below, it is possible to provide a more satisfactory explanation of the change in deposits than the rate of change of deposits.

As part of a fuller study of lags in monetary policy, Robert Solow and John Karaken examined the "mechanism connecting monetary policy actions -- operations on bank reserves and reserve requirements -- and the price and volume of bank loans to business."¹⁴ This is not quite the same as the lag between changes in deposits and changes in reserves, because the link between interest rate on bank loans and changes in reserves is

¹³ Meigs, op. cit., p. 72.

¹⁴ Karaken and Solow, op. cit., p. 52.

not direct. In fact, Solow and Karaken were not quite satisfied with the results they obtained.¹⁵ However, they were able to make the inference that:

....a sustained change in free reserves starting from an equilibrium position and undisturbed by further changes in data generates a time sequence for r_t which does eventually converge to the new equilibrium level. But the rate of convergence is not terribly fast so that interest rate is driven sluggishly to restore equilibrium in the credit market.¹⁶

They found that even after six quarters had elapsed only a fifth of the full effect on the interest rate was felt. The choice of interest rate on bank loans as an index of tightening or easing credit is open to question. The whole weight of the 'availability doctrine' goes against such a test. In a market where non-price competition is regarded as important, it is not surprising that the authors found the effect on price, that is, interest rate, slow and weak.

II Determinants of Changes in Demand Deposits

The hypothesis that is to be tested with the aid of empirical evidence is that the change in demand deposits of the banking system during any given period is the result of the change in aggregate unborrowed

¹⁵The equation estimated by Karaken and Solow was:

$$\begin{aligned} \Delta r_t = & 0.1705 - 0.0355 r_t + 0.02771 I_t + 0.0023 L_t - 0.0015 F_t \\ & (.0479) \quad (.0103) \quad (.0054) \quad (.0006) \\ & + 0.2636 \Delta r_{t-1} - 0.4215 \Delta r_{t-2} \quad R^2 = 0.41, \\ & (.1402) \quad (.1376) \end{aligned}$$

where r_t stands for average interest rate on bank loans, I_t for current dollar seasonally adjusted inventory accumulation, L_t for the measure of corporate liquidity, and F_t for free reserves.

¹⁶Karaken and Solow, op. cit., p. 57.

reserves of that period as well as the changes of the earlier periods. In addition, changes in demand deposits will be conditioned by interest rates, borrowings from the Federal Reserve during the period and the level of outstanding borrowings of the preceding period. In its most general form it is postulated that:

$$\Delta D_t = f(\Delta R_t, \Delta R_{t-1}, \Delta R_{t-2}, + \dots \Delta R_{t-n}, i_t, \Delta B_t, B_{t-1})$$

where ΔD = changes in demand deposits per period

ΔR = changes in unborrowed reserves per period

i = interest rate

ΔB = changes in borrowings per period

B = level of outstanding borrowing

and subscript t = time,

A. Aggregate unborrowed reserves, current and lagged

Of the explanatory variables prime importance attaches to changes in aggregate unborrowed reserves, current and lagged.¹⁷ As reserves constitute the basis of deposit expansion or contraction, changes in reserves in any given period must necessarily affect changes in deposits of that period. The inclusion of changes in reserves of the preceding periods is done on the assumption that changes in demand deposits are, in part, a delayed response to changes in reserves.

¹⁷The term unborrowed reserves refers to the total reserves held by banks less their borrowings. Unborrowed reserves are separated from borrowed reserves because the former are more or less a permanent acquisition while the latter is only a temporary source of reserves. Besides borrowing, reserves held against time deposits must be deducted from total reserves to obtain the unborrowed reserves relevant only to changes in demand deposits.

The opening chapter contained a detailed discussion of the factors that influence the magnitude of the deposit multiplier. A reference was made there to the time element in the expansion process, though all the reasons for the lag were not indicated. It is easy to see why there may be a lag in the expansion of deposits. Reserves flow from one bank to another as the proceeds from a loan or security purchase are spent by a bank's customer. If there is a lag in the use of proceeds, the total deposit expansion becomes a delayed response to changes in reserves. In fact, it is believed that changes in reserves caused by the actions of monetary authorities affect the banks in the leading financial centers in the first instance and that part of these changes are then transmitted with a delay to country banks. A second reason for the lag in deposit expansion may be the inability of banks to convert their excess reserves immediately into loans and investments. Such a situation may be ruled out in the case of large banks with ready access to financial markets. But country banks, far removed from the financial centers, may be obliged to carry such excess reserves, causing thereby a lag in deposit expansion.¹⁸

These reasons suggest that changes in demand deposits will be affected not only by changes in reserves of that period but also of the preceding periods. But it is difficult to determine a priori the number of previous periods that should be included. This can be decided only by empirical experimentation. Period here refers to an interval of two weeks or half a month.

¹⁸ This type of lag, i.e., the time taken for converting reserves into earning assets does not apply to the deposit contraction process. There is, in fact, an asymmetry between the expansion and contraction processes. Assuming that the bank is initially in a fully loaned-up position, if it loses reserves, it has to contract its earning assets and thereby deposits, while if it gains reserves it is under no compulsion to expand deposits.

B. Interest rate

The rate of interest has an influence on the banks and on the borrowers, but its effects are opposite in direction. For the banker, a rise in the rate of interest means a rise in the opportunity cost of holding reserves and, therefore, induces him to expand his deposits speedily and to the maximum extent possible. Other things remaining the same, a rise in interest rate inhibits borrowing on the part of banks' customers. The formulation that is presented here is from the point of view of the banker, i.e., the function to be estimated is a supply function and therefore interest rate should have a positive effect on demand deposits.

The level of interest is suggested as an explanatory variable instead of the change, as the banks reactions are conditioned more by the absolute level than by the small changes from period to period especially when the interval of the period chosen is as short as two weeks. This is also in accord with what is sometimes described as 'three-gears' view of the level of interest rates.¹⁹

C. Borrowings

The effect of the level of outstanding borrowings must be distinguished from the effect of changes in borrowings. The level of borrowings of the preceding period (B_{t-1}) has a negative influence on changes in demand deposits of any given period. A high level of indebtedness to the system, for example, exercises a restraining influence on the banks. On

¹⁹ According to this view, banks and businessmen consider the current level of interest as 'high,' 'low' or 'middle' and how they behave is governed not so much by small changes in interest rate but by whether the level fits into the high, low or normal bracket. (See for an elaboration of this view, Report of the Committee on the Working of the Monetary System (Radcliffe Report) (London: H.M.S.O. cmd. 827, 1959), pp. 153-154.

such occasions banks become cautious in their lending policies because they do not desire to place themselves in a situation where they will be compelled to borrow again in order to meet a drain, internal or external.

On the other hand the effect of changes in borrowings (ΔB) on demand deposits is positive. An increase in borrowings leads to an augmentation of reserves and in turn to an increase in deposits while repayments reduce the reserves and, therefore, deposits.

D. 'Own' as contrasted with aggregate reserves

The hypothesis presented above treats the changes in demand deposits of the banking system as being caused by changes in the aggregate reserves of the banking system. Demand deposits of the banking system can be broken down into deposits of different classes of banks such as Reserve city and country banks and they can be related to changes in aggregate reserves. Also, demand deposits of different classes can be causally related to changes in their 'own' reserves, i.e., reserves held by them. The more useful approach and the one that was followed, in main, in the empirical investigation, is to link the demand deposits of different classes of banks to changes in aggregate reserves because this approach helps to study the impact of a variable which is directly under the control of central banking authorities.

E. 'Dynamic' elements of changes in aggregate reserves

Changes in reserves are initiated by monetary authorities partly to offset certain seasonal influences ('defensive' responsibility) and partly to implement certain policy objectives ('dynamic' responsibility). It has been suggested by some that the high degree of correlation noted between changes in demand deposits and changes in reserves of the same period may be due to the fact that reserves are 'fed in' by the Federal

Reserve as the member banks demonstrate they are prepared to use them. The seasonal offsetting operations are essentially of this nature and the response of banks to such flows of reserves will be immediate as they are anticipated by banks. A lagged response is more likely to changes in reserves that are purely the result of monetary objectives, i.e., the 'dynamic' elements of changes in reserves, and this hypothesis will be tested with the use of seasonally adjusted data on reserves and deposits.

III The Methodology of Empirical Investigation

The speed and magnitude of deposit expansion and contraction were measured with the aid of distributed lag functions. Changes in net demand deposits of different classes of banks were related to the explanatory variables discussed in the last section and the technique of least squares was used to estimate the coefficients of the multiple regression equations.

Except for the changes in borrowings (ΔB), all of the other explanatory variables are given to the banker; he cannot influence them in making his decisions. Unborrowed reserves of the banking system are controlled by the Federal Reserve system; the banker is, by and large, a price taker in the money market, and in the given period he cannot undo his decision of the previous period to borrow or not to borrow. Thus these variables can be said to cause changes in demand deposits.

The inclusion of changes in borrowing among the explanatory variables raises a problem in terms of statistical estimation. As borrowing is under the control of the individual banker, subject only to disapproval by the Federal Reserve banks, no cause and effect relationship can be

maintained.²⁰ The causation need not always be from borrowings to deposits; it could well happen that borrowings were necessitated by a simultaneous expansion in deposits. This variable has to be taken into account, however, in order to neutralize its effects, even if it offends the principle of one-way causation. If this were not done, its effect might be wrongly attributed to some other variable with which it is associated such as changes in unborrowed reserves.

Equations were computed separately for the period 1954-59 and 1960-63. The separation of the evidence into two parts was necessitated by the fact that the Federal Reserve system switched in January 1960 from the use of semi-monthly periods to bi-weekly periods in presenting data on reserves and deposits. Thus an interval of two weeks constituted a period during 1960-63 and an interval of half a month during 1954-59.

A. Definition of variables

Net demand deposits. The dependent variables in the equations were net demand deposits of different classes of banks. Net demand deposits are demand deposits subject to reserve requirements. They are equal to gross demand deposits less cash items in the process of collection and demand balances due from banks. Bi-weekly averages of daily figures were used for the period 1960-63 and semi-monthly averages of daily figures for the period 1954-59.

²⁰The degree of control exercised by the Federal Reserve on member bank borrowings is discussed by C. R. Whittlesey in "Credit Policy at the Discount Window," Quarterly Journal of Economics, May, 1959. His conclusion was that under normal circumstances "the member bank can assume that its request for loan will not be refused." p. 211. Thus borrowings become a variable largely under the control of the banks themselves.

Aggregate unborrowed reserves. Aggregate unborrowed reserves are equal to the total reserves held by banks less their borrowings. But the variable used in the estimating equations required two other adjustments on this figure. First, reserves held against time deposits were subtracted from it. Second, during the period 1954-59, reserves were adjusted to a uniform reserve requirement of 20 per cent for central Reserve city banks, 18 per cent for Reserve city banks and 12 per cent for country banks. For the period 1960-63, unborrowed reserves of Reserve city banks (which included also the central Reserve city banks until the classification was abolished) were adjusted to a uniform reserve requirement of 16½%. No adjustment was called for in the case of country banks, since there was no change in their reserve requirements.

Interest rate. The specific interest rate used was the market yield on three months Treasury bills. The data were obtained from the Bond Yields Tables of various issues of the Federal Reserve Bulletin.

Changes in borrowings. These were adjusted to a common reserve requirement basis along the lines indicated for unborrowed reserves. As in the case of net demand deposits and unborrowed reserves, bi-weekly averages of daily figures were used for the period 1960-63 and semi-monthly averages of daily figures for the period 1954-59.

B. Equations computed

Apart from computing separate regressions for the two periods 1954-59 and 1960-63, the observations within each period were separated according to the phase of the business cycles in which they fell. The asymmetry in the process of deposit expansion and contraction was pointed out earlier. Monetary policy tends to be generally tight during upswings of the business cycle and easy during the downswings. By separating the observations

according to the phase of the cycle, the difference, if any, between deposit expansion and contraction processes can be brought out. This raises, however, the problem of the selection of suitable turning points. Solow has pointed out that the lag between the need for action and the taking of action is three months in the case of switch to tight money and 8.5 months in the case of switch to easy money.²¹ Since choosing dates other than cyclical turning points involves subjective evaluation as to when changes in monetary policy occurred, the observations were separated according to the NBER turning points. An effort was made, however, in one case to group the observations according to probable dates of changes in monetary policy and to study the response of banks.

For the period 1960-63, several pairs of equations were computed with reserve city and country banks' net demand deposits related to a given set of explanatory variables of the banking system. Equations were computed separately using upswing and downswing observations and are given respectively in Tables XIII and XIV. In addition, the responses of Reserve city banks and country banks to changes in their 'own' reserves were studied using upswing observations and the resulting equations are given in Table XV. For the period 1954-59, the impact of the independent variables on changes in net demand deposits of three classes of banks, namely, central Reserve city, Reserve city and country banks, were studied and the regressions based on the upswing and downswing observations are given in Tables XVI and XVII. It was pointed out that changes in monetary policy did not coincide with the turning points in the cycle. An attempt was therefore made to study the reactions of banks strictly during a period of

²¹Karaken and Solow, op. cit., p. 70.

TABLE XIII
Results of regressions of changes in net demand deposits
1960 - 63 upswing observations (n = 79)
Regression coefficient (top line) and standard error (bottom line)

Variable	Country	R. City	Country	R. City	Country	R. City	Country	R. City	Country	R. City
ΔR_t	1.131 (.124)	3.602 (.298)	1.126 (.122)	3.635 (.293)	1.118 (.121)	3.640 (.289)	1.142 (.124)	3.719 (.327)		
ΔR_{t-1}	.339 (.124)	.172 (.297)	.336 (.122)	.195 (.294)	.337 (.122)	.194 (.292)	.294 (.123)	-.020 (.324)		
ΔR_{t-2}	.138 (.128)	-.211 (.306)	.141 (.126)	-.232 (.303)	.147 (.125)	-.235 (.300)	.161 (.128)	-.128 (.338)		
R_{t-3}	.032 (.135)	-.216 (.324)								
i	68.8	35.9	69.1	-37.5			111.9	185.0		
ΔB	.901 (.457)	4.845 (1.094)	.915 (.450)	4.756 (1.082)	.974 (.439)	4.724 (1.052)				
R_{t-1}	-.221 (.230)	-.024 (.551)	-.220 (.228)	-.026 (.549)	-.101 (.139)	-.091 (.334)	-.396 (.216)	-.942 (.568)		
Constant	-105.04	82.46	-106.02	89.06	67.37	-50.16	-197.36	-385.95		
$\sum_{i=0}^2 R_{t-i}$	1.608	3.563	1.603	3.598	1.602	3.599	1.597	3.571		
Total deposit multiplier	5.271		5.201		5.201		5.168			
$\bar{R}^2$	.579	.723	.584	.725	.587	.728	.566	.656		

TABLE XIV

Results of regressions of changes in net demand deposits

1960 - 63 downswing observations (n = 20)

Regression coefficient (top line) and standard error (bottom line)

Variable	Country	R. City	Country	R. City	Country	R. City	Country	R. City	Country	R. City
ΔP_t	1.097 (.270)	3.132 (.828)	1.083 (.252)	3.118 (.770)	1.114 (.250)	3.152 (.741)	1.049 (.261)	2.901 (.970)		
ΔR_{t-1}	-.012 (.363)	-.222 (1.110)	-.034 (.333)	-.245 (1.017)	.032 (.333)	-.242 (.985)	-.009 (.346)	-.084 (1.284)		
ΔR_{t-2}	.166 (.381)	-.371 (1.167)	-.017 (.330)	-.406 (1.009)	.091 (.332)	-.488 (.953)	-.112 (.337)	-1.013 (1.251)		
R_{t-3}	.070 (.349)	.074 (1.070)								
i	-241.81 (246.97)	-267.15 (756.53)	-239.57 (237.44)	-264.80 (726.26)			-239.92 (247.09)	-267.02 (170.85)		
ΔB	1.277 (.901)	8.120 (2.760)	1.275 (.867)	8.118 (2.652)	1.276 (.868)	8.119 (2.569)				
R_{t-1}	-.066 (.507)	.021 (1.554)	-.100 (.460)	-.015 (1.408)	-.391 (.359)	-.336 (1.062)	-.289 (.460)	-1.218 (1.708)		
Constant	573.28	807.99	590.79	826.38	94.15	277.45	625.95	1050.29		
$\sum_{i=0}^2 R_{t-i}$	1.251	2.539	1.032	2.467	1.237	2.422	.928	1.804		
Total deposit multiplier	3.790		3.499		3.659		2.732			
R^2	.443	.476	.484	.516	.483	.546	.441	.227		

TABLE XV
Results of regressions of changes in net demand deposits on "own" reserves
1960 - 63 upswing observations (n = 79)
Regression coefficient (top line) and standard error (bottom line)

Variable	Country	R. City	Country	R. City	Country	R. City
ΔR_t^j	3.409 (.348)	4.337 (.355)	3.427 (.334)	4.320 (.336)	3.438 (.291)	4.451 (.393)
ΔR_{t-1}^j	1.118 (.276)	-.038 (.365)	1.033 (.259)	-.023 (.349)	1.120 (.274)	.246 (.401)
ΔR_{t-2}^j	.234 (.274)	-.061 (.384)			.236 (.272)	-.035 (.426)
i	-51.160 (96.080)	3.810 (290.890)			-55.712 (90.831)	480.370 (297.672)
ΔB_t^j	-.372 (2.398)	4.949 (1.181)	-.871 (2.228)	5.237 (1.002)		
B_{t-1}^j	1.376 (2.072)	-.725 (1.376)			1.479 (1.950)	-3.635 (1.320)
Constant	23.041	30.024	47.146	-26.474	139.739	-1017.743
$\sum_{i=0}^2 R_{t-i}^j$	4.761	4.238	4.460	4.297	4.794	4.662
R^2	.697	.715	.705	.724	.701	.648

TABLE XVI

Results of regressions of changes in net demand deposits
1954 - 59 upswing observations (n = 108)
Regression coefficient (top line) and standard error (bottom line)

Variable	Country	R.City	C.R.City	Country	P.City	C.R.City	Country	R.City	C.R.City
ΔR_t	.652 (.094)	1.492 (.127)	1.484 (.107)	.669 (.094)	1.492 (.126)	1.483 (.107)	.719 (.082)	1.304 (.104)	1.480 (.100)
ΔR_{t-1}	.122 (.084)	.234 (.105)	-.074 (.109)	.112 (.084)	.234 (.103)	-.0723 (.107)	.120 (.083)	.253 (.106)	-.025 (.193)
ΔR_{t-2}	.091 (.083)	-.013 (.103)	-.282 (.107)	.102 (.083)	-.0132 (.102)	-.282 (.106)	.100 (.083)	-.017 (.105)	-.346 (.110)
i	29.057 (34.387)	-18.287 (39.62)	-.803 (34.61)	-6.205 (22.337)	-19.114 (27.578)	1.013 (28.428)			
ΔB^j	-1.109 (.809)	1.102 (.446)	.849 (.243)	-.908 (.798)	1.103 (.441)	.845 (.238)			
B_{t-1}^j	-.666 (.494)	-.0067 (.232)	.0211 (.227)				-.295 (.318)	-.121 (.164)	-.084 (.194)
Constant	92.68	83.051	.522	85.669	82.96	.0055	109.150	82.233	2.480
$\sum_{i=0}^2 R_{t-i}$	.865	1.713	1.128	.883	1.713	1.129	.939	1.540	1.109
		3.706			3.725			2.588	
R^2	.44	.61	.65	.44	.61	.65	.44	.59	.61

TABLE XVII
Results of regressions of changes in net demand deposits
1954 - 59 downswing observations ($n = 35$)
Regression coefficient (top line) and standard error (bottom line)

