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# MONEY CREATION AND THE THEORY OF THE BANKING FIRM

RICHARD E. TOWEY\*

## I. INTRODUCTION

ONE OF THE MOST widely accepted propositions in economics is that total demand deposits of commercial banks are determined by the quantity of cash reserves and the reserve ratio. The multiple expansion process is described, albeit in simplified form, in every principles textbook. In more advanced treatments, this "pure theory of fractional reserve banking" is extended to incorporate reserve leakages to currency and other forms of deposits, desired excess reserves, differential reserve requirements, etc. But even with the elaborate specification and testing of money supply theory by Brunner [6], Cagan [7], Friedman and Schwartz [10] and others, there is growing dissatisfaction with this type of analysis. To a large extent, this arises because private bank responses are treated as almost trivially mechanical. They may, as the theory posits, be able to force deposits on the general public equal to some precise multiple of reserves under certain conditions. Alert students soon recognize the irony, however, that when shifts to currency or to banks with different reserve ratios are permitted, it is apparently the behavior of the general public which determines total deposits from a given monetary base. Even the