Variable	Country	R.City	C.R.City	Country	R.City	C.R.City	Country	R.City	C.R.City
ΔR_t	.179 (.151)	.880 (.195)	.585 (.216)	.204 (.152)	.925 (.198)	.611 (.214)	.285 (.145)	.763 (.216)	.530 (.210)
ΔR_{t-1}	.198 (.155)	.365 (.200)	.110 (.226)	.146 (.151)	.362 (.206)	.081 (.22)	.144 (.157)	.396 (.232)	.125 (.226)
ΔR_{t-2}	.024 (.138)	.076 (.188)	-.149 (.209)	.029 (.138)	.128 (.190)	-.122 (.208)	.037 (.143)	.079 (.214)	-.169 (.207)
i	98.721	192.61 (142.15)	63.93 (130.57)	25.287 (39.119)	-17.24 (53.18)	-49.607 (57.68)			
ΔB_t^j	-4.247 (2.208)	2.032 (.604)	.998 (.709)	-2.713 (1.186)	1.918 (.615)	1.079 (.703)			
B_{t-1}^j	-1.794 (1.421)	-1.320 (.832)	-1.079 (1.11)				.339 (.747)	-.281 (.351)	-.648 (.493)
Constant	-48.167	-36.002	4.250	-89.468	47.82	81.85	-68.113	59.91	67.05
$\sum_{t=0}^2 R_t - i$	.401	1.241	.446	.479	1.415	.570	.467	1.238	.486
Total deposit multiplier		1.828			2.464			2.191	
$\bar{R}^2$	.07	.41	.15	.06	.38	.15	.01	.21	.14

TABLE XVIII
Results of regression of changes in net demand deposits
November 1954 - December 1957 (n = 70)
Regression coefficient (top line) and standard error (bottom line)

Variable	Country	R.City	C.R.City	Country	R.City	C.R.City	Country	R.City	C.R.City
ΔR_t	.620 (.096)	1.442 (.171)	1.314 (.131)	.620 (.093)	1.435 (.108)	1.314 (.128)	.719 (.085)	1.110 (.136)	1.111 (.136)
ΔR_{t-1}	.094 (.087)	.139 (.141)	-.077 (.133)	.085 (.083)	.136 (.130)	.0589 (.123)	.082 (.089)	.202 (.147)	-.034 (.149)
ΔR_{t-2}	.091 (.084)	.127 (.128)	-.192 (.121)	.093 (.082)	.120 (.126)	-.192 (.120)	.113 (.084)	.108 (.134)	-.226 (.136)
i	-1.137 (35.91)	-32.008 (56.28)	-1.21 (52.6)						
ΔB_t^j	-1.828 (.850)	1.576 (.54)	1.117 (.25)	-1.747 (.807)	1.581 (.533)	1.098 (.248)			
B_{t-1}^j	-.206 (.509)	.068 (.32)	.117 (.290)				.0221 (.485)	-.078 (.275)	-.050 (.266)
Constant	70.704	63.804	-38.038	39.387	8.511	-12.859	35.828	38.599	-2.567
$\sum_{i=0}^2 R_t - i$	.805	1.708	1.043	.798	1.691	1.063	.914	1.420	.851
Total deposit multiplier		3.556			3.552			3.185	
R^2	.56	.56	.60	.57	.57	.62	.54	.51	.51

TABLE XIX

Results of regressions of changes in net demand deposits
1954 - 59 Seasonally adjusted upswing observations (n = 108)
Regression coefficient (top line) and standard error (bottom line)

Variable	Country	R.City	C.R.City	Country	R.City	C.R.City	Country	R.City	C.R.City
ΔR_t	.379 (.085)	1.042 (.124)	1.177 (.133)	.391 (.086)	1.046 (.122)	1.179 (.132)	.421 (.079)	.897 (.125)	1.166 (.134)
ΔR_{t-1}	.005 (.080)	.125 (.124)	.086 (.137)	.018 (.819)	.127 (.120)	.094 (.135)	.006 (.081)	.056 (.130)	.049 (.137)
ΔR_{t-2}	-.123 (.070)	-.042 (.119)	-.199 (.129)	-.099 (.077)	-.031 (.113)	-.185 (.126)	-.108 (.076)	-.129 (.122)	-.229 (.129)
i	-33.45 (25.40)	-30.24 (29.3)	-11.61 (28.9)						
ΔB^j	-.645 (.721)	1.002 (.250)	.391 (.177)	-.553 (.713)	.997 (.244)	.409 (.155)			
B_{t-1}^j	.078 (.370)	-.056 (.160)	-.0324 (.160)				-.290 (.195)	-.186 (.115)	-.188 (.123)
Constant	128.988	87.947	32.56	58.899	32.878	-2.402	99.196	102.043	38.07
$\sum_{i=0}^2 R_{t-i}$	.261	1.125	1.064	.310	1.142	1.088	.319	.824	.986
Total deposit multiplier		2.450			2.530			2.129	
$\bar{R}^2$	.209	.401	.433	.192	.405	.442	.205	.351	.363

TABLE XX

Results of regressions of changes in net demand deposits
1954 - 59 Seasonally adjusted downswing observations ($n = 35$)
Regression coefficient (top line) and standard error (bottom line)

Variable	Country	R.City	C.R.City	Country	R.City	C.R.City	Country	R.City	C.R.City
ΔR_t	.340 (.161)	.905 (.194)	1.108 (.234)	.366 (.154)	.931 (.184)	1.097 (.219)	.343 (.144)	.820 (.197)	1.051 (.230)
ΔR_{t-1}	.128 (.145)	.055 (.185)	-.035 (.220)	.144 (.135)	.099 (.171)	-.043 (.208)	.125 (.141)	.043 (.191)	-.015 (.223)
ΔR_{t-2}	-.108 (.152)	-.070 (.193)	.147 (.232)	-.085 (.143)	-.048 (.184)	.137 (.218)	-.098 (.146)	-.040 (.199)	.156 (.231)
i	-.45.930 (82.75)	48.510 (84.72)	10.884 (88.50)						
ΔB_t^j	.684 (1.728)	.893 (.572)	1.094 (.769)	.402 (1.440)	1.149 (.477)	1.090 (.656)			
B_{t-1}^j	.650 (1.580)	-.418 (.541)	-.043 (.680)				-.211 (.434)	-.264 (.191)	-.138 (.269)
Constant	3.053	20.238	-57.280	-23.660	22.520	-40.180	-7.273	70.020	-36.030
$\sum_{i=0}^j R_{t-i}$	.360	.890	1.220	.425	.982	1.191	.371	.823	1.192
Total deposit multiplier		2.470			2.598			2.386	
$\bar{R}^2$	.041	.396	.371	.090	.421	.412	.094	.352	.363

Description of Symbols:

ΔR = changes in aggregate unborrowed reserves per period in millions of dollars.

i = interest rate.

B = level of outstanding borrowings in millions of dollars.

ΔB = changes in borrowings per period in millions of dollars.

Subscript t = time.

Superscript j = variable relevant to the class of bank for which equations are estimated.

(Net demand deposits are also measured in millions of dollars.)

Source of Data: J. L. releases of the Board of Governors of the Federal Reserve System

"Deposits, Reserves and Borrowings of Member Banks."

The upswing observations of 1954 - 59 include observations from August 1954 to June 1957, and from May 1958 to December 1959. The downswing observations include observations from January 1954 to July 1954, and from July 1957 to April 1958. The upswing observations of 1960 - 63 include observations from January 13, 1960 to May 4, 1960 and from February 22, 1961 to October 30, 1963. The downswing observations include observations from May 18, 1960 to February 21, 1961.

tight money. The period chosen was December 1954 to November 1957 and the regressions based on these 70 semi-monthly observations are given in Table XVIII. With a view to studying the responses of banks to the 'dynamic' elements in changes in reserves, the data on all the variables for the period 1954-59 were seasonally adjusted and the equations calculated, using these seasonally adjusted data, for the upswings and downswings are given respectively in Tables XIX and XX.

IV Conclusions²²

A. Response to changes in aggregate unborrowed reserves

The equations estimated showed that the reactions of banks to changes in aggregate unborrowed reserves was prompt. For all classes of banks, the most important factor influencing the changes in demand deposits in any given period appears to have been the changes in unborrowed reserves of the same period. Changes in unborrowed reserves of the preceding periods also have a positive effect on changes in deposits of a given period in country banks, indicating a lagged response on their part to changes in reserves.

In the case of central Reserve city banks, which were treated as a separate class in the analysis for the years 1954-59, the entire positive effect of changes in reserves on deposits was felt in the same period as the change in reserves, i.e., of all the reserve variables current and lagged, only the coefficient for current period changes in reserves (ΔR_t)

²²The results that are being summarized here are based mainly on the equations computed using upswing observations. Equations relating to the downswings did not turn out with many significant coefficients. Attention is drawn, however, when important differences between the results of the two phases of the cycles are noticed.

was positive (Table XVI). The coefficient for ΔR_{t-2} (changes in reserves lagged two periods) was negative and statistically significant.²³ This appears to indicate that central Reserve city banks expanded their earning assets and therefore their deposits rapidly in response to changes in reserves, but as these deposits were used up, part of their reserves and deposits were lost to other segments of the banking system in the subsequent periods. This is an interesting result in as much as it throws light on the flow of reserves and deposits in the banking system.

Changes in unborrowed reserves of the current as well as the preceding period, i.e., ΔR_t and ΔR_{t-1} , induced positive changes in demand deposits of the second category of banks, Reserve city banks, during 1954-59. The coefficients for both the reserve variables were positive and significant (Table XVI), implying a one-period lag in the response to changes in reserves. About 88% of their total reaction to changes in unborrowed reserves occurred in the same period as the change itself; the balance in the following period.²⁴

In the case of country banks, a lagged response to changes in reserves was noticeable during both 1954-59 and 1960-63. The lag was longer,

²³The term 'significant' is used here and elsewhere only in the technical sense, i.e., a coefficient is described as significant if as large a value would have been obtained by chance in less than 5 per cent of the time.

²⁴No such lagged response was discernible in the findings for the period 1960-63. The difference is probably attributable to the fact that banks formerly classified as central Reserve city banks and Reserve city banks were brought under one category of Reserve city banks. The effect

however, by one period in the earlier than in the later years.²⁵ For country banks during 1954-59, the coefficients for ΔR_t , ΔR_{t-1} , and ΔR_{t-2} were positive. This signifies that changes in demand deposits were influenced by and in the same direction as changes in reserves of the current and two preceding periods. Only the coefficient for the current period changes in reserves (ΔR_t), however, was statistically significant, accounting for 75 per cent of the total reaction to changes in reserves.

The coefficients for the lagged reserve variables were not significant. The high standard errors of the coefficients for these variables may have been caused by multicollinearity, i.e., inter-correlation among explanatory variables. In fact when changes in demand deposits were regressed on ΔR_{t-2} alone, the coefficient for this variable was positive and significant. This also ties in with the fact that the coefficient for ΔR_{t-2} was negative for central Reserve city banks. This finding goes to strengthen the point made earlier that as the expansion process cumulates, the central Reserve city banks lose part of their reserves and deposits to other banks, particularly country banks.

During 1960-63, there was only a one-period lag in the response of country banks to changes in reserves. The coefficients for ΔR_t as well as that for ΔR_{t-1} were positive and significant (Table VIII). About 70 per cent of their total reaction to changes in reserves came in the same period as the change in reserves and the rest in the following period.

It is seen from this investigation that changes in demand deposits

²⁵It may be worth recalling that an interval of two weeks constituted a period during 1960-63 whereas the interval of a period was half-a-month during 1954-59.

that occur in the same period as the changes in unborrowed reserves constitute an overwhelming proportion of the total reaction of banks. A lag in the response to changes in reserves is also noticed and is accounted for by country banks and by banks classified prior to 1962 as Reserve city banks. At the time when central Reserve city banks were treated separately, it took half a month or less for the full effect of changes in reserves to be reflected on the demand deposits of these banks. In the case of Reserve city banks, it took between half a month and one month and in the case of country banks, a little longer than a month.

The response of deposits to changes in reserves manifests itself not only in terms of timing, i.e., with or without lag, but also of magnitude. The magnitude of response, otherwise referred to as the deposit multiplier, is measured by the size of change in demand deposits resulting from a unit change in unborrowed reserves. If the actual deposit multiplier is less than the potential multiplier during a period of expansion of reserves, it means that part of the increase in reserves is held as excess reserves, while such a difference during a period of contraction of reserves means that banks are using the excess reserves held previously.

During the period 1960-63, the size of deposit multiplier was 5.271 during the upswing and 3.790 during the downswing.²⁶ The value for the upswing was slightly less than the maximum possible deposit multiplier

²⁶The value of the deposit multiplier was calculated by adding the coefficients for ΔR_t , ΔR_{t-1} and ΔR_{t-2} for both Reserve city banks and country banks. For example, during the downswing the values of the coefficients for the Reserve city banks for ΔR_t , ΔR_{t-1} , and ΔR_{t-2} were 3.132, -0.222, and -0.371 and the corresponding values for the country banks were 1.097, -0.012 and 0.166 (Table II). The addition of all these coefficients gives a value of 3.790.

of at least 6.06, based upon a uniform reserve requirement of 16%, while the value for the downswing was very much below that of the potential multiplier. In the period 1954-59, the size of the deposit multiplier was 3.706 for the upswings and 2.156 for the downswings. These values are not only less than the potential multiplier but are also very much less than the corresponding values for 1960-63. Three reasons may be suggested for the lower values of the deposit multiplier during 1954-59. First, since all of vault cash can be treated as legal reserves since 1960 on, the multiplier in the later period becomes larger. But this cannot contribute much to the difference in the magnitudes of the multiplier since the proportion of total reserves held as vault cash is no more than 10 per cent. Second, the minimum reserve requirements were higher during the period 1954-59 than in the later period. The unborrowed reserves for the period 1954-59 were adjusted to a uniform requirement of 20 per cent for central Reserve city banks, 18 per cent for Reserve city banks, and 12 per cent for country banks, while for the period 1960-63, they were 16.5 per cent for Reserve city banks and 12 per cent for country banks. Third, and probably most important from the point of view of the impact of monetary policy, there was a smaller flow of new reserves to country banks during 1954-59, contributing again to a lower deposit multiplier. The equations computed to determine the size and speed of the flow of new reserves to country banks showed that between 1960 and 1963, 33 per cent of the new reserves went to country banks, while between 1954 and 1959, 23 per cent of the new reserves reached country banks. The equations com-

puted are:

(1960-63)

$$\Delta R_t^c = 6.530 + 0.284 \Delta R_t + 0.014 \Delta R_{t-1} + .0389 \Delta R_{t-2}$$

(.0311) (.032) (.0326)

$$\bar{R}^2 = .45$$

(1954-59)

$$\Delta R_t^c = 2.264 + .153 \Delta R_t + 0.044 \Delta R_{t-1} + 0.0418 \Delta R_{t-2}$$

(.0212) (.022) (.021)

$$\bar{R}^2 = .27$$

where ΔR_t^c stands changes in unborrowed reserves of country banks.

This finding on the changing pattern of distribution of reserves has serious implications from the point of view of implementation of monetary policy.

B. Impact of interest rate

It was argued in the theoretical section that the rate of interest would have a positive effect on changes in demand deposits since the estimating functions were supply functions. The empirical results do not show that interest rate is a determining factor of changes in demand deposits. In none of the equations computed was the coefficient for interest rate significant. This was true of both periods as well as for the upswing and downswing phases of the cycle.

Some reasons may be offered for the failure of interest rate to emerge as a significant variable in the statistical estimation. The separation of the observations according to the phase of the business cycle may have partly taken away the effect of interest rate. Another reason for the insignificance of the interest rate may be that its influence is hidden in the coefficient for changes in reserves of the current period (ΔR_t). A rise in the rate of interest may lead to a fuller response to

changes in the reserves of any given period, resulting in a higher coefficient for ΔR_t . This argument is similar to the one put forward by Robert Eisner on the role of interest rate in a distributed lag investment function. Eisner wrote:

The role of the rate of time discount or interest rate in such a model is expressed primarily in the accelerator coefficients which in turn derive their effect from changes in demand The immediate effect of an interest rate change in so far as the acceleration principle is concerned will of course be felt only because the non-lagged accelerator coefficient changes.²⁷

C. Impact of borrowing

The level of outstanding borrowing appears to have a negative influence on changes in demand deposits. The coefficient for this variable, B_{t-1} , was negative in most of the equations computed, though it was not statistically significant. The problem of multicollinearity turns up in this context also, accounting to some extent for the insignificance of the coefficient. Changes in borrowings are correlated with the level of outstanding borrowings and therefore regressions were computed with only one of these two included as an explanatory variable. Then it is seen that the coefficient for B_{t-1} turns close to being significant for Reserve city banks during the upswing phase of 1960-63 (Table VIII), while the coefficient continues to be insignificant for the period 1954-59.

A positive association between changes in borrowings and changes in demand deposits was noticeable in the case of central Reserve city and Reserve city banks during both phases of the cycle in the two periods. The

²⁷Robert Eisner and Robert H. Stortz, "Determinants of Business Investment," Impacts of Monetary Policy, (Englewood Cliffs: Prentice Hall, 1963), p. 123.

coefficient for this variable was mostly negative for country banks but was not significant in any of the equations. Since country banks borrow very little it is not surprising that their borrowing did not have a noticeable impact on deposits.

The really surprising aspect of the result is the difference in the value of the coefficient for B between two periods. During the upswing phase of 1954-59, the values of the coefficients for the central Reserve city and Reserve city banks were .849 and 1.102 respectively. These values were much smaller than the figure of 4.845 for the Reserve city banks during the period 1960-63. The higher reserve requirement of the earlier period explains the difference only to a small extent. Banks borrowed very heavily during 1954-59 compared to the later years. The average level of outstanding borrowings during the upswing phase of the business cycle in the period 1954-59 was \$632.29 million; the average of semi-monthly changes in borrowings was \$17.40 million. For the corresponding phase in 1960-63, the average level of outstanding borrowings was \$183.62 million and the average of bi-weekly changes in borrowings was \$-3.12 million, i.e., there was a net reduction in indebtedness. The asymmetry between the responses to expansion and to contraction of reserves may also account for the difference in value of the coefficient for change in borrowings between the two periods. Nevertheless, the strikingly different coefficients for the two periods stress the difficulty in establishing a stable relationship between borrowings and deposits. The motivations for member bank borrowing are discussed in the Appendix to this chapter.

D. The total effect of the explanatory variables

The independent variables chosen, i.e., changes in aggregate un-borrowed reserves of the current and the two preceding periods, interest rate and the level of outstanding borrowings, were able to explain more of the variation in net demand deposits of Reserve city banks than of country banks. The $\bar{R}^2$ of the equations indicate the percentage of variance in net demand deposits accounted for by the equations.

For the period 1954-59, during the upswings, the relevant equations accounted for 61.5 per cent, 59.5 per cent and 43.8 per cent of the variance in net demand deposits of the central Reserve city, Reserve city and country banks respectively. For the period 1960-63, the $\bar{R}^2$ of the equations for Reserve city and country banks, respectively, were 65.6 per cent and 56.6 per cent. The corresponding values for the downswings were low in both periods.

The percentage of variance in net demand deposits explained was particularly low in the case of country banks during the period 1954-59. Even an alternate formulation which substituted net demand deposits by a new dependent variable which was the sum of net demand deposits and demand balances due from banks, did not improve the fit of the equation, i.e., the strength of the relationship. The low explanation of changes in net demand deposits is probably due to the shifting pattern in the flow of new reserves among different classes of banks even within each period separately studied.

E. Response to changes in 'own' reserves

It was pointed out in the theoretical section that changes in demand deposits of different classes of banks could be studied either as a response to changes in aggregate un-borrowed reserves or as a response to changes in

their 'own' reserves, i.e., reserves held by the respective class of banks. The former approach was preferred over the latter for the reason indicated earlier and the empirical findings discussed so far were based on equations using this approach. The response of banks to changes in their 'own' reserves was, however, studied using the upswing observations of 1960-63 to see if any additional light was thrown on the nature of lags.

The reactions of banks to changes in their 'own' reserves were quite similar to their reactions to changes in aggregate reserves. (Compare Tables I and III.) In the case of Reserve city banks, all the positive effect on net demand deposits came in the same period as the change in un-borrowed reserves. In the case of country banks, 75 per cent of their total response occurred in the same period as the change in un-borrowed reserves and the balance in the following period. A lagged response was clear as evidenced by the highly significant positive coefficient for ΔR_{t-1} . The lag in response to changes in aggregate reserves (which was noted earlier) is in part explained by the time taken for the transmission of reserves from the leading financial centers where changes in reserves occur initially, to country banks. But the presence of a lagged response even to changes in 'own' reserves goes to strengthen the argument that the time lag may also be due to the inability of country banks located far away from financial centers to convert their reserves into earning assets immediately.

The deposit-reserve ratio²⁸ was approximately 4.66 for Reserve city banks and 4.79 for country banks. Thus, in spite of the lower reserve re-

²⁸The use of the term 'deposit multiplier' in relation to a class of banks may not be legitimate. Hence, the introduction of the term 'deposit-reserve ratio.'

quirements, the country banks' ratio was only slightly higher, indicating on the part of country banks a greater tendency to maintain excess reserves.

F. Response to 'dynamic' elements in unborrowed reserves

The responses of banks to the 'dynamic' elements of changes in unborrowed reserves were studied by using seasonally adjusted data on all the variables. The period studied was 1954-59. It was expected that since a lag in the response of banks was found to changes in reserves that included both seasonal and 'dynamic' elements, if anything, the seasonally adjusted data would confirm the existence of lags. But the results obtained were disappointing; most of the coefficients turned out to be insignificant.

Changes in demand deposits induced by changes in unborrowed reserves of the same period were positive in all types of banks during both the upswings and downswings of the cycle, i.e., the coefficient of ΔR_t was positive and significant in all the equations (Tables XIX and XX). But none of the lagged reserve variables had a significant coefficient. Thus no lagged response to the 'dynamic' component of changes in reserves was established by our tests. The magnitude of response with seasonal adjustment was smaller than that without the adjustment. The deposit multiplier was 2.69 for the upswings and 2.18 for the downswings. The only other variable that had a significant effect on demand deposits was the change in borrowings. The coefficient was positive and significant for central Reserve city banks and Reserve city banks but its value for the central Reserve city banks (.391) was very small. Thus the efforts to isolate the response of banks to the purely policy changes in reserves through the use of seasonally adjusted data did not prove very fruitful.

not of changes in banks' borrowings from the Federal Reserve.

G. Response of banks during a period of strict tight money

As changes in monetary policy do not synchronize with turning points in the business cycle, the separation of observations according to the phase of the business cycle only approximately groups them into periods of tight money and easy money. Therefore, the responses of banks during the period August 1954 - November 1957 which could be regarded strictly as a period of tight money was studied.

The results obtained (Table XVIII) were not different from the ones for the upswing observations of 1954-59. The only important difference noted was the absence of a lagged response on the part of Reserve city banks, i.e., ΔR_{t-1} was not significant for the period August 1954 - November 1957 while it was for the upswing observations of 1954-59. The magnitude of deposit multiplier was more or less the same for these two periods and the impact of borrowing was also quite similar.

H. Summary

This investigation has shown that it takes about a month and a half for the full effect of changes in unborrowed reserves to be reflected on demand deposits. A very high proportion (about 80 per cent) of the total effect on deposits occurs in the same semi-monthly period as the change in unborrowed reserves. The lagged response of country banks appears to be, in part, due to the delay in the transmission of reserves to country banks from the leading financial centers. There is also evidence to show that the pattern of distribution of new reserves among different classes of banks changes from period to period. The magnitude of the deposit multiplier for the banking system differs between the two periods 1954-59 and 1960-63; it is larger in the latter period. A similar difference is noticeable in the impact of changes in banks' borrowings from the Federal Reserve.

A difference is also seen between the banks' reaction during the upswing and downswing phases of the business cycle. The magnitude of response during the downswing is smaller.

Changes in member bank borrowing or loaned deposits during the course of the chapter and a difference was noticed in the reaction between the two periods 1954-59 and 1960-63. To explain the difference, it is necessary to analyse the determinants of member bank borrowing.

Theories of borrowing

Two commonly known explanations of the factors influencing borrowing are known under the names of 'need theory' and 'profit theory'. The 'need theory' rests on the premise that banks are reluctant to borrow unless they need it. Therefore, they borrow only when they need and the volume of borrowing is affected very little by profitability or cost of borrowing. The 'profit theory', on the other hand, holds that member banks borrow from the reserve banks when it is profitable to do so, i.e., when the rate of interest is higher than the discount rate, and repay when it is unprofitable.

The development of the 'need theory' was Winfield Baifler. He does not detail the reasons for his preference for this theory. In his view, there are two types of situations that force borrowing. The first includes the "requirements of the member banks in agricultural or other communities where seasonal fluctuations in the demand for banking accommodation are large."² The

² Baifler, *Money, Interest and Money Markets in the United States*, p. 11.

² Baifler, *Money, Interest and Money Markets in the United States*, p. 11. (The same source is cited in the text.)

APPENDIX TO CHAPTER III

DETERMINANTS OF MEMBER BANK BORROWING

The impact of changes in member bank borrowing on demand deposits was examined in the course of the chapter and a difference was noticed in the magnitude of reaction between the two periods 1954-59 and 1960-63. To appreciate fully the causes for the difference, it is necessary to analyse in some detail the determinants of member bank borrowing.

I Theories of Borrowing

The two most widely known explanations of the factors influencing member bank borrowing go under the names of 'need theory' and 'profit theory.' The 'need theory' rests on the premise that banks are reluctant to be in debt. Therefore, they borrow only when they must and the volume of their borrowings is affected very little by profitability or cost of borrowing. The 'profit theory,' on the other hand, holds that member banks borrow from the Reserve banks when it is profitable to do so, i.e., when market rate of interest is higher than the discount rate, and repay the borrowings when it is unprofitable.

The leading exponent of the 'need theory' was Winfield Reifler who set forth in great detail the reasons for his preference for this theory. According to him, there are two types of situations that force banks to borrow. The first includes the "requirements of the smaller member banks located in agricultural or other communities where seasonal fluctuations in the demand for banking accommodation are large."¹ The

¹Winfield W. Reifler, Money Rates and Money Markets in the United States, (New York: Harper & Brothers, 1930), p. 31.

second relates to "requirements of larger city member banks where seasonal fluctuations are not so pronounced. The borrowings of these banks has generally been repaid at the end of a few days and has arisen not out of the desire to extend new loans but out of the necessity for replenishing temporary deficits in reserves."² In both of these cases "the typical motivation for borrowing at the Reserve banks has arisen primarily out of the needs either of the bank itself or of its customers and not out of any differential which may have existed between discount rates and money rates in the open markets."³ To vindicate his position that member bank borrowing was not governed by opportunities for profit, Reifler showed that between 1917 and 1928 open market rates had frequently deviated widely and for long periods from discount rates.

At the core of the need theory lies the definition of the term 'need.' If the term is taken to include "the needs of the customers," it does not become clear where the need theory ends and the profit theory begins. The assumption that member bank borrowing was not influenced by interest rate was challenged, among others, by Robert Turner. He correlated the volume of borrowing with the spread between the discount rate and various market rates of interest by month for the period 1922 and 1936 for the system as a whole and for individual Federal Reserve Districts and came to the conclusion that the "profit theory appears to offer a partial explanation of changes in the volume of borrowings . . . While borrowings have tended to increase as the profit spread increased there seems to be

²Ibid., p. 31.

³Ibid., p. 32.

a limit beyond which borrowings do not readily go, in spite of further increases in the profit spread."⁴

There is one common ground between the two theories. 'Tradition against borrowing' is an element common to both theories with the difference that this factor is the very basis of the need theory while it plays only a limiting role in the profit theory. In practical terms, this tradition is reflected in the behaviour of banks in two ways: one, as the volume of outstanding borrowing increases, banks are reluctant to borrow more; second, as the total reserves of banks increase because of gold flows, open market operations, etc., banks utilize part of the increased reserves in reducing their indebtedness to the system. The profit theory would, however, claim that this reluctance to borrow can be overcome provided the profits to be obtained from borrowing are sufficiently attractive. If the elements stressed by both theories are combined, the generalized theory of borrowing might be stated as follows:

$$\Delta B_t = f [\Delta R_t, B_{t-1}, (i_m - i_d) t]$$

where i_m = market rate on paper the bank might liquidate to obtain reserves
 i_d = discount rate

and other symbols as indicated in the chapter. Under this formulation,

$\frac{\partial(\Delta B_t)}{\partial(\Delta R_t)}$ and $\frac{\partial(\Delta B_t)}{\partial B_{t-1}}$ would be negative for reasons already indicated.

⁴Robert C. Turner, Member Bank Borrowing, (Columbus: The Ohio State University Press, 1938), p. 143. For a detailed account of the controversy on this question see James Meigs, Free Reserves and the Money Supply, pp. 7-30; M. E. Polakoff, "Reluctance Elasticity Least Cost and Member Bank Borrowing: A Suggested Integration," Journal of Finance, XV, March 1960, pp. 1-18; Warren L. Smith, "The Instruments of General Monetary Control," National Banking Review, Vol. I, No. 1, September 1963, pp. 50-54.

$\frac{\partial \Delta_B}{\partial (i_m - i_d)}$ would be positive, if the profit theory held good.

II The Analysis of Member Bank Borrowing 1954-59 and 1960-63

A. General observations on the relationship between borrowing and the explanatory variables

Changes in unborrowed reserves. Focusing attention first on the period 1954-59, it is seen that changes in unborrowed reserves and member bank borrowing generally moved in the opposite direction. In the case of central Reserve city banks, only in 38 of the 144 semi-monthly observations did changes in their unborrowed reserves and borrowings move in the same direction. For Reserve city banks and country banks they moved in the same direction on fewer occasions. This indicates that at least during this period banks increased their borrowings when they lost reserves and repaid their borrowings when they gained reserves. In contrast was the behaviour during 1960-63. Of the 100 bi-weekly observations between January 1960 and October 1963, in the case of both Reserve city banks and country banks, changes in unborrowed reserves and their borrowings moved in the same direction on 42 occasions. The negative impact of changes in reserves on borrowings appeared to be limited during this period.

Level of outstanding borrowings. The level of outstanding borrowing in both these periods had clearly a negative effect on current period borrowings. The effect of outstanding borrowings on borrowings during the current period had to be inferred from the movement of outstanding borrowings themselves. The level of borrowings did not show a continuous rise for any class of banks during these two periods. The longest continuous rise covered only three semi-monthly or bi-weekly periods and even such periods of rise were rare. Usually any rise in the level during a period

was followed by a fall in the next period. The desire not to be in debt appears to be a strong force acting on the behaviour of banks.

Profit spread. Profit spread was measured by the difference between market yield on three months' Treasury bill and the discount rate. The market yield on Treasury bill was chosen since the Treasury bill was the paper a bank was most likely to sell in order to obtain reserves as an alternative to borrowing. From September 1960 to the middle of 1963, the discount rate remained unaltered at 3%. During the period 1960-63, the market yield on Treasury bill was less than the discount rate except during two bi-weekly periods. The period 1954-59 saw big jumps in the discount rate and the Treasury bill rate. There were occasions when the profit spread was positive as well as negative. The discount rate of the Federal Reserve Bank of New York rose from $1\frac{1}{8}\%$ in mid 1954 to $3\frac{1}{2}\%$ in August 1957. Bill rate rose from $\frac{1}{4}$ of 1 per cent in mid 1954 to over $3\frac{1}{2}\%$ in late 1957. In consequence, the discount rate which had been $\frac{1}{4}$ of 1 per cent above the bill rate in mid 1954 was only $\frac{3}{8}$ of 1 per cent above in July 1956 and $\frac{1}{8}$ of 1 per cent below it October 1957. The profit spread ranged from -1.139 to +.866. By looking at the set of observations between profit spread and member-bank borrowing, it did not appear that there was any relationship between the two. In a situation where a particular variable is determined by more than one factor, a two dimensional picture depicting the relationship between the dependent and one of the explanatory variables does not always clearly indicate the extent of association between the two.

... were respectively .35, .43 and .20. This
... reserves increased by \$1 million, the

... city and country banks would respectively

... by \$360,000, \$411,000 and \$200,000. But this

B. Estimates of the effects of explanatory variables

The results of the regression analysis showed that changes in un-borrowed reserves had a strong negative effect on the borrowings of the three classes of banks during the period 1954-59 while this negative influence was felt only by country banks during 1960-63. The level of outstanding borrowings had a decisive negative effect on borrowings of all classes of banks during both periods. The profit spread had a very mild positive effect on the three classes of banks during the period 1954-59 but had no effect either on Reserve city banks or country banks during 1960-63.

Borrowings from the Federal Reserve Banks by different classes of banks were estimated by using the following relationship:

$$\Delta B_t^j = \alpha_0 + \alpha_1 \Delta R_t^j + \alpha_2 B_{t-1}^j + \alpha_3 (i_m - i_d) + u_t$$

where j refers to the class of bank and other symbols as indicated earlier. Separate equations were estimated for the two periods 1954-59 and 1960-63. The data used were the 144 semi-monthly observations from the beginning of 1954 to the end of 1959 and the 103 bi-weekly observations from the beginning of 1960 to the end of October 1963. The estimated equations are given in Table I.

Changes in unborrowed reserves. Changes in unborrowed reserves had a negative effect on the borrowing of all three classes of banks during 1954-59. The values of the coefficient for the central Reserve city, Reserve city and country banks were respectively .36, .43 and .20. This means that if their unborrowed reserves increased by \$1 million, the central Reserve city, Reserve city and country banks would respectively reduce their borrowings by \$360,000, \$430,000 and \$200,000. But this

Table XXI

Regressions of changes in borrowings

1954-59

$$\Delta B^{crc} = 66.605 - .3689 \Delta R_t^{crc} - .3444 B_{t-1}^{crc} + 55.19 (i_m - i_d) \\ (.0508) \quad (.0587) \\ \bar{R}^2 = .393$$

$$\Delta B^{rc} = 43.189 - .4390 \Delta R_t^{rc} - .1141 B_{t-1}^{rc} + 35.77 (i_m - i_d) \\ (.0386) \quad (.0349) \\ \bar{R}^2 = .524$$

$$\Delta B^c = 18.320 - .2011 \Delta R_t^c - .1038 B_{t-1}^c + 16.22 (i_m - i_d) \\ (.034) \quad (.034) \\ \bar{R}^2 = .395$$

1960-63

$$\Delta B^{rc} = 21.87 - .0152 \Delta R_t^{rc} - .1953 B_{t-1}^{rc} + 10.623 (i_m - i_d) \\ (.0342) \quad (.0438) \\ \bar{R}^2 = .153$$

$$\Delta B^c = 9.515 - .0891 \Delta R_t^c - .1564 B_{t-1}^c + 6.813 (i_m - i_d) \\ (.0155) \quad (.082) \\ \bar{R}^2 = .39$$

The superscripts crc, rc and c indicate that the variables refer to central Reserve city, Reserve city and country banks.

ΔB , B_{t-1} , ΔR are in millions of dollars.

negative impact was not seen on the borrowings of the Reserve city banks during ¹⁹⁶⁰⁻1963. The coefficient for this variable was not significant. In the case of the country banks, however, the coefficient was negative and significant but its value was only .08 which was smaller than the one for the earlier period. Though changes in unborrowed reserves have a negative effect on member-bank borrowing, the strength of its influence seems to vary considerably from one period to another.

Outstanding borrowing. The negative effect of outstanding borrowing is seen unmistakably. In all classes of banks and in both periods, the coefficient of the variable was negative and significant. The highest value of the coefficient was in the case of the central Reserve city banks during the period 1954-59.

Profit spread. The 'profit-spread' variable had a minor role to play in the explanation of member-bank borrowing.⁵ Its coefficient was positive and significant for all classes of banks during 1954-59. Its influence was greatest in the case of central Reserve city banks; an increase in the profit spread by 1 percentage point would lead to an increase in their borrowings by \$55.19 million. The coefficient for this variable was not significant either for country banks or for Reserve city banks during 1960-63.

C. Conclusions

Member bank borrowing was sought to be explained in terms of three variables: changes in unborrowed reserves, the level of outstanding borrowing and the profit spread. This generalized form of explanation

⁵This is shown by the fact that dropping the profit-spread variable reduced the $\bar{R}^2$ of the equations only very slightly.

combines the elements of both need theory and profit theory. The profit motive did not emerge as a significant factor in determining member-bank borrowing. The level of outstanding borrowings had a decisive negative influence. Changes in unborrowed reserves had a strong negative effect on borrowing during 1954-59.

These findings throw some additional light why changes in borrowing were associated with smaller changes in the volume of demand deposits in 1954-59 than in 1960-63. It appears that the dominant factor influencing borrowing during 1954-59 was the motive to offset or counteract changes in unborrowed reserves. This emergency nature of borrowed reserves might have tended to limit the volume of deposits that could be supported by such reserves. For the period 1960-63, no single factor emerged as an important force determining member-bank borrowing, particularly in the case of Reserve city banks. As pointed out in the course of the chapter, during this period, the volume of borrowing was very limited and banks repaid their loans leading to a net reduction in indebtedness. Thus the loss of reserves through repayments, deliberately decided upon by banks, must have led to a reduction in deposits by a multiple determined by the then prevailing minimum reserve requirement.

CHAPTER IV

DEPOSIT VARIABILITY IN INDIVIDUAL BANKS

This chapter deals with inter-bank differences in variability in demand deposits, focusing attention on those characteristics of banks that account for such differences. It examines in particular the relationship between size of banks and variability in their demand deposits.¹ While the last two chapters were concerned with the behavior of banks in the aggregate, this and the following chapter are devoted to an examination of certain micro-economic relationships in banks.

It is appropriate first to note the difference in deposit experience between individual banks and the banking system. Deposit variability is expected to be higher in individual banks than in the banking system for several reasons. The dictum that "every loan creates a deposit" applies only to the banking system. The deposits of any one bank are not the result of the loan and investment policy of that bank but rather of the banking system. In the case of an individual bank as a loan is granted and as borrowers make use of created deposits, there is no assurance that these deposits will come back to the same bank. For the banking system as a whole the increase in deposits and the increase in loans occur simultaneously, but for individual banks, loans and deposits can very well move in the opposite direction. A brisk lending activity on the part of individual banks can result

¹The impact of deposit variability on the portfolio policy is discussed in the Appendix to the chapter.

in wide swings in their deposits. The seasonal fluctuations in deposits are likely to be more dominant in individual banks than in the banking system. The seasonal influences will be less operative in the latter to the extent that regional seasonal forces offset one another.

That the fluctuation in demand deposits in individual banks is greater than that experienced by the banking system is supported by the data on 114 sample banks collected as part of this study. For the year 1962, the index of variability of demand deposits (as measured by the coefficient of variation of the bi-weekly levels of demand deposits) for the banking system was .02. The index of variability in the case of every one of the banks in the sample was higher. The average of the index for all the 114 banks was .066.

I Factors Causing Variation in Deposits

In analysing the factors that lead to fluctuations in demand deposits, only those factors that account for differences in fluctuations among banks will be dealt with here. Cyclical and secular factors will not be considered inasmuch as these affect all the banks, though this is not to deny their differential effects on individual banks. Nor will such factors as relative population changes among areas and competitive shifts in deposits in which some banks grow at the expense of others be dealt with; these are essentially once-over changes -- and perhaps sometimes a trend -- even for the banks affected.²

²Instability in deposits in individual banks is necessarily related to the structure of the banking system. Before the establishment of the Federal Reserve System, the pyramided structure of reserve holdings without a central institution capable of supplying additional reserves made bigger banks, especially in New York, subject to sudden swings in deposits. The situation is different now; the discussion of variability made here is in the context of the structure that exists today.

A. Seasonal Factors

A major factor causing fluctuations in demand deposits is the seasonal influence, as has been shown in Chapter II. The extent of seasonal variability in individual banks will necessarily vary from region to region and according to the types of customers the banks deal with. The seasonal influence is likely to be very dominant in banks that are located in what are described as 'one industry areas.' Agriculture is probably most seasonal in all its operations and this seasonality in agriculture is reflected in both loan operations and deposit levels of banks located in agricultural areas. Conversely, in banks situated in areas where the industrial set-up is more diversified, the seasonal swings are less marked. Thus, urban banks will generally be subject to less seasonal fluctuations than rural banks. But this argument has to be modified to take account of the fact that country banks maintain deposits with their correspondent city banks and that the seasonal fluctuations in deposits experienced by them are transmitted to the city banks through changes in inter-bank deposits. A strong similarity between the seasonal pattern of 'demand balances due from banks' of country banks and that of their 'total demand deposits' was noted in an earlier chapter. One effect of country banks holding inter-bank deposits is that the seasonal pattern of total demand deposits of reserve city banks are brought closer to that of country banks.

B. Composition of deposits

It was shown in Chapter II that seasonal variability varied from one type of deposit to another. For the banking system as a whole, during the year 1962 overall variability was found to be the highest in U.S. Government deposits followed by inter-bank deposits and 'other' deposits in that

order.³ Thus, one factor contributing to the difference in stability in total demand deposits among banks may very well be the composition of deposits.

To what extent does composition vary as the size of banks changes? From the figures given by the Federal Deposit Insurance Corporation for the year 1954 (See Table XXII) it is seen that the share of total deposits represented by inter-bank deposits was directly related to size, ranging from .3 of 1 per cent in banks with deposits of \$2 million or less up to 15.5 per cent in banks with deposits of more than \$1 billion. U.S. Government deposits were more evenly distributed among large and small banks. The share of business and personal deposits, which constituted the bulk of demand deposits, showed a slight decline as the size increased.

To appreciate the full significance of the compositional factor, the ownership pattern in 'Business and Personal Deposits' among banks of different size groups has to be analysed. As revealed by Table XXIII, the distribution of ownership in the number of accounts and in the amount of deposits was strikingly different between small banks and big banks. The proportion of domestic business deposits to total amount of deposits progressively increased as the size of bank groups increased and the share of individuals and farm operators declined. The proportion of domestic business accounts and individual accounts to total number of accounts increased as the size group increased. The share of farm operators and non-profit organizations in total number of accounts, however, declined as the

³Variability in each type of deposit was measured by computing the coefficient of variation of the bi-weekly levels during the year. The coefficients for the U.S. Government deposits, inter-bank deposits, and 'other' deposits were .260, .048, and .024, respectively.

Table XXII

Percentage distribution of deposits within size groups of insured commercial banks,

Banks with deposits (in millions of \$), June 30, 1954

<u>Deposit</u>	<u>All banks</u>	<u>1 or less</u>	<u>1 to 2</u>	<u>2 to 5</u>	<u>5 to 10</u>	<u>10 to 25</u>	<u>25 to 50</u>	<u>50 to 100</u>	<u>100 to 250</u>	<u>250 to 500</u>	<u>500 to 1,000</u>	<u>More than 1,000</u>
Total deposits	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
All demand deposits	72.6	75.3	70.1	66.5	63.7	63.1	67.8	72.6	76.3	78.5	79.2	76.7
All time and savings de- posits	27.4	24.7	29.9	33.5	36.3	36.9	32.2	27.4	23.7	21.5	20.8	23.3
Business and personal de- posits total	80.8	88.0	88.3	88.1	87.8	87.7	85.2	80.4	77.4	75.7	78.0	75.7
Demand de- posits	55.8	64.2	59.4	55.7	53.0	52.6	54.9	55.2	55.3	56.2	58.7	57.0
Time and sav- ings deposits	25.0	23.8	28.9	32.4	34.8	35.1	30.3	25.2	22.1	19.5	19.3	18.7
Government deposits	10.5	11.7	11.4	11.4	11.3	10.4	11.0	11.6	11.6	12.0	8.7	8.8
Inter-bank deposits	8.7	.3	.3	.5	.9	1.9	3.8	8.0	11.0	12.3	13.3	15.5

Source: Annual Report of the Federal Deposit Insurance Corporation, 1954, p. 74.

Table XXIII

Ownership of demand deposits related
to size of bank, January 27, 1960
(Percentage distribution within size group)

<u>Type of holder</u>	<u>Size of bank (total deposits in millions of dollars)</u>					
	<u>Under 2</u>	<u>2-10</u>	<u>10-50</u>	<u>50 - 250</u>	<u>250 - 1,000</u>	<u>1,000 and over</u>
	<u>Number of Accounts</u>					
All holders	100.0	100.0	100.0	100.0	100.0	100.0
Domestic	8.2	9.3	10.7	12.6	13.9	12.6
Non-profit business organization	7.6	5.7	4.4	4.2	4.1	3.0
Farm operators	14.7	7.3	2.1	1.0	1.2	1.0
Individuals - personal	69.3	77.6	82.6	82.0	80.5	82.6
	<u>Amount of deposits</u>					
All holders	100.0	100.0	100.0	100.0	100.0	100.0
Domestic	30.5	40.2	52.3	66.5	69.5	71.4
Non-profit business organization	5.1	5.2	4.8	5.5	4.1	4.2
Farm operators	20.7	10.5	1.8	0.8	1.0	0.7
Individuals - personal	43.3	43.1	38.0	24.5	22.0	18.7

Source: Federal Reserve Bulletin, April 1960, p. 369.

size of the group increased. It is also seen (Table XXIV) that the average size of account for domestic business was roughly fifteen times the average size for individual accounts.⁴ Thus big banks differ from small banks both in the type of holders who are dominant and in the average size per account.

Table XXIV

Demand deposits of individuals, partnerships and corporations, January 27, 1960

Type of Holder	Number of Accounts (millions of \$)	Amount (billions of \$)	Average Size of Account
All holders	57.1	109.5	\$ 1,900
Domestic business	6.0	64.5	10,700
Farm operators	3.0	4.4	1,460
Individuals - personal	44.9	32.3	720

Source: Adapted from data given in Federal Reserve Bulletin, April 1960, p. 367.

To find out if the composition of deposits accounts for differences in variability among individual banks, it is necessary to know the answers to three questions:

1. Does the extent of fluctuation vary from one type of deposit to another in individual banks?
2. Are personal accounts more volatile than business accounts?
3. Does volatility of an account increase as the size of an account increases?

⁴In the absence of data on the number of accounts and the amount of deposits in each size group, it was not possible to compute the average amount on account for each type of holder in each size group of banks.

It is not possible to provide satisfactory answers to these questions as the relevant data are not available. Some answers, however, may be suggested on the basis of limited information that was obtained. From the weekly statements published by the New York Clearing House, it was found that during 1962 in all the eleven banks that were members of that Clearing House, the weekly levels of U.S. Government deposits fluctuated much more than the net demand deposits other than Government deposits.⁵ This conclusion was arrived at by calculating the coefficients of variation in weekly levels of the two types of deposits for each bank (See Table 1 in the Statistical Appendix). Data were not available on an individual bank basis to measure the volatility in inter-bank deposits.

There are writers who hold that personal deposits are more volatile than business deposits. The a priori reasoning for this argument is that in the case of personal deposits, payments are spread over the entire period of, say, a month with receipts coming only at stated intervals, while in business deposits payments and receipts occur continuously over the period. It is also widely held that large accounts are more volatile than small accounts. For example, Lyle Gramley writes: "Other things being

⁵The difference between the experience of the individual banks and the banking system in this context must be noted. It was stressed in Chapter II that as far as the banking system was concerned, fluctuations in total demand deposits were less than the sum of the fluctuations in U.S. Government deposits and 'other' deposits because of the negative correlation between the two types of deposits. But on an individual bank basis, this negative correlation need not necessarily be present, i.e., the withdrawal from tax and loan accounts need not necessarily match the reserve gains that may occur through Treasury disbursements. The New York City special depositaries, for example, account for a disproportionately large share of tax and loan credits because of the volume of Treasury marketable obligations sold in the city and the amount of taxes paid by corporations with checks drawn on their accounts with New York banks. But government payments are more evenly distributed over the country. Thus, Treasury operations at least initially drain funds from New York City banks.

equal, the more actively customers add to and withdraw from their balances the larger the swings that would be expected in a bank's total deposits. Large banks, in which many individuals and business accounts -- as well as accounts of other banks -- especially active might therefore be expected to show unusually large variation in deposits."⁶ In essence, the Gramley argument is that active accounts are more volatile and that large accounts tend to be more active. This reasoning does not rest on sound premises. There is a distinction between "volatility" of an account and "activeness." An account may be very active and yet may not be subject to wide swings in the total level. Deposit swings are caused by lack of synchronization between credits and debits. A high deposit turnover rate does not necessarily preclude a high degree of synchronization between debits and credits. Also, there is reason to doubt that activity as measured by transactions per dollar of account increases as the size of account increases. A study by the Kansas Bank Management Commission found that in that state checking account activity measured in terms of number of items processed over a month per dollar of demand deposits was not materially different for banks with over \$20 million in deposits than for banks with less than \$1 million in deposits.⁷

An examination of the average monthly balances of 50 personal and 50 business accounts drawn from a leading bank of Philadelphia indicated that personal accounts were more volatile than business accounts. The monthly balances supplied related to the 12 months in 1963 and the size of personal accounts examined varied from an average monthly balance of \$300

⁶Lyle E. Gramley, "Deposit Instability at Individual Bank," Essays on Commercial Banking, Federal Reserve Bank of Kansas City, p. 43.

⁷"Interpretation of Size-Cost Relationship in Banking," Monthly Review of Federal Reserve Bank of Kansas City, March, 1961, p. 8.

to one of \$195,000 and that of business accounts from an average \$12,000 to one of \$2,400,000. The coefficient of variation of the monthly levels of deposits was distinctly higher in personal accounts than in business accounts. The average of the coefficient for the 50 personal accounts was .4802 compared to the average of .2513 for the 50 business accounts. On the basis of this very limited study, one cannot venture to generalize on the comparative variability in personal and business accounts. There was no indication within each type of any relationship between size of account and variability in deposits. The coefficient of variation and the average monthly level of deposits of the accounts examined are given in Table II of the statistical appendix.

C. Flow of funds among accounts

An important factor leading to greater stability in deposits in bigger banks is the flow of funds from one account to another. The larger the bank the greater the probability that a check drawn on a given account will be credited to another account in the same bank. At one extreme, if we imagine there is only one bank, all debits will come back as credits except for leakage of currency to the public. As the size of a bank increases,⁸ this increased possibility of funds flowing from one account to another within the bank ensures a greater degree of stability. For this

⁸ 'Bigness' of banks in this context must be related in some sense to the bigness of the market in which they operate. For example, a bank with deposits of \$100 million would be 'small' in New York City and could not expect much return flow of funds from a given check drawn but, it could expect a return flow of larger magnitude if the bank is located in a smaller place.

reason, even if individual accounts are volatile, the aggregate may not be.⁹ From the same point of view, stability may increase if there is a wider diversification in the ownership of deposits. Where the deposits of a bank are concentrated in the sense of being drawn from one sector of the economy, the inflow or outflow is likely to be in the same direction for most of the accounts. But as bank size increases, customers are usually drawn from different sectors and this may ensure a greater stability of deposits. The advantage in this regard is greater when there is nationwide branch banking.

D. Compensatory balances

Banks frequently require that their business borrowers maintain a given percentage of the face value of the loan or line of credit as compensatory balances. One explanation of this practice is that it is intended to limit deposit fluctuations. The existence of this practice though it may have relevance to the deposit experience of the banks imposing such requirements does not imply that deposits of banks with these requirements would be more stable than those of banks without them. A study of bank loan practices by the Federal Reserve found that in 1955 approximately one-fourth of the banks surveyed had minimum balance requirements for some of their business borrowers and that over ninety per cent of banks with deposits of \$500 million and over had such requirements. The survey also reported that large banks tended to have higher requirements than small banks.¹⁰ The reasons

⁹This only emphasizes the point that to the extent that there is negative correlation among accounts, the variance of the total deposits in a bank will be less than the sum of the variances of individual accounts.

¹⁰Caroline Cagle, "Credit Line and Minimum Balance Requirements," Federal Reserve Bulletin, June 1956, p. 579.

for imposing compensatory balances are many and, therefore, the impact of these balances on deposit fluctuation even among banks with such requirements would vary according to the motives leading to the imposition of these requirements. Also, from the standpoint of reducing fluctuations in deposits, some banks may not feel the need to insist on these balances because their customers are always in the habit of maintaining surplus funds with them. Therefore, the fact that big banks insist on these balances more than small banks does not throw any light on the relative stability of deposits among banks in different size groups.

E. Growth factor

It has been suggested by some writers that the deposit experience of growing banks will be different from that of banks that evidence no growth. Donald Hester has argued that growing or declining banks will show less instability than banks which are of unchanging size.¹¹ Lyle Gramley found from a study he conducted that at least in the case of banks in the small size groups "higher long run growth rates tend to minimize intermediate term deposit losses."¹² There is no reason to think that growth rate in a bank will have an effect on stability in deposits except probably that a bank that is declining rapidly might be subject to a run and therefore to a high degree of deposit instability. Otherwise the effect of growth is already reflected in size and it is the latter that counts.

¹¹Hester's conclusion rests on his assumption regarding the probability distribution of transactions in banks and is also related to the measure of variability chosen by him, i.e., the ratio of variance of deposits to the level of deposits. Donald A. Hester, "An Empirical Exam of a Commercial Bank Loan Offer Function," Cowles Foundation Discussion Paper 111 (Mimeo), p. 15 and Appendix A.

¹²Gramley, Op.cit., p. 48.

Thus, the factors acting on the variations in deposits in individual banks are several and many of the factors which act in the same direction are usually found together. The difference between small banks and big banks becomes, therefore, something more than a distinction in pure size unless other factors are kept constant.

II Empirical Findings on Deposit Variability

This part reports the results of empirical investigations on variability in demand deposits in individual banks. With the aid of data on demand balances of individual banks supplied by the Federal Reserve Bank of Philadelphia, the relationship between size of banks and over-all variability in their demand deposits was first examined. Next, an attempt was made to isolate the seasonal variability in banks and to study its relationship to size of banks. Wherever possible, other characteristics of banks influencing variability were included in the examination.

A. Total variability

The focus of investigation in this section is on the total variability that occurs in demand deposits during a year in individual banks. By total variability is meant the over-all variation, i.e., both systematic and random.

Introduction. It is often contended that big banks experience five greater swings in deposits than small banks. Commenting on this generally held opinion, Gramley observes, "This view is rather widespread and of such ancient origin as to warrant the title of an accepted tradition of banking."¹³

¹³Gramley, op.cit., p. 43.

Thus, the folklore of commercial banking tends to associate increased variability with larger-sized banks.

In specifying the characteristics that have an influence on banks' willingness to lend, Hester regarded the instability of demand deposits as an important factor. He treated a bank's expected utility of its portfolio as a function of the rate of return on its assets, the standard deviation of rates of return, and the variance of its deposits. His conclusion on the relationship between size of bank and stability in demand deposits was, "the ratio of variance of deposits to the level of deposits is an increasing function of bank size. Thus, large banks are expected to be less willing to lend than small banks, if banks are averse to a higher deposit variance."¹⁴ Hester's conclusion on size and stability was partly derived mathematically and partly supported by empirical evidence on some of the values in the final expression. Apart from the reservations one might have as to the assumptions underlying his mathematical demonstration, the crucial question is whether the ratio chosen, i.e., the ratio of variance of deposits to the level of deposits, was a suitable index of variability. This problem is discussed at a later stage.

On the basis of a sample survey of banks, Gramley came to the conclusion that stability increased as the size of banks increased. A hundred banks in the Tenth Federal Reserve District were chosen at random from five different size groups, the allocation of banks to each size group being in proportion to their distribution in the population of Tenth District. The deposit experience of the sample banks was analysed in terms of deposit

¹⁴Hester, op. cit., p. 15.

losses. Based on the average total demand balances in every Reserve period from the beginning of 1955 to the middle of 1957, the maximum percentage decline of total demand deposits in any period of six months or less was recorded for each sample bank. From these data, Gramley arrived at the conclusion: "Grouping deposit losses by size of banks and computing the average for each bank size group, it is found that in the largest size class -- banks with total deposits of more than \$25 million -- deposit losses are approximately 20 per cent smaller than in the lower size groups. This difference proves to be statistically significant; that is, there are less than five chances in a hundred that observed results could have been due to random sampling errors. The four smaller bank size groups, on the other hand, are indistinguishable on the basis of their short-run deposit instability."¹⁵ This conclusion, though it has relevance only to the Tenth District member banks, calls into serious question the generally held opinion that instability in demand deposits increases with size of banks.

To be able to analyse in detail the degree of fluctuations in deposits in individual banks, it is necessary to construct an index of variability. The standard deviation strikes anyone as a suitable measure of dispersion. But the absolute value of this measure does not throw light on the relative degree of fluctuations among banks. To obtain a meaningful interpretation, these values have to be divided by the mean level of deposits of each bank. Then a direct comparison among banks becomes possible. The main focus presented here is on the coefficient of variation, i.e., the ratio of standard deviation to the mean level of deposits as the index of variability.

¹⁵Gramley, op. cit., p. 44.

As pointed out earlier, Hester treated the ratio of variance to the mean level of deposits as the measure of variability. This measure is not quite suitable for two reasons. Variance of deposits, being a sum of money squared has no economic meaning in itself. Second, the numerator and the denominator in this ratio are in different units of measurement, the numerator being money squared and the denominator being a sum of money. On both counts, it is preferable to use the coefficient of variation as the index. The standard deviation which is a sum of money can be compared with the mean value, also a sum of money.¹⁶ Thus, the index that is obtained is a pure number.

It has to be noted that the choice between the two ratios is not unimportant. One can arrive at opposite conclusions on the connection between variability and size, depending on the ratio chosen. The ratio of variance to level of deposits may be increasing while the coefficient of variation is decreasing.¹⁷ It is possible to show under what conditions

¹⁶For this reason Hicks preferred to use 'standard deviation' instead of 'variance' as a measure of certainty. J. R. Hicks, "Liquidity," Economic Journal, December 1962, p. 729.

¹⁷Let σ be standard deviation and σ^2 the variance and $\bar{D}$ the mean level of deposits. It is possible for $(\sigma/\bar{D})$ to decrease as $\bar{D}$ increases while $(\sigma^2/\bar{D})$ to increase as $\bar{D}$ increases. The condition to be met in that case is:

$$\frac{d(\sigma/\bar{D})}{d\bar{D}} < 0 \quad \text{and} \quad \frac{d(\sigma^2/\bar{D})}{d\bar{D}} > 0$$

$$\text{or} \quad \frac{d\sigma}{d\bar{D}} \cdot \frac{1}{\bar{D}} - \frac{\sigma}{\bar{D}^2} < 0 \quad \text{i.e.,} \quad \frac{d\sigma}{d\bar{D}} < \frac{\sigma}{\bar{D}} \quad (1)$$

$$\text{and} \quad \frac{d\sigma^2}{d\bar{D}} \cdot \frac{1}{\bar{D}} - \frac{\sigma^2}{\bar{D}^2} > 0 \quad \text{i.e.,} \quad \frac{d\sigma^2}{d\bar{D}} > \frac{\sigma^2}{\bar{D}} \quad (2)$$

$$\frac{1}{2} \frac{\sigma}{\bar{D}} < \frac{d\sigma}{d\bar{D}} < \frac{\sigma}{\bar{D}} \quad \text{or} \quad \frac{1}{2} < \frac{\bar{D}}{\sigma} \cdot \frac{d\sigma}{d\bar{D}} < 1$$

i.e., if the deposit elasticity with respect to standard deviation is between .5 and 1.

this can happen.

The use of standard deviation in the index of variability is not without its shortcomings. The squaring process tends to emphasize the larger deviations. In fact, it is virtually a process of weighting in which each deviation is given a weight in proportion to its own size and the added emphasis on the extremes thus introduced is not fully eliminated by taking the square root. The standard deviation will always give a larger numerical result than any of the other measures of dispersion except the range. In the discussion that follows, the coefficient of variation as already pointed out will be the main index of variability, but another measure will also be considered. That measure will be the ratio of the average of the bi-weekly changes (ignoring sign) of each bank to its mean level of deposits. This ratio has the advantage of eliminating any trend that may be present in the series and it also reduces the effect of large deviations.

The analysis of deposit variability presented below is based on a sample of banks chosen from the Federal Reserve District of Philadelphia. The total number of banks in the District in 1962 was 464. These banks were classified into four groups according to their size as measured by total deposits. In choosing a sample, it was considered desirable to assign larger weights to the groups at either extreme since this would permit a reliable estimate of the slope of the regression line. Accordingly, all banks with total deposits of \$100 million and above and all those with less than \$2 million were included in the sample. Applying a sampling fraction of one-eighth, a random selection was made from the other two size groups. Thus, the sample consisted of 114 member banks which formed about one-quarter of the population. The size distribution of the

banks in the population and in the sample were as follows:

<u>Size of banks and total deposits</u>	<u>Number of banks in the District</u>	<u>Number of banks in the sample</u>
\$2 million and less	46	46
\$2 - \$10 million	264	33
\$10 - \$100 million	136	17
\$100 million and above	<u>18</u>	<u>18</u>
	464	114

For each of the banks included in the sample, the Federal Reserve Bank of Philadelphia provided the average of daily balances of demand deposits, time deposits, and total deposits for each bi-weekly period in 1962. Thus, each bank had 26 observations for each of the three categories of deposits.

The primary focus in this study is on the variability in demand deposits. The standard deviation, the mean, the coefficient of variation, the average of the bi-weekly changes (ignoring sign) and its ratio to the mean level of deposits were calculated from the basic data on demand balances and are reproduced in Table III in the statistical appendix. These calculations provide the basis for the analysis which follows.¹⁸

The size factor. Both the distribution of the index of variability in different size groups and a more rigorous test by means of regression analysis indicated an inverse relationship between variability in demand

¹⁸The coefficient of variation might well overstate the variability in demand deposits if there is a trend in the series. By plotting the series for a number of banks, it was found that there was no trend in them and, therefore, no adjustment for the trend factor was considered necessary. Banks with high deposit variability were examined to see if this high variation was caused by any strong trend present in them and it was not found to be the case. The absence of trend is also confirmed by the fact that the two measures of variability yield more or less the same results.

deposits and size of banks, as measured by the mean level of deposits for the year. Deposit elasticity with respect to the index of variability was not, however, high.

The coefficient of variation, i.e., the index of variability, ranged from a low figure of .02 to a high of .17. The average for all the banks as indicated earlier was .06. The distribution of this coefficient in different size groups pointed to a negative correlation between size and variability (see Table XXV). Out of 24 banks with demand deposits of over \$10 million, ten, i.e., 41.66 per cent, had a coefficient of variation of less than .03, while only 2 out of 90 banks with deposits of less than \$10 million had a coefficient of variation of less than .03. Five of 24 big banks, i.e., 20.83 per cent, had, however, a coefficient of variation of more than .09. Looking at the results from a slightly different angle, of

Table XXV

Distribution of the index of variability in demand deposits
in different size groups

Banks with demand deposits (in \$)	Less than .03	.03- .039	.04- .049	.05- .059	.06- .069	.07- .079	.08- .089	Over .09
Less than 500,000	1	1	2	5	3	3	2	2
500,000 to 1m	-	2	7	9	4	4	1	4
1m - 10m	1	9	6	9	8	1	2	4
10m - 100m	6	2	2	-	-	2	-	2
100m & above	<u>4</u>	<u>1</u>	<u>-</u>	<u>-</u>	<u>1</u>	<u>-</u>	<u>1</u>	<u>3</u>
	12	15	17	23	16	10	6	15

12 banks with a coefficient of variation of less than .03, ten banks, i.e., 83 per cent, were in the big size group. Out of a total of 15 banks with

a coefficient of variation of over .09, 5 banks, i.e., 33-1/3 per cent were in the big size group. These facts lead to the conclusion that variability in deposits as measured by the coefficient of variation has a tendency to fall as the bank size increases.

The estimation of a linear relationship between size of banks and the measures of variability confirmed the inverse relationship between the two, not directly but by implication. A double-log relationship, on the other hand, established more firmly the negative correlation, though the relationship was not strong.

Applying the technique of least squares to the 114 sample observations, the following equations were estimated:

$$(1) \quad \sigma = 386.2151 + .3916\bar{D} \quad \bar{R}^2 = .5216$$

$$(.0351)$$

$$(2) \quad \frac{\sigma}{\bar{D}} = .0662 - .0000003368\bar{D} \quad \bar{R}^2 = .0011$$

$$(.0000003170)$$

$$(3) \quad A = 154.877 + .222699\bar{D} \quad \bar{R}^2 = .820$$

$$(.009322)$$

$$(4) \quad \frac{A}{\bar{D}} = .0334 - .0000001429\bar{D} \quad \bar{R}^2 = .018$$

$$(.000000008)$$

where $\bar{D}$ = average level of demand deposits (in \$10,000)

σ = standard deviation of demand deposit levels (in \$1,000)

$\frac{\sigma}{\bar{D}}$ = the coefficient of variation (with σ and $\bar{D}$ in the same unit).

A = Average of the bi-weekly changes (ignoring sign) in \$1,000

$\frac{A}{\bar{D}}$ = A divided by $\bar{D}$ (with A and $\bar{D}$ in the same unit).¹⁹

¹⁹It is worth recalling here that the indexes of variability are only $\frac{\sigma}{\bar{D}}$ and $\frac{A}{\bar{D}}$ but equations relating σ and A to $\bar{D}$ were estimated so as to draw certain inferences from them regarding the behavior of $\frac{\sigma}{\bar{D}}$ and $\frac{A}{\bar{D}}$.

The coefficients for the bank-size variable in Equations (2) and (4) were negative but not statistically significant. The values of $\bar{R}^2$ in both equations were very low. We have, therefore, to turn to equations (1) and (3) to gain some knowledge of the relative variation in demand deposits in banks of different sizes. The coefficient for $\bar{D}$ was highly significant and positive in both these equations. This means that σ or A increases as the size of bank increases, as one normally expects. A bank with deposits of \$100 million will naturally experience a higher fluctuation in deposits in dollar amount than a bank with \$100,000 deposits. The deposit elasticity in relation to σ and A , however, indicates how $(\frac{\sigma}{\bar{D}})$ or $(\frac{A}{\bar{D}})$ behaves as $\bar{D}$ increases. At the point of means of σ and A , the deposit elasticities were .73 and .69. Since these elasticities are less than 1,²⁰ it can be concluded that $(\frac{\sigma}{\bar{D}})$ or $(\frac{A}{\bar{D}})$ decreases as $\bar{D}$ increases, i.e., variability in deposits as measured by either of these indexes decreases as the size of bank increases.

The results obtained by using the double-log formulation brought out more explicitly the negative relationship between size and variability. This alternate formulation assumes the functions to be estimated as exponential, i.e., the structural relationships are assumed to take the form:

$$\sigma = \alpha \cdot \bar{D}^{\beta} u$$

$$\left(\frac{\sigma}{\bar{D}}\right) = \alpha' \cdot \bar{D}^{\beta'} u'$$

$$A = \alpha'' \cdot \bar{D}^{\beta''} u''$$

$$\frac{A}{\bar{D}} = \alpha''' \cdot \bar{D}^{\beta'''} u'''$$

²⁰In order that $\frac{d(\frac{\sigma}{\bar{D}})}{d\bar{D}} < 0$, it is necessary to show that

$$\frac{d\sigma}{d\bar{D}} \cdot \frac{1}{\bar{D}} - \frac{\sigma}{\bar{D}^2} < 0 \quad \text{or} \quad \frac{d\sigma}{d\bar{D}} \cdot \frac{1}{\bar{D}} < \frac{\sigma}{\bar{D}^2} \quad \text{or} \quad \frac{d\sigma}{d\bar{D}} < \frac{\sigma}{\bar{D}}$$

Since $\frac{d\sigma}{d\bar{D}} \cdot \bar{D} < \sigma$, it implies $\frac{d\sigma}{d\bar{D}} < \frac{\sigma}{\bar{D}}$ and therefore

$$\frac{d(\frac{\sigma}{\bar{D}})}{d\bar{D}} < 0$$

Exponential functions can be transformed into linear functions by taking the logarithms of the variables. The results using this relationship were:

$$\begin{array}{lll}
 (5) & \log \sigma = -.2331 - .9345 \log D & \bar{R}^2 = .946 \\
 & & (.0209) \\
 (6) & \log \frac{\sigma}{D} = -.2572 - .053 \log D & \bar{R}^2 = .038 \\
 & & (.022) \\
 (7) & \log A = .8817 - .9500 \log D & R^2 = .97 \\
 & & (.013) \\
 (8) & \log \left(\frac{A}{D}\right) = .3182 - .0506 \log D & R^2 = .095 \\
 & & (.0104)
 \end{array}$$

In equations (6) and (8), the coefficients for $\log D$ were negative and significant, i.e., in the basic structural equations D had a negative exponent. This establishes that $\left(\frac{\sigma}{D}\right)$ and $\left(\frac{A}{D}\right)$ are decreasing functions of D . Much the same result is obtained by examining equations (5) and (7). The coefficients for $\log D$ in these equations were positive but less than unity and significant. Logarithmic functions imply constant elasticities and these are given by the coefficients. Equations (5) and (7) thus give deposit elasticities with respect to σ and A of less than 1, which as pointed out earlier means that $\left(\frac{\sigma}{D}\right)$ and $\left(\frac{A}{D}\right)$ decrease as D increases. It is important, however, to note that the inverse relationship between $\left(\frac{\sigma}{D}\right)$ and D , though statistically significant is not strong. The deposit elasticity with respect to σ as seen from equation (6) is only .05 which means that a hundred per cent increase in the size of banks leads to only a 5 percent decrease in variability.

Other factors. The efforts to improve further the explanation of the variability in deposits by introducing additional factors were rendered difficult because of the non-availability of more data on individual banks. Risk of identification of individual banks made it impossible to obtain data on the location and the number of branches of the banks. Information on the number of accounts and the volume of personal and business deposits separately for the banks were not available at the Federal Reserve Bank of

Philadelphia. The only information that could be obtained was the location of banks according to the region to which they belonged.²¹ This information was utilized to find out the impact of regional differences in terms of occupational structure.

The occupational structure of the region in which banks were located measured either by the percentage of working force employed in agriculture or in manufacturing was found to have no significant effect on variability. This conclusion has, however, to be accepted with reservation because of the high degree of aggregation involved in the variables used to test the hypothesis.

It was argued in the first part of this chapter that banks located in areas where the economy was more diversified would experience less fluctuations in deposits than those in less diversified areas. Percentage of working force employed in manufacturing was treated as a proxy for diversification and it was therefore expected that banks located in areas with a higher percentage of working force employed in manufacturing would have a lower index of variability. On the other hand, since the focus was on overall fluctuations in deposits, i.e., both seasonal and random, the more important agriculture was an occupation in a region, the higher would be the fluctuation in deposits in that region. Therefore, the impact of occupa-

²¹ For this purpose, the Federal Reserve District of Philadelphia was divided into 15 regions, a classification based on the work of Bogue and Beale. (Donald J. Bogue and Calvin L. Beale, Economic Areas of the United States, New York: Free Press of Glencoe, 1961.)

tional structure on variability was studied by measuring the influence of two variables, namely, the percentage of working force employed in agriculture and the percentage employed in manufacturing.

The equations computed showed no relationship between occupational structure and variability. The coefficient for manufacturing had a negative sign and that for agriculture a positive sign in all the relevant equations. This is according to the a priori reasoning, but neither of the variables was statistically significant whether introduced along with the bank-size variable or whether introduced alone. Some of the equations computed are given below:

$$\begin{aligned}
 (9) \quad \log \left(\frac{G}{D} \right) &= -2.132 - .1232 \log M - .0527 \log \bar{D} & \bar{R}^2 &= .0347 \\
 & \quad (.2442) \quad (.0229) \\
 (10) \quad \log \left(\frac{G}{D} \right) &= -2.009 - .2460 \log M & \bar{R}^2 &= .001 \\
 & \quad (.244) \\
 (11) \quad \frac{G}{D} &= .0605 + .000786 Ag & \bar{R}^2 &= .0026 \\
 & \quad (.000924) \\
 (12) \quad \log \left(\frac{G}{D} \right) &= -2.629 + .0295 \log Ag - .04844 \log \bar{D} & \bar{R}^2 &= .034 \\
 & \quad (.0572) \quad (.0256) \\
 (13) \quad \log \left(\frac{G}{D} \right) &= -2.986 + .0848 \log Ag & \bar{R}^2 &= .015 \\
 & \quad (.0509)
 \end{aligned}$$

where M = percentage of working force employed in manufacturing industries in the region; Ag = percentage of working force employed in agriculture in the region.

Because of the high degree of aggregation involved in the variables used, it is not surprising that their coefficients did not turn out to be significant.

Similarly, no relationship was found between growth rate in banks and variability in their demand deposits. It was, however, pointed out earlier that there was no strong reason for the growth rate to affect in

one way or another variability in deposits. The growth variable introduced to test this hypothesis was the average level of demand deposits on three call dates in 1962 as a percentage of the average level on three call dates in 1957 for each bank. The coefficient for this variable was positive in all the equations but not significant in any one of them. Hence, no firm conclusions could be reached. The equations estimated are:²²

$$\begin{aligned}\frac{T}{D} &= .0634 + .0000102 G & \bar{R}^2 &= .0088 \\ & \quad (.0000858) \\ \frac{T}{B} &= .0645 - .0000003375 \bar{D} + .000018 G & \bar{R}^2 &= .000 \\ & \quad (.000000318) \quad (.000085) \\ \log \frac{T}{D} &= -.4047 - .06526 \log \bar{D} + .31459 \log G & \bar{R}^2 &= .0482 \\ & \quad (.02391) \quad (.21643) \\ \log \frac{T}{B} &= -3.399 + .1076 \log G & \bar{R}^2 &= .0065\end{aligned}$$

Variability of time versus demand deposits. It is generally held

that banks experience less variability in time deposits than in demand deposits over the short period, the reason being that time deposits are held not for the purpose of making payments but as a means of employing savings. The data on sample banks lend support to this view. In measuring variability in time deposits in the sample banks, one has to take note of the fact that almost every bank experienced a month-to-month increase in time deposits during 1962 following the rise in maximum interest rates payable on time deposits. It was therefore necessary to eliminate this trend and take only the ratio of the standard deviation of the residual to the mean level of time deposits as the index of variability.²³ An analysis of the distribution

²²Wherever $\bar{R}^2$ is negative, it is recorded as zero.

²³The variance of the residual for each bank was obtained by regressing the bi-weekly levels of time deposits on time trend. The standard deviation of the residual, the mean level of time deposits and the ratio between the two for each bank in the sample are given in Table IV in the statistical appendix.

of this index among the various size groups clearly indicates that the extent of variation in time deposits is very limited (see Table XXV). Of the 114 banks, eighty-four, i.e., 75 per cent had an index of less than .05, whereas in the case of demand deposits, there were only 44 banks, i.e., 39 per cent that had a coefficient of variation of less than .05. The average variability in the sample banks for time deposits was .012 compared to .06 in demand deposits.

Table XXVI

Distribution of the index of variability in time deposits
in different size groups

Banks with time deposits of (in \$)	.0050 and less	.0051 to .010	.011 to .050	.051 to .10	above 0.1	Total
Less than 500,000	-	1	2	1	-	4
500,000 to 1 m	-	-	8	17	-	25
1m to 10 m	3	20	30	4	3	60
10m to 100m	1	10	7	2	-	20
Over 100 million	-	-	4	1	-	5
Total	4	34	51	25	3	114

B. Seasonal variability

The most important element in the systematic variation in any time series over a year is the seasonal factor. The last section was concerned with over-all variability which included both seasonal and non-seasonal variations. In this section the relationship between size of banks and the extent of seasonal variability alone will be examined.

Approximately half of the banks in the sample exhibited a seasonal pattern that was akin to the pattern found for the entire District. Con-

sidering only the banks whose pattern was similar to that of the system, it was found that the amplitude of the seasonal index decreased as the size of banks increased. The proportion of over-all variability accounted for by seasonal factors was not, however, related to size of banks.

In order to measure the extent of seasonal variability in individual banks, what is needed is the seasonal index for each of the banks included in the sample. This information is hard to get as the banks themselves do not compute such an index. It was therefore necessary to evolve a technique by which seasonal variability could be isolated from other types of variability in the case of these banks.

Underlying the technique employed here is the premise that the seasonal pattern in demand deposits of the sample country banks conformed to the pattern in the aggregate demand deposits of all Third District country banks and that the only differences among them was one of amplitude. A similar assumption was made in the case of sample Reserve city banks. In order to compare the differences in amplitude, it was decided to estimate the following function:²⁴

$$\left(1 - \frac{D_t^j}{\bar{D}^j}\right) = \alpha + \beta(1 - S_t) + u$$

$$j = 1 \dots \dots \dots 114 \text{ (banks)}$$

$$t = 1 \dots \dots \dots 12 \text{ (months)}$$

Where D_t^j = the level of demand deposits of the j th bank in month t

$\bar{D}^j$ = the average monthly level of demand deposits of the j th bank

S_t = the seasonal adjustment factor for the month t for demand deposits in the Third District (the index will vary depending on whether j is a Reserve city or country bank.)

²⁴ This formulation was preferred over regressing $\frac{D_t^j}{\bar{D}^j}$ on S_t because it is possible with this formulation to give the same interpretation for the values of β whether $\frac{D_t^j}{\bar{D}^j}$ is above or below 1.

The estimated values of β would indicate the amplitude of seasonal pattern in each bank compared to the average pattern in the District. If β was equal to 1, then the pattern in that bank was "typical." If it was greater than 1, then the amplitude of the seasonal pattern was greater than the average, and if it was less than 1, the amplitude was less than the average. The values of R^2 obtained for each equation would show the extent of variability accounted for by seasonal factors in each bank. Having obtained a measure of the amplitude of the seasonal pattern and the extent of seasonal variability in each bank, the relationship of each of these to size of banks could be easily estimated.

In 1960, the Federal Reserve System switched from the use of semi-monthly periods to bi-weekly periods in presenting data on banks. This introduced some difficulties in estimating the functions. First, the monthly seasonal index for 1962 for all country banks and for all Reserve city banks in the Third District could not be computed as monthly balances after 1960 were not available. The latest year for which the monthly seasonal index could be computed was 1959. The X-9 seasonal adjustment program, however, gives the forecast for an additional year. Therefore, the seasonal index with which the movement in deposits in sample banks was compared was that of 1960. This is not a serious compromise as there is not likely to be any significant change in seasonal pattern between 1960 and 1962. Second, the data on sample banks were on a bi-weekly basis and they had to be converted into monthly balances as the seasonal index was on a monthly basis. This was done by first multiplying the balance for each bi-weekly period by the ratio of the number of days in a given month covered by that period to the total number of days in that month, and then by adding the parts relevant for each month. This procedure rests on the

unsatisfactory assumption that within a bi-weekly period, the level of deposits on any given day is more or less the same. The method though defective for this reason, had to be adopted in the absence of a more satisfactory alternate procedure.

The equations estimated according to the procedure outlined above (see Table V in the Statistical Appendix for the equations) showed that of the total 114 banks, the deposit movement of only 54 banks corresponded to the seasonal pattern of the District, i.e., the coefficient for the seasonal index variable was significant only in 54 equations. This does not mean that there is no seasonal element in deposit variation in the other banks but only indicates that their seasonal pattern differs from that of the pattern for the entire District. The fifty-four banks whose seasonal pattern resembled that of the District were not concentrated in any particular size group. In almost every size group, approximately half the banks corresponded to the pattern of the District, as can be seen from Table XXVII.

Table XXVII

Conformity to the seasonal pattern of the
District according to size groups

<u>Banks with demand deposits (in millions of \$)</u>	<u>Total number of banks</u>	<u>Number of banks which conformed to the pattern of the District</u>
Less than 2	65	25
2 - 10	24	15
10 - 100	13	7
above 100	12	7

By restricting the analysis to the fifty-four banks whose seasonal

pattern conformed to that of the District, it was found that the amplitude of the seasonal pattern²⁵ decreased with increase in the size of banks. This result was obtained by regressing the β coefficients obtained for the fifty-four banks on the size of bank. The equation obtained was:

$$\beta = 2.835 - .0000285\bar{D} \quad \bar{R}^2 = .115$$

(.0000132)

The coefficient for $\bar{D}$ was negative and significant implying that as the size of bank increased, the amplitude decreased. The addition of the regional variable, i.e., the percentage of working force employed in agriculture did not improve the explanation of the variation in amplitude.

Confining again the attention to the fifty-four banks, whose seasonal pattern resembled that of the District, no relationship between size of banks and the extent of seasonal variability was established. The $\bar{R}^2$ in each of the equations estimated gives the proportion of variances in $(\frac{\beta_i}{\bar{\beta}})$ accounted for by the equation. This gives an idea of the extent of seasonal variability in each bank. Therefore, the values of $\bar{R}^2$ obtained were related to the size of banks and the resulting equation was:

$$\bar{R}^2 = .490 + .000000575\bar{D} \quad \bar{R}^2 = 0$$

(.00000105)

The coefficient for $\bar{D}$ was highly insignificant indicating the absence of any relationship between size of banks and the extent of seasonal variability.

For the most part this empirical investigation yielded only negative results. Variability in demand deposits was not related to the occupational structure of the region in which banks were located. There was also no evidence that variability was affected by growth rate of banks.

²⁵For a definition of the amplitude of seasonal movement and the extent of seasonal variability, see Chapter II, p. 43. The extent of seasonal variability is, however, measured differently here.

APPENDIX TO CHAPTER IV

THE IMPACT OF DEPOSIT VARIABILITY ON PORTFOLIO POLICY

Liquidity and profitability are the two criteria that guide the actions of a banker in the choice of his assets. Though some assets may earn little profit and though some may have little liquidity, the asset mix as a whole must ensure an adequate return and at the same time enable the banker to meet the demands of his depositors. The requirements of liquidity are mainly governed by the fluctuations in deposits and the function of maintaining liquidity against deposit demands is described sometimes as "protective liquidity." Uncertainty regarding future deposit levels need not, however, impose a special burden on the banker but for different degrees of liquidity attached to his various assets. As Porter pointed out, "if bonds were always marketable at par and loans callable on demand without possibility of default, the bank could never become illiquid, however erratic the behaviour of its deposits. The greater the extent to which any or all of these latter uncertainties exist, the greater becomes the first concern for the future course of deposits."¹ Chapter IV has been concerned with inter-bank differences in variability in demand deposits; this appendix examines briefly the impact of deposit variability on bankers' choice of assets.

A. The Hypothesis

By 'portfolio policy' is meant the policy by which a banker decides to allocate his funds among the various assets. Without doubt,

¹Porter, op. cit., p. 325.

deposit variation is not the only criterion determining a bank's asset distribution. How much of a given asset a banker will hold will also depend on how much of other types of assets he holds or desires to hold. For example, the amount of cash assets a banker desires to hold will vary negatively with the rate of return on investment and loan assets and positively with the risk associated with other assets. The composition of available funds is a key factor, however, in determining a bank's choice of assets. Writers advising on portfolio policy emphasize this aspect of the problem and their advice usually takes the form of rules for 'conversion' of bank funds. The usual system of conversion starts by classifying liabilities -- kinds of deposit accounts and capital accounts -- and then specifying in detail the way in which each class of funds should be employed or converted.² These mechanical formulas of conversion, however, fail to provide a suitable guide to banks because they overlook the fact that the same type of funds may be subject to different degrees of fluctuations in different banks and that deposit variance may be related to such factors as size. But the basic principle underlying the formulas, that the degree of fluctuations in the funds available must determine the degree of liquidity required by banks in their assets, is valid. (1) as the variability in demand deposits of

Bankers' reactions to fluctuations in deposits are summarized by Donald Hester: "Banks are less willing to lend when their deposits are unstable. This behaviour derives from banks' aversion to discounting, criticism by bank examiners and emergency reserve adjustments. The probability

²A well-known scheme along these lines is the one described in "Conversion of Commercial Bank Funds," by Harold E. Zarker, Boston: Bankers Publishing Company, 1942.

that a given excess reserve position will be insufficient to meet the weekly fluctuations is an increasing fluctuation of deposit instability. Consequently, banks suffering from very unstable deposits prefer a more liquid portfolio."³

There is no simple way of measuring the liquidity of an entire portfolio. The ratio of any single asset group to total assets or deposits does not provide a correct index of liquidity because no single asset group is composed of homogeneous set of assets. Nevertheless, the ratio of loans to total assets or deposits is often regarded as some measure of comparison of liquidity among banks. In the light of the arguments advanced above, one would expect that banks with high deposit fluctuations will tend to have a lower ratio of loans to total deposits. An important conclusion of this chapter has been that variability in demand deposits is inversely related to size and on this ground big banks will have a larger proportion of loans in their portfolios than smaller banks. Again, on the same basis, banks with larger proportions of time deposits will have a higher proportion of loans in their portfolios because time deposits are more stable in the short run than demand deposits.⁴ Thus, the discussion leads to two ceteris paribus hypotheses: (1) as the variability in demand deposits of banks increases, the ratio of loans to total deposits in the banks will decrease or, alternately, as the size of bank increases, the ratio of loan to total deposits increases, and (2) as the proportion of time deposits to total deposits increases, the ratio of loan to total deposits will increase.

³Hester, op. cit., p. 15

⁴This is in addition to the reason that time deposits are subject to lower reserve requirement than demand deposits.

B. Empirical results

A comparison of the distribution of assets among banks of different size groups is revealing in this context. As can be seen from Table XXVIII, the ratio of loans to total assets increases as the size of bank increases and the highest ratio is found in the biggest size group. Also, as the ratio of loans to total assets gains in importance with the increase in size-group, the ratio of government obligations to total assets steadily declines. Starting from the smallest size group, the ratio of cash assets to total assets declines up to the size group of \$50-100 million, but thereafter, the ratio rises as the size-group rises. This increase in ratio after a size level is accounted for by the fact that these banks fall into classes that are required to maintain higher minimum reserves. Of course, these ratios are based on the aggregates for each size group and there might well be considerable differences among individual banks falling within each group.

Table XXVIII

Percentage distribution of assets within size groups
of National Banks, December 31, 1960

<u>Banks with</u> <u>deposits of</u>	<u>Govt.</u> <u>obligations</u>	<u>Other</u> <u>assets</u>	<u>Loans</u>	<u>Cash</u> <u>assets</u>
Less than 500,000	24.15	3.21	40.14	28.56
500,000 - 750,000	25.86	4.58	40.36	27.37
750,000 - 1,000,000	30.24	7.22	39.95	21.52
1 million - 2 million	31.30	7.81	39.78	20.08
2 million - 5 million	29.90	9.91	40.03	18.78
5 million - 10 million	28.82	10.91	40.82	17.94
10 million - 25 million	28.71	10.13	41.53	17.88
25 million - 50 million	28.79	8.68	42.78	17.73
50 million-100 million	26.99	8.89	42.63	19.62
100 million-500 million	22.26	6.82	45.29	23.67
Above 500 million	19.67	7.29	49.71	20.57

Source: Annual Report of the Comptroller of the Currency, 1960.

The relationship between portfolio policy and deposit variability was investigated with the aid of information supplied by the Federal Reserve Bank of Philadelphia on selected balance sheet items of the sample banks as on two dates, namely, December 31, 1961, and September 28, 1962. From these data the average of the ratios of loans to total deposits as on these two dates was computed for each bank and these ratios were related to the average level of ^{demand} deposits of each bank over the year 1962, the index of variability in demand deposits and the average of the ratio of time to total deposits on these two dates.

No direct relationship was established between variability in demand deposits and the loans-deposits ratio. A positive relationship between the ratio of loans to total deposits and the size of banks and the ratio of time to total deposits did, however, emerge. The equations estimated are:

$$L/D^T = 0.5295 + \frac{.1958 (\sigma/D)}{(.2053)} \quad \bar{R}^2 = .0000$$

$$L/D^T = 0.4868 + \frac{.1029 (TD/D^T)}{(.0604)} \quad \bar{R}^2 = .0165$$

$$L/D^T = 0.4236 + \frac{.00000202 \bar{D}}{(.0000008)} + \frac{.2055 (TD/D^T)}{(.072)} \quad \bar{R}^2 = .0592$$

where L/D^T is the average of the ratio of loans to total deposits on the two dates, December 31, 1961, and September 28, 1962; (TD/D^T) is the average of the ratio of time to total deposits on the two dates; and other symbols as indicated in the chapter.

In equation (1) the coefficient for the index of variability in demand deposits is not statistically significant. Nor is the sign in accord with the theory developed in the earlier part of the analysis. In equation (2), the coefficient for the ratio of time deposits to total

deposits has the "right" sign. It is not statistically significant though the t statistic value is quite high. In equation (3), the coefficients for the average level of demand deposits and the ratio of time to total deposits are positive and significant, implying that the ratio of loans to deposits increases as the size of bank increases and also as the ratio of time to total deposits increases. Thus, in terms of the hypotheses stated earlier, the alternate form of hypothesis (1) and hypothesis (2) are accepted.⁵ The $\bar{R}^2$ for equation (3) is very low. Though the attempt here has been directed toward examining the relationship between loans-deposit ratio and deposit variability rather than offering a full explanation of the variation in loans-deposit ratio, even in terms of the limited problem posed, better results could have been obtained if a finer breakdown of the loan and deposit items had been available.

⁵A study quite similar to the one in this appendix was made by James L. Pierce. In estimating the proportion of available funds banks devoted to loans, he included among other independent variables the ratio of government deposits to available funds and the total available funds. Government deposits in commercial banks tended to be highly unstable and, therefore, the inclusion of the ratio of government deposits to available funds as a variable could provide a test whether the composition of funds was an element in the portfolio decision. The coefficient for this variable was found to be negative and significant. He found the coefficient for available funds positive; the magnitude of the coefficient implied that a 1% increase in available funds would produce an .89% increase in loans, a result contrary to the one obtained in this appendix. The difference in results is probably accounted for by the fact that the study here covered banks ranging from the smallest size group to the biggest size group, while Pierce's study was based on time series aggregates composed of weekly observations of the portfolios of 85 large commercial banks. James L. Pierce, "The Monetary Mechanism: Some Partial Relationships." Cowles Foundation Discussion Paper (mimeo).

CHAPTER V

RELATION OF CHANGES IN AGGREGATE RESERVES

TO CHANGES IN DEMAND DEPOSITS,

INDIVIDUAL BANKS

Changes in reserves followed by changes in deposits are the immediate targets in the open market strategy and in an earlier chapter the magnitude and timing of response of the banking system to changes in aggregate reserves were analysed. The purpose of this chapter is two-fold: first, it will compare the behaviour of demand deposits in individual banks to that in the banking system; second, it will study the extent of response of individual banks to changes in aggregate reserves. The data on sample banks used in the last chapter will be the basis of study here. The analysis is, therefore, confined to the 26 bi-weekly observations for the year 1962.

I Differences in the Behaviour of Demand Deposits

The movement of demand deposits in the big banks showed a closer correspondence than that of the smaller banks with the behaviour of demand deposits in the banking system, but even in the case of big banks the similarity was not very strong. In striking contrast, the similarity in the pattern among banks falling in each size group was quite strong.

To compare the movement of demand deposits in individual banks with that in the banking system, an index of conformity had to be computed. The index chosen was the ratio, expressed as a percentage, of the number of times the change in demand deposits in the individual bank

and the system was in the same direction to the total number of changes. The perfect score is 100%, the direction of change of deposits in the bank from period to period being exactly the same as in the banking system. An index of less than 50% means that the direction of change in that bank differs more often from that in the system than it agrees with that in the system. Admittedly, this is a rough index. But a more sophisticated tool of analysis was considered necessary only when this index pointed to such a need.

A. Individual banks and the system

The index of conformity of the banks ranged from a low of 32% to a high of 80%. The similarity in the behaviour of demand deposits between small banks and the banking system was poor. Generally, banks falling in the small size group had a lower index of conformity than the banks falling under the bigger size groups, i.e., they showed less similarity. As Table XXIX shows, of the 89 banks with demand deposits of ten million dollars and less, only 45, i.e., fifty per cent, had an index of more than 52%. The average of the indexes of the banks in each size group increases steadily as the size of the group increases. The average for the smallest size group was 54% and that for the largest group was 63%.

Table XXIX

Distribution of the index of conformity in different size groups.

Size Group	Description of size group (in thousands of \$) of	Value of the index			
		52% and less	53 - 64	65 - 78	More than 78
1	Less than 500	8	9	2	--
2	500 - 1,000	15	12	4	--
3	1,000 - 5,000	18	12	3	--
4	5,000 - 10,000	3	2	1	--
5	10,000 - 50,000	1	4	2	--
6	50,000 - 90,000	2	2	3	--
7	90,000 - 300,000	1	3	2	--
8	Above 300,000	--	2	2	1

B. Aggregates of size groups and the system

Changes in demand deposits of banks falling in each size group were aggregated and the size groups were then compared to the banking system. Though the indexes of conformity of these size groups to the banking system showed very little difference, a more inclusive analysis which took note of both direction and magnitude indicated that the behaviour of demand deposits in small size groups corresponded very little to that of the banking system. The index of conformity ranged from 60% to 76% and the indexes for the various size groups, starting from the smallest, were 60%, 68%, 64%, 64%, 72%, 68% 68% and 76%. Since this index emphasized only the direction of change, ignoring completely the magnitude, the coefficients of determination (R^2) between changes in demand deposits in each size group and the changes in the banking system were calculated. The value of $\bar{R}^2$ in the case of the three smallest size groups was very low (Table XXX, column 9) indicating very little correspondence between the behaviour of demand deposits in these size groups and that of the banking system. Surprisingly, the relationship between the second largest group and the banking system was also poor. Banks with demand deposits of \$10 million to \$50 million showed the closest similarity to the banking system as evidenced by the highest value of $\bar{R}^2$.

A comparison among size groups showed that the movements of deposits in groups 1, 3, 6, and 7, were close to one another. No other pattern was observable, as confirmed by the values of R^2 between each group and every other group and the banking system given in Table II.

Table XXX

Changes in demand deposits

The coefficient of determination (R^2) among size groups and the banking system

	Size groups								Banking System
	1	2	3	4	5	6	7	8	
Size group 1	1	.37	.48	.17	.006	.51	.63	.01	.01
Size group 2	.37	1	.00	.32	.09	.06	.07	.06	.03
Size group 3	.48	.00	1	.02	.38	.79	.67	.32	.06
Size group 4	.17	.32	.02	1	.39	.02	.01	.17	.29
Size group 5	.006	.09	.38	.39	1	.38	.12	.47	.40
Size group 6	.51	.06	.79	.02	.38	1	.61	.33	.11
Size group 7	.63	.07	.67	.01	.12	.61	1	.17	.08
Size group 8	.01	.06	.32	.17	.47	.33	.17	1	.36
Banking system	.01	.03	.06	.29	.40	.11	.08	.36	1

Response to Changes in Aggregate Reserves

The purpose of studying the response of individual banks to changes in aggregate reserves is to find out how banks of different sizes are affected by actions of monetary authorities. Of course, there is no direct link between changes in aggregate reserves and changes in deposits of individual banks. The missing link is the change in the behavior of banks concerned. In Chapter III, changes in demand deposits of banks were treated, in part, as a delayed

C. Comparisons within size groups

The extent of conformity in the behaviour of demand deposits between banks falling in each size group and the aggregates of each size group was quite marked. Of the 114 banks, there were only eleven banks which had an index of conformity of 52% or less in relation to their size groups. The distribution of the within-group index of conformity as shown by Table XXXI shows the close parallel among banks in each size group.

Table XXXI

Distribution of within-group index of conformity

<u>Size group</u>	<u>52% and less</u>	<u>53%-64%</u>	<u>65%-78%</u>	<u>79% and above</u>	<u>Average</u>
1	--	4	12	3	72%
2	1	12	11	7	68%
3	5	8	16	4	66%
4	1	2	3	--	64%
5	1	2	4	--	66%
6	1	2	3	1	64%
7	2	1	2	1	64%
8	--	--	2	3	80%

II Response to Changes in Aggregate Reserves

The purpose of studying the response of individual banks to changes in aggregate reserves is to find out how banks of different sizes are affected by the actions of monetary authorities. Of course, there is no direct connection between changes in aggregate reserves and changes in demand deposits of individual banks. The missing link is the change in reserves of the banks concerned. In Chapter III, changes in demand deposits of different classes of banks were treated, in part, as a delayed

response to changes in reserves and this delay was estimated with the aid of a distributed lag function. The actions of monetary authorities do not affect directly all banks. Banks whose reserves are affected first by open market operations expand or contract their assets as the conditions demand and their actions affect other banks. Thus the process of expansion or contraction spreads. But in this process, the secondary reactions may affect some banks in a manner that is not consistent with the initial changes in aggregate reserves. Such inconsistent reactions are more likely the smaller the size of banks and the more distant the banks are from the leading financial centers.

A. Contrasting response, large and small banks

Changes in demand deposits of most banks in the sample were unrelated to changes in aggregate reserves, either current or lagged. Changes in aggregate reserves had an impact only in the case of nine big banks. Even of these nine banks, the impact was clearly noticeable only in the first five biggest banks. The strongest impact was found in the biggest bank.

The technique followed to estimate the reactions of individual banks was quite similar to the one adopted for estimating the lags in relation to different classes of banks. Changes in total demand deposits in each bank for each period were related to changes in aggregate unborrowed reserves of the same period as well as changes of the two previous periods. Symbolically,

$$\Delta D_t^j = f(\Delta R_t, \Delta R_{t-1}, \Delta R_{t-2}). \quad \begin{array}{l} j = 1 \dots 114 \text{ banks} \\ t = 1 \dots 25 \text{ bi-weekly periods.} \end{array}$$

ΔR_t was negative and significant. The negative coefficient on ΔR_{t-1} was also significant. The positive coefficient on ΔR_{t-2} was not significant. This pattern of coefficients indicates that as the bank expanded

No other independent variables were included. The aggregate amount of borrowings during the period or the level of borrowings of the previous period of the banking system had no meaning in this context.

The connection between changes in aggregate reserves and changes in demand deposits, and by implication changes in reserves of banks with deposits of less than \$90 million, was very tenuous. Equations relating to approximately fifty banks were estimated. In none of the banks with demand deposits of less than \$90 million were the coefficients for changes in reserves, either current or lagged, statistically significant. The values of R^2 were zero in all these cases indicating a total absence of any relationship between changes in demand deposits in these banks and changes in aggregate reserves. It was, therefore, decided not to estimate the equations relating to other banks.

Of the eleven banks in the sample with demand deposits of above \$90 million, in the case of nine the coefficient for ΔR_t was significant, i.e., that changes in aggregate unborrowed reserves of a given period induced significant changes in the deposits of these banks in the same period. (See Table XXIV for the equations.) But in the case of four of them, the value of R^2 ranged from 0.05 to 0.15. This implies that the variation in the deposits of these banks was accounted for by changes in aggregate reserves only to a very small extent. The reactions of the remaining five corresponded closely to changes in aggregate reserves. The reaction pattern in the largest bank was an exact replica of the reaction in the whole system. The coefficient for current period changes in unborrowed reserves (ΔR_t) was highly significant and positive and the coefficient for ΔR_{t-2} was negative and significant. The negative coefficient for the lagged reserve variable indicates that as the bank expanded

Table XXXII

Regressions of changes in total demand deposits

of the nine big banks in the sample

Banks arranged in
a descending order
in relation to size

	ΔR_t	ΔR_{t-1}	ΔR_{t-2}	Constant	$\bar{R}^2$
Bank No. 1	8.691 (1.186)	-1.119 (1.338)	-3.588 (1.234)	-150.395	.73
Bank No. 2	9.310 (2.413)	-2.779 (2.722)	-1.880 (2.510)	-213.108	.37
Bank No. 3	4.183 (.813)	-.8451 (.9182)	.412 (.846)	93.580	.50
Bank No. 4	2.515 (.649)	-.2014 (.7323)	-1.103 (.675)	-18.79	.39
Bank No. 5	2.263 (.503)	-1.029 (.568)	-1.145 (.524)	-27.41	.54
Bank No. 6	3.463 (1.841)	-.0948 (2.077)	-2.344 (1.916)	230.679	.09
Bank No. 7	1.089 (.488)	-.564 (.550)	-.467 (.507)	-96.639	.15
Bank No. 8	2.469 (1.212)	1.000 (1.368)	-1.917 (1.261)	-5.856	.15
Bank No. 9	.734 (.372)	-.350 (.420)	.113 (.387)	-33.981	.05

Changes in total demand deposits of banks are in thousands of dollars while changes in unborrowed reserves are in millions of dollars.

Procedure for estimating the reactions was the same as in the

small banks. The equation relating to the response of the

was also estimated so that this might provide a standard of

Table XXXIII for the equations).

its assets in response to increases in reserves in the current period, it lost part of the reserves in the subsequent period to other banks. Changes in demand deposits in this bank closely corresponded to changes in aggregate reserves as evidenced by the high value (.73) of R^2 . In the case of the other four big banks, the coefficient for current period changes in reserves (ΔR_t) was significant and the value of R^2 ranged from 0.37 to 0.54. It is interesting to note that all these five banks on whom the impact of changes in aggregate reserves was clearly noticeable were located in Philadelphia. This finding led to an examination of the behaviour of demand deposits in seven other banks located in the Philadelphia region, included in the sample. Changes in demand deposits in none of these small banks showed any correspondence to changes in aggregate reserves. Thus small banks located in the same region were immune to the influences felt by the big banks. These results emphasize that the impact of the actions of monetary authorities is felt mostly by large banks located in leading financial centers.

B. Varying response of size groups

By aggregating the changes in demand deposits of banks in each size group, it is found that there was practically no impact of changes in aggregate reserves on the three smallest size groups and also the second biggest group. The impact on the three middle-sized groups was not strong. The biggest size group felt the impact most.

The procedure for estimating the reactions was the same as in the case of individual banks. The equation relating to the response of the banking system was also estimated so that this might provide a standard of comparison (See Table XXXIII for the equations).

changes in demand deposits caused by
reserves of the early period were large and in the
change Table XXXIII The coefficient for reserves
(ΔR_{t-2}) was negative and significant. This negative
Regressions of changes in total demand deposits of size groups
explaining. This could happen only if the banks over-
Size group of banks ΔR_t ΔR_{t-1} ΔR_{t-2} Constant R^2

Group 1	-.028 (.705)	-.938 (.795)	-.0396 (.733)	- 118.3	0
Group 2	.127 (.589)	-.275 (.665)	-.156 (.613)	50.725	0
Group 3	2.698 (2.630)	3.691 (2.968)	-.767 (2.737)	723.440	0
Group 4	1.622 (.702)	.656 (.793)	-.231 (.731)	113.137	.11
Group 5	4.555 (2.095)	1.377 (2.364)	- 1.061 (2.179)	471.607	.09
Group 6	11.149 (7.22)	16.613 (8.157)	- 7.129 (7.522)	2192.6	.15
Group 7	11.170 (8.571)	9.267 (9.671)	- 7.635 (8.919)	1696.4	0
Group 8	26.940 (4.350)	- 5.971 (4.909)	- 7.220 (4.527)	315.009	.63
Banking system	9.454 (1.186)	-.748 (1.333)	- 2.458 (1.234)	30.641	.74

Changes in total demand deposits of size groups are in thousands of dollars while changes in unborrowed reserves are in millions of dollars. Changes in total demand deposits of the banking system are in millions of dollars.

Deposits of this group showed no similarity to changes in reserves. In contrast, there was a close parallel between changes in deposits of the largest size group and changes in reserves.

For the banking system, changes in demand deposits caused by changes in unborrowed reserves of the same period were large and in the same direction as the change in reserves. The coefficient for reserves lagged two periods (ΔR_{t-2}) was negative and significant. This negative coefficient needs explaining. This could happen only if the banks over-expanded deposits during a given period so that they were compelled to contract their deposits in the subsequent period. This appears to have been the case as the value of the coefficient for current (ΔR_t) period changes is very large. The deposit multiplier, by adding the coefficients for the reserve variables, was 6.656. The high value (.73) of R^2 indicates the close association between changes in demand deposits and changes in aggregate reserves.

The changes in demand deposits in the three smallest size groups were totally unrelated to changes in aggregate reserves, as shown by the fact that the value of $\bar{R}^2$ was zero in the three equations.

In the case of the three middle-sized groups, i.e., banks with demand deposits of \$5 to \$10 million, \$10 to \$50 million, and \$50 to \$90 million, the impact was mild. The coefficient for at least one of the reserve variables was significant. The value of $\bar{R}^2$ was quite low, ranging from 0.05 to 0.15.

Changes in demand deposits of the second largest group, i.e., banks with demand deposits of \$50 to \$90 million, were unrelated to changes in aggregate reserves. This is consistent with the earlier finding that changes in demand deposits of this group showed no similarity to changes in the banking system. In contrast, there was a close parallel between changes in demand deposits of the largest size group and changes in

aggregate reserves. The coefficient for current period changes in reserves was positive and significant and that for ΔR_{t-2} was negative and significant. Changes in aggregate reserves, current and lagged, accounted for 73 per cent of the variance in demand deposits of this group.

It is seen from the analysis presented above that banks with deposits of less than \$10 million are practically independent of the actions of monetary authorities. There is no parallel between changes in their demand deposits and changes in aggregate reserves. Even in the case of banks with deposits between \$10 million and \$90 million, the influence was only slightly felt. The main conclusion to be drawn from the study is that the brunt of adjustment arising from changes in aggregate reserves is borne by banks in the largest size group.

and was given in this study to the analysis of the seasonal variation in demand deposits. It was shown that during the period 1953-59, demand deposits, on the average, for 60 per cent of the banks. The pattern and the extent of seasonal variation both among banks and their different components are very different. The responsibility of the central bank, operating through its seasonal offsetting operations dominate 'dynamic' or 'open market' operations. The analysis of the seasonal variation in demand deposits showed that their pattern and magnitude differed not only among different components of demand deposits but also among the total demand deposits of banks. The seasonality of the demand deposits of banks showed that hardly fifty per cent of the banks followed the pattern of the seasonal offsetting operations of the central bank. But the seasonal offsetting operations of the central bank were not the only factor influencing the seasonal variation in demand deposits.

CHAPTER VI

CONCLUSIONS

Variability of demand deposits was analysed at two levels, first at the macro level of the banking system and second at the micro level of individual banks. The study focused attention on two aspects of the problem, the seasonal element in deposit variation and the relationship between changes in demand deposits and changes in aggregate reserves. The conclusions that emerge and their implications primarily for monetary policy are briefly discussed below.

I Seasonal Variations and Monetary Actions

The importance given in this study to the analysis of the seasonal forces stems from the fact that they are a major element contributing to deposit variation over a year. It was shown that during the period 1955-59, the seasonal factors accounted, on the average, for 60 per cent of the total variability. The pattern and the extent of seasonal variation both in the total demand deposits and their different components are very relevant to the 'defensive' responsibility of the central bank. Quantitatively speaking, the seasonal offsetting operations dominate 'dynamic' or policy elements in the open market operations. The analysis of the seasonal variations showed that their pattern and magnitude differed not only among the different components of demand deposits but also among the total demand deposits of different classes of banks. The examination of the seasonal pattern in the sample banks showed that hardly fifty per cent of them conformed to the pattern of the District. But the seasonal off-

setting operations of the system are conducted on an aggregative basis and therefore, like the dynamic elements, have a differential impact on banks. This fact is not generally recognized.

In this context the 'experiment' suggested by Aschheim,¹ that the monetary authority refrain from seasonal offsetting in open market operations and engage only in those open market operations that would be in the pursuit of dynamic goals alone, takes on an additional significance. The implication of this proposal is that the monetary authority will release to the commercial banks through the discount window reserves that previously were released by means of defensive open market operations. Aschheim suggested the separation of the defensive and dynamic operations so as to enhance the public comprehension and appraisal of central bank activity. But even from the narrow view of helping commercial banks to cope with seasonal strains, there is much to be said in favor of supplying the seasonal funds through the rediscount window. It avoids the uneven effects on banks that must necessarily result from operations conducted on an aggregative basis.²

¹Joseph Aschheim, *Financial Intermediaries and the Goals of Monetary Policy*, Papers and Proceedings of the American Economic Association, 1962, pp. 360-371.

²The Reserve Bank of India has been following such a practice since 1952. The circumstances under which the Reserve Bank of India introduced the scheme are somewhat different. A peculiar characteristic of the Indian money market is the highly seasonal character of variations in the demand for funds. During the busy season, lasting roughly between October and May, funds flow out of the banking system and in the slack season, they return. Prior to 1952, the commercial banks provided themselves with funds needed in the busy season through the sale of securities to the Reserve Bank. But the Reserve Bank of India found the system of open-market purchases not so desirable as a means of supplying funds. The customary mechanism of buying securities in the busy season worked satisfactorily so long as the commercial banks repurchased the securities when funds flowed back to them in the slack season. But it was found in the few years preceding 1952 that repurchases by banks in the slack season were on a relatively small scale; accordingly, the Reserve Bank had to carry increasing amounts of securities in its portfolio season after season. The Reserve Bank therefore switched to a system whereby seasonal requirements were met through rediscounts or loans rather than through open market operations.

II Impact of Monetary Policy

The analysis of the timing relationships in the sequence of policy decisions, actions and results in the monetary and fiscal policy areas has increasingly come to occupy the attention of economists. If the lags involved are long and highly variable, they would seriously undermine the basis for discretionary monetary or fiscal policies. The present study deals in part with the first sequence in the chain of reactions generated after monetary authorities have acted.

The conclusion that emerges is that the banking system responds promptly to changes in reserves and that it does not take more than a month and a half for the full impact of changes in unborrowed reserves to be reflected in demand deposits. An overwhelming part of the reaction to changes in reserves occurs in the first semi-monthly period itself. The lagged response is primarily seen only in the country banks.³

From a study of the reactions of banks separately, the process of transmission of reserves within the banking system emerges clearly. In the case of central Reserve city banks, all the positive effect on demand deposits of changes in aggregate reserves occurs in the same semi-monthly period as the change in reserves, while in the subsequent periods the effect is only negative. In the case of country banks, changes in aggregate reserves in any period lead to positive changes in demand deposits in three periods. The two findings together indicate that the actions of monetary

³A useful extension of this analysis would be to investigate the time lag involved between changes in aggregate reserves and changes in the loans and investments of commercial banks. This would indicate in what order and with what speed banks adjust their assets to changes in reserves.

While it has not probed into the reasons for this, this investigation points to the fact

authorities in introducing changes in reserves through open-market operations initially affect banks in the important financial centers and that these effects are then transmitted to other banks through a process of expansion or contraction of deposits set in motion by the banks affected in the first instance. The lag in the response of country banks to changes in aggregate reserves is, therefore, partly accounted for by the delay in the transmission of reserves to these banks. There is, however, reason to believe that part of the lagged response of country banks may also be due to their slow reaction to changes in reserves as evidenced by a lag in their response to changes in their 'own' reserves.

While the response of banks in terms of timing was prompt, the magnitude of response changed from period to period. The deposit multiplier was distinctly smaller in the period 1954-59 than in 1960-63. A deposit multiplier less than that of the potential multiplier during a period of monetary restraint implies that banks are using excess reserves that existed at the beginning of the period. But the reasons for changing values of the deposit multiplier must be found in other factors also. An interesting result obtained in this context was that the flow of reserves to country banks during 1954-59 was smaller than in the later period. Approximately 33 per cent of the new reserves went to country banks in the period 1960-63 while the corresponding figure for the period 1954-59 was 23 per cent. This changing pattern has important consequences for monetary policy. Under a system of differing reserve requirements, the magnitude of deposit multiplier changes as the distribution of reserves among different classes of banks alters. The reasons for the changing patterns must lie in factors such as inter-regional trade flows. While it has not probed into the reasons for such changing patterns, this investigation points to the fact

that over the short period, the pattern of distribution of new reserves is unstable.⁴

The data on deposits of individual banks made it possible to study the impact of monetary policy on banks of different sizes. Changes in demand deposits of the banking system are governed by changes in aggregate reserves but those of individual banks are related directly only to their own reserves which are influenced not only by changes in aggregate reserves but also by the trading relations of each bank with other banks. If, however, monetary policy affects all banks more or less in the same way, one would expect to find a certain similarity between changes in demand deposits of individual banks and changes in aggregate reserves.

As far as the banks included in the sample were concerned, it was seen that changes in demand deposits of banks with less than \$90 million bore no relationship to changes in aggregate reserves. On the other hand, demand deposits of banks with deposits of above \$90 million were clearly affected by changes in aggregate reserves. But even among these, only the five largest banks moved in close step with changes in aggregate reserves. It was also found that the change in demand deposits of small banks located in the same region as the largest banks were unrelated to changes in aggregate reserves. The implication of these findings is that the connection between changes in aggregate reserves and changes in demand deposits of small banks is very tenuous.

⁴This changing pattern in the flow of reserves led Simmons to believe that monetary authorities would not be able to determine the amount by which bank reserves must be changed in order to bring about a desired alteration in the aggregate money stock. See Edward Simmons, "The Monetary Mechanism Since the War," Journal of Political Economy, (April 1950), pp. 124-126.

The question whether big business or small business is affected more by monetary controls has often been discussed. To answer this question it would seem to be important to find out which types of banks are affected most. One of the findings of the present study is that the main brunt of adjustment to changes in reserves initiated by monetary authorities is borne by banks with demand deposits of above \$300 million. Changes in demand deposits of only these banks are found to be in conformity with changes in aggregate reserves.

The question of the effect of member-bank borrowing on open-market operations has been debated for a long time. The Reserve position doctrine of the 1920's held that changes in member-bank borrowing moved in a direction opposite to changes in unborrowed reserves and therefore had the effect of neutralizing the actions of monetary authorities. The theory also held that member banks were reluctant to be in debt and that the volume of their borrowing was affected very little by changes in profitability. The opposite view is that banks do borrow when it is profitable for them to do so, i.e., whenever the discount rate is lower than the prevailing market rate of interest, though there is a limit to the debt a bank is willing to incur, a limit that is set by factors such as the tradition against borrowing.

The analysis of member-bank borrowing over the two periods 1954-59 and 1960-63 clearly indicated that changes in borrowing moved in a direction opposite to changes in unborrowed reserves, i.e., the dominant motive of member-bank borrowing appears to be to offset in part the movements of changes in unborrowed reserves generated by monetary authorities. For the period 1954-59, a decrease in aggregate unborrowed reserves of \$1 resulted in an increase in the borrowing of \$.28. The offsetting borrowing occurred in the same semi-monthly period as the change in reserves. The inducement

to borrow when the market rate of interest (measured in this analysis by the market yield on the three months' Treasury Bill) was above the discount rate, was also present, but this profit motive was a very mild force influencing the member-bank borrowing. Also, different classes of banks showed differing degrees of sensitivity to these factors. The impact of these factors was strongest on the central Reserve city banks.

The fact that the Federal Reserve operations are diluted by counter-movement through the discount window raises the question as to what should be the target of monetary actions. Tobin has argued that in shooting at gross reserves (unborrowed reserves plus borrowings) the Federal Reserve is shooting at a moving target. The Reserve position theorists felt that because of the counteracting impact of borrowing, direct control of deposit expansion through the control of the total volume of bank reserves could be difficult. In aiming at gross reserves, the Federal Reserve is hitting at a moving target but this does not render the actions of monetary authorities ineffective, so long as they can predict within limits the extent of member bank borrowing. The implication of the empirical finding that member bank borrowing moves in a direction opposite to changes in reserves is that the monetary authorities in aiming at a given level of gross reserves must increase or decrease the supply of reserves through open-market operations more than they would have done had there been no offsetting borrowing. Or alternately, discounting must become much more of a policy weapon than it is now.

STATISTICAL APPENDIX

Table I

Variability in Government Deposits
and in net demand Deposits other
than Government Deposits, 1962

Name of Bank	Coefficient of variation of weekly levels of	
	U.S.Gov. Deposits	net demand deposits other than U.S.Gov.
Bank of New York	.4970	.0503
Chase Manhattan Bank	.3475	.0396
First National City Bank	.2660	.0198
Chemical Bank New York Trust Co.	.3661	.0314
Morgan Guaranty Trust Co.	.5162	.0451
Manufacturers Hanover Trust Co.	.2601	.0326
Irving Trust Co.	.3864	.0489
Bankers Trust Co.	.1300	.0420
Marine Midland Trust Co.	.6450	.0737
United States Trust Co.	.5619	.1251
Grace National Bank	.4101	.3828

Table II - A

Variability in Personal Accounts

Size of Accounts - Average monthly Balance in \$	Coefficient of variat- ion of monthly levels of deposits.
300	.1100
400	. -
500	.3460
800	.7280
900	.5550
1100	.6741
1200	.4440
1300	.5160
1500	.6000
1500	.4900
1600	.5480
1700	.2350
1700	.5790
1900	.5150
2100	.1060
2200	1.1650
2400	.5050
2400	.2356
2400	.7560
2700	.6120
2800	.3846
3300	.6900
3400	.7360
3600	.1924
3600	.6160
3700	.5280
4800	.3416
5100	.2390
6300	.1760
6400	1.0915

Table II - A

Cont.

Size of Accounts -
Average Monthly
Balance in \$

Coefficient in variat-
ion of monthly levels
of deposits

6900	.2700
7400	.4490
7400	.6120
7500	.5800
8200	.3175
8800	.5150
9900	.4873
10900	1.5000
12200	.5688
12600	.5511
12700	.5560
16600	.2239
18100	.5290
22700	.4222
29200	.6400
30800	1.1900
31200	.2070
52400	.5000
54300	.1800
194800	.0500

Table II - B

Variability in Business Accounts

Size of Account - Average monthly balance in \$	Coefficient of Var- iation of monthly levels of deposits
12040	.1412
15668	.2742
17074	.2360
24383	.6512
26266	.3152
26730	.3446
32099	.3782
33208	.1841
33466	.1924
36408	.2238
36708	.2617
40699	.2012
51075	.1891
52966	.1687
53641	.1990
78591	.1702
83183	.1657
111740	.2327
119341	.3263
121491	.1852
124391	.2250
138699	.3105
155607	.3621
158310	.2066
190549	.3330
221260	.1804
228015	.2982
230290	.0913
241850	.0729

Table II - B

Cont.

Size of Account - Average monthly balance in \$	Coefficient of Variation of monthly levels of deposits	
254865	.3829	A/S
275932	.1430	
286823	.3240	.04327
305932	.1545	.04353
349990	.4291	.03172
358773	.1940	.04976
358906	.3817	.04300
365981	.3359	.04780
471723	.3550	.03644
474839	.2227	.05748
510172	.2247	.03112
527522	.2669	.04963
532264	.1232	.03068
549140	.3698	.03879
608400	.2125	.04037
1380000	.1615	.04085
2140000	.2287	.02413
2420000	.3033	.04328
2440000	.2526	.03896
2480000	.2850	.03982
7420000	.0970	.02732
		.03552
		.04444
		.03726
		.03626
		.03117
		.04057
		.04027

Table III

Variability of Demand
Deposits for Sample Banks.

Size of bank -aver- age of the bi-weekly demand de- posits. In thousands of \$ ($\bar{D}$)	Measures of Variability			
	σ	$\sigma/\bar{D}$	A	A/ $\bar{D}$
294.2	27.2763	.09271	19.182	.06520
336.8	32.5115	.09653	14.671	.04356
342.7	10.9544	.03196	7.101	.02072
355.2	25.5147	.07183	17.675	.04976
374.4	11.0905	.02962	12.355	.03300
378.8	16.1864	.04273	14.319	.03780
398.2	24.5357	.06161	14.510	.03644
414.0	29.4957	.07124	23.797	.05748
414.0	25.8843	.06252	12.884	.03112
414.1	23.6431	.05709	16.792	.04060
414.4	33.4962	.08083	12.714	.03068
434.3	25.2982	.05825	15.513	.03572
453.8	23.7486	.05233	18.297	.04032
454.3	44.1361	.07715	17.227	.04048
455.7	40.4845	.08884	13.270	.02912
562.0	25.3377	.05484	15.375	.03328
467.6	29.6142	.06333	18.685	.03996
485.0	23.3880	.04822	19.167	.03952
488.7	28.9309	.05919	13.351	.02732
518.4	50.8330	.09806	18.414	.03552
528.1	30.1164	.05027	20.300	.03844
534.6	21.2838	.03981	14.580	.02728
547.6	40.5092	.07397	19.867	.03628
562.3	28.0535	.04989	17.769	.03160
573.4	45.2990	.07900	25.539	.04452
590.0	32.9393	.05583	23.765	.04028

Table III
Cont.

Size of
bank - aver-
age of the
bi-weekly
demand de-
posits. In
thousands of
\$ ($\bar{D}$)

Measures of Variability

	σ	$\sigma/\bar{D}$	A	$A/\bar{D}$
595.5	36.7559	.06172	23.082	.03876
597.0	37.3630	.06258	25.289	.04263
598.3	46.2168	.07725	19.887	.03324
612.6	22.6274	.03693	21.269	.03472
615.2	32.4100	.05512	19.317	.03140
654.7	33.8082	.05168	21.553	.03292
664.5	34.3656	.05171	20.068	.03020
666.2	34.2198	.05136	25.049	.03760
682.1	58.3095	.08548	27.557	.04040
683.2	80.8949	.11840	35.417	.05184
695.6	32.2305	.04634	17.780	.02556
718.7	37.4165	.05206	20.124	.02800
725.9	30.4795	.04198	22.009	.03032
735.5	51.1077	.06948	28.920	.03932
760.1	33.2114	.04369	20.857	.02744
764.3	83.6719	.10947	27.331	.03576
806.9	31.5170	.045077	25.111	.03112
836.5	37.2021	.04447	21.414	.02560
882.1	52.1248	.05909	24.240	.02748
886.5	64.5458	.07276	29.006	.03272
887.5	55.9553	.06304	22.472	.02532
891.9	36.6878	.04113	27.007	.03028
901.8	97.9336	.10859	39.355	.04364
921.3	50.4876	.05480	31.914	.03464
1020.8	55.0363	.05390	26.949	.02640
1052.2	36.5513	.03473	21.086	.02004
1175.9	127.0393	.10803	80.385	.06836

Table III
Cont.

Size of bank - aver- age of the bi-weekly demand de- posits. In thousands of \$ ($\bar{D}$)	Measures of Variability			
	σ	$\sigma/\bar{D}$	A	$A/\bar{D}$
1193.0	45.2437	.03792	33.118	.02776
1291.1	86.9252	.06733	32.123	.02488
1346.5	45.5741	.03384	34.255	.02544
1373.6	152.7000	.01116	55.054	.04008
1454.3	80.8331	.05588	30.424	.02092
1481.9	122.8820	.08292	56.312	.03880
1484.5	84.7643	.05709	28.206	.01900
1561.6	105.0285	.06725	62.526	.04004
1663.1	90.0055	.05411	43.374	.02608
1729.0	134.0634	.07753	74.554	.04312
1874.6	320.1936	.17081	78.108	.04220
1970.6	76.8049	.03897	37.516	.01904
2051.3	184.1874	.08979	75.488	.03680
2202.8	111.0495	.05041	50.576	.02296
2275.8	113.0707	.04968	59.444	.02612
2430.4	74.6592	.030719	56.483	.02324
2604.3	151.4100	.05813	83.754	.03216
2681.9	167.7349	.06254	71.768	.02676
3034.0	97.9615	.02569	57.525	.01896
3043.9	108.9954	.035807	85.107	.02796
3089.0	474.9863	.15376	77.966	.02524
3143.8	185.1917	.05890	96.452	.03068
3426.4	137.3098	.04007	83.330	.02432
3555.8	170.7219	.04801	117.057	.03292
3745.2	210.7889	.05628	117.749	.03144
3957.3	260.1240	.06573	105.739	.02672
3980.4	265.0867	.06659	201.408	.05060
4230.0	283.1748	.06694	88.830	.02100

Table III

Cont.

Size of bank average of the bi-weekly demand deposits. In thousands of \$ ($\bar{D}$)	Measures of Variability			
	σ	$\sigma/\bar{D}$	A	$A/\bar{D}$
5665.1	189.6312	.04064	118.680	.02554
4766.3	211.6199	.04439	167.583	.03516
5340.9	188.8120	.03535	145.486	.02724
5447.8	292.0787	.05361	206.184	.03764
5766.7	401.9191	.06969	199.528	.03460
6377.6	910.1164	.14360	290.262	.04580
7706.4	373.5251	.04846	180.022	.02336
8785.6	346.3986	.03942	235.103	.02676
10242.6	1348.8633	.13169	332.680	.03248
11331.5	768.9980	.06796	373.486	.03296
12225.9	309.3446	.02530	179.965	.01472
12320.5	490.7249	.03982	366.658	.02976
12816.0	2224.9910	.17361	525.456	.04100
20447.3	702.6898	.03436	539.809	.02640
32610.5	911.5832	.02795	890.919	.02732
51242.9	126.1502	.02461	957.217	.01868
57426.6	1608.9167	.02801	1205.959	.02100
58352.6	4251.4436	.07285	1743.576	.02988
58741.2	2825.1412	.04809	1139.579	.01940
65978.6	5204.6750	.07884	1781.422	.02700
68140.0	1722.5968	.02528	1349.172	.01980
71509.4	1815.4845	.02536	1666.136	.02328
90667.6	4080.3334	.04500	3303.927	.03644
109238.7	3580.0659	.06592	3006.249	.02752
109901.0	9329.5728	.08489	6241.140	.05676
112543.0	10264.1838	.09120	9579.660	.08512
194665.0	4643.4503	.02364	4524.015	.02324
228863.0	23624.1023	.10322	14116.270	.06168
340835.0	6913.3422	.02028	5671.494	.01664

Table III
Cont.

Size of bank aver- age of the bi-weekly demand de- posits. In thousands of \$ ($\bar{D}$)	Measures of Variability			
	σ	$\sigma/\bar{D}$	A	$A/\bar{D}$
389323.2	61407.6882	.15772	6696.359	.01720
530071.3	10798.2691	.02037	9032.415	.01704
767979.8	25472.0983	.03316	23100.832	.03008
902081.1	24991.5990	.02770	16057.044	.01780

Description of Symbols:

$\bar{D}$ = average of the bi-weekly levels of demand deposits.

σ = standard deviation of the bi-weekly levels of demand deposits.

A = average of the bi-weekly changes (ignoring sign) in demand deposits.

(All in thousands of dollars.)

Table IV
 Variability of Time Deposits for
 Sample Banks

Size of bank average of the biweekly levels of time deposits in thousands of \$ (TD)	standard deviat- ion of the resid- ual after the elimination of trend in thous- ands of \$ (σ_u)	$\sigma_u / \bar{TD}$
384.000	8.5070	.02215
436.600	10.6549	.02440
467.400	4.2108	.00900
496.692	38.6892	.07789
544.500	10.6712	.01959
549.461	4.1181	.00747
602.500	18.5817	.03084
610.1153	5.6086	.00919
621.8461	12.57591	.020223
642.615	6.4430	.01002
636.153	11.3721	.01787
654.307	8.3212	.01271
682.807	18.6858	.02736
707.461	7.9032	.01117
708.500	15.8476	.02236
714.615	6.6663	.00932
726.000	11.2876	.01554
732.038	7.05022	.00963
737.500	4.8812	.00661
749.230	8.0327	.01072
763.961	11.4513	.01498
771.2692	7.5820	.00983
823.000	5.8807	.00714
825.500	6.9704	.00844
829.269	15.1702	.01829
898.307	10.7756	.01199
954.192	10.3249	.01082
960.000	12.9170	.013455
964.961	11.9640	.012398

Table IV

Cont.

Size of bank- average of the biweekly levels of time deposits in thousands of \$ (TD)	Standard deviation of the residual after the elimination of trend in thousands of \$ (σ_u)	$\sigma_u / \overline{TD}$
1008.1538	5.48610	.00544
1027.6538	5.94723	.00578
1046.3076	13.46119	.01286
1068.9615	3.99776	.00374
1071.6923	116.05872	.10829
1111.4230	13.62710	.01226
1113.6538	9.65792	.00872
1121.1538	8.45728	.00700
1136.0384	25.04362	.022045
1140.1153	10.42674	.009135
1141.0000	37.05166	.03247
1154.9230	18.60934	.01611
1180.3461	5.74659	.00486
1195.7308	30.41074	.02553
1227.2692	22.57160	.01839
1250.3076	12.92969	.01034
1282.0384	14.14223	.01103
1293.9615	9.05528	.00699
1314.4615	80.73632	.06142
1365.6538	19.72061	.01444
1408.5769	16.75104	.01189
1432.2692	28.25229	.01832
1453.6154	11.54676	.00794
1666.6423	133.91427	.08034
1732.2692	21.52004	.01242
1746.0000	12.51660	.007943
1782.4615	14.66372	.00822
1812.6923	22.06534	.01217
1927.11538	17.17895	.00891
1932.0769	36.49425	.01888
2123.0384	41.95491	.01976
2153.1154	17.62031	.00818

Table IV

Cont.

Size of bank-
average of the
biweekly levels
of time deposits
in thousands of
\$ (TD)

Standard deviation
of the residual after
the elimination of
trend in thousands
of \$ (σ_u)

 $\sigma_u / \bar{TD}$

2185.3461	20.54614	.00940
2191.3461	35.89517	.01638
2239.1153	27.67389	.01236
2501.4615	37.66549	.01505
2975.8846	228.69037	.07684
2986.6154	26.79897	.00818
3180.0000	25.41462	.00799
3215.1923	36.74636	.01142
3360.0769	42.66522	.01269
3628.8076	86.16999	.02375
3753.4615	28.31679	.00754
3891.7692	76.83559	.01974
4154.4577	50.69175	.01236
4574.3461	582.65672	.12737
4963.6538	55.86880	.01125
5177.1923	45.50979	.00879
5378.1153	382.40882	.07104
5557.1154	37.27225	.00676
5697.1153	38.51993	.00676
5800.4615	25.31631	.00436
5797.5384	83.08493	.01433
6490.6154	132.54127	.02042
6586.7307	55.67904	.00845
6713.1923	87.11660	.01297
6897.2692	237.74324	.03446
7277.0385	48.19070	.00662
8277.3846	89.41669	.01080
9210.0385	120.02701	.01303

Table IV

Cont.

Size of bank- average of the biweekly levels of time deposits in thousands of \$ (TD)	Standard deviation of the residual after the elimination of trend in thousands of \$ (σ_u)	$\sigma_u / \overline{TD}$
10,446.9615	76.69947	.00734
11,295.4615	64.56144	.00571
12,300.8077	591.59472	.04809
12,614.3846	83.62629	.00662
18,679.6153	963.29256	.05156
20,461.8461	153.70803	.00751
28,137.7307	660.91012	.02348
34,281.5380	192.14319	.00560
34,956.7300	1487.67713	.04255
38,242.2300	372.73703	.00974
40,104.9615	360.80035	.00899
47,877.5000	843.95184	.01762
48,317.9615	1103.89558	.02284
56,186.5384	457.23330	.00813
64,088.0384	982.48342	.01533
65,759.8076	408.78730	.00621
66,066.2307	1651.04025	.02501
66,584.5380	643.74770	.00562
70,625.0384	4045.44811	.05728
76,927.9230	276.98039	.00360
103,941.3461	6387.16044	.06144
160,667.6538	5121.53488	.03187
176,503.5000	4179.55590	.02368
178,806.6538	5600.70100	.03134
209,083.6923	4498.80000	.02151

Table V
Regressions on Seasonal Index

Bank No.	Constant	β Coefficient	$\bar{R}^2$	$\bar{S}^2$
1	.0938	2.0858*	.4255	15.4948
2	.2129	.8166	.0348	15.5594
3	.1106	1.7601	.1938	27.6902
4	1.6540	2.1634*	.5334	11.2339
5	.2003	.3212	.0854	25.0486
6	.7796	3.8531*	.4581	46.9553
7	.1015	.2721	.0925	35.4455
8	.0221	.7822	.0106	22.5571
9	.0536	5.1456*	.8227	16.5738
10	.3576	1.6941*	.3146	15.4542
11	.1074	3.9635	.0646	290.7200
12	.1609	2.7722	.0956	115.7257
13	.0102	.2567	.0922	30.1129
14	.1088	.6867	.0244	20.8260
15	.4870	2.4828*	.2853	37.2506
16	1.8211	2.1787	.1066	66.8655
17	.0258	1.3684	.0344	43.8353
18	.0367	1.4688*	.3199	11.3839
19	.1499	.6656	.0032	14.9787
20	.3651	.9376	.1978	7.7140
21	1.2579	2.6824*	.2655	47.1064
22	.3297	.8110	.0607	12.5288
23	.3438	1.9133*	.3900	14.8464
24	.0030	5.4459*	.6387	47.4314
25	.0385	.2790*	.5163	19.9030
26	.0477	1.5760	.1635	25.6933
27	.1670	2.3194	.0678	97.3278
28	.3476	.5714	.0658	5.9925
29	.2460	1.1563*	.3387	6.5653
30	.1235	1.0580	.2221	8.8092
31	.0260	.7075	.1228	6.4199
32	.1036	.8527	.0536	14.6035

Table V
Cont.

Bank No	Constant	β Coefficient	$\bar{R}^2$	$\bar{S}^2$
33	.8671	.3145	.0894	33.2839
34	1.2773	3.5709*	.5664	27.0308
35	1.0126	3.8271*	.4044	56.3395
36	1.0044	5.1567*	.5428	61.6188
37	1.4044	2.4893*	.4278	21.8873
38	1.2759	3.6283*	.5729	27.2185
39	.1654	3.3832*	.5512	25.6996
40	.0261	1.3791	.1675	19.2791
41	.4742	.9703*	.4847	2.7033
42	.0800	3.2035*	.4216	37.0712
43	.0654	.6173	.0708	6.7511
44	.1172	.3585	.0230	5.5700
45	.2741	1.8598	.1138	46.6922
46	.3685	.5924	.0348	18.1778
47	.8255	1.6447	.2003	23.4704
48	.0338	.0217	.0999	35.1011
49	1.0923	.6376	.0766	6.9239
50	.2966	.4682	.0106	8.0804
51	.0583	1.0003	.1647	10.2849
52	.8799	4.1345*	.6186	29.5526
53	.4801	1.2044	.0531	29.2200
54	.6830	1.6561	.0816	45.1877
55	.3516	1.7310*	.3040	16.8192
56	.0831	1.9912*	.2946	23.0914
57	.5265	2.9399*	.1889	79.0624
58	.0006	2.9732*	.5757	18.0816
59	.0935	1.0738	.0833	18.7811
60	.0532	2.2038*	.5792	9.8014
61	.0662	3.0159	.0402	202.8138
62	.3887	.5515	.0155	11.9228
63	.0354	3.0828*	.5680	20.0202
64	.1377	1.1567*	.2707	8.5768
65	.0783	2.2008	.2496	33.8701
66	.0328	2.3148*	.6671	7.5753

Table V

Cont.

Bank No	Constant	ρ Coefficient	$\bar{R}^2$	$\bar{S}^2$
67	.2900	1.3962*	.4829	5.6340
68	.0035	.4266	.0565	2.4581
69	.0479	.7543*	.6066	.7097
70	.0107	.7143*	.3964	1.3900
71	.0243	1.0735*	.4863	2.2621
72	.0767	1.2096*	.5892	1.9537
73	.0491	.9640*	.5197	1.6141
74	.1594	1.0435	.0816	17.9407
75	.2009	.3700	.0861	34.9667
76	.2109	2.2294	.1346	59.7321
77	.2004	.1780	.0889	10.1507
78	.0952	.8582	.1049	10.4814
79	.5785	5.8077*	.7285	36.0012
80	.3225	2.2346*	.4252	17.8042
81	.0089	2.9735*	.6369	14.1906
82	.4018	2.7392*	.4967	20.6153
83	.2624	.5008	.0196	10.3650
84	.3828	.9802	.2362	7.1103
85	.3892	1.4309*	.2822	12.5170
86	.1166	1.0001*	.4202	3.6376
87	.0730	2.4095*	.6545	8.6590
88	.6652	.6081	.0301	8.9779
89	.1948	1.4599	.1435	24.4204
90	.3295	2.4842	.1947	54.9289
91	.8836	1.0112	.1438	11.6992
92	.4315	1.4029*	.5095	5.1600
93	.0487	2.6150*	.6620	9.8800
94	.2224	7.2309*	.5686	109.9118
95	.0208	2.8332*	.7802	6.5296
96	.0903	.3854	.0695	17.0278
97	.0827	.6448	.0471	8.7698
98	2.8844	1.9541	.1143	51.4128
99	.0725	.2369	.0726	7.1837

Table V

Cont.

Bank No	Constant	β Coefficient	$\bar{R}^2$	$\bar{S}^2$
100	.5179	2.3837	.0870	90.3471
101	.0151	4.7276*	.4668	68.5013
102	.9463	4.4788	.1165	166.6457
103	.1405	2.9558*	.4200	31.7465
104	.1406	1.3762	.0292	46.2823
105	.0956	1.1721*	.5797	22.7674
106	.1681	2.3924	.0799	95.3330
107	.1074	1.3681	.0795	31.2580
108	.1358	3.5676*	.4866	36.2951
109	.1452	1.8550*	.2914	20.2924
110	.3462	3.4834*	.6139	21.3753
111	.6225	2.9038*	.5130	21.8221
112	1.0178	2.6181*	.3302	34.7657
113	1.4904	.6185	.0289	18.0458
114	1.1726	2.7603*	.4017	29.6054

* Implies significance at .025 level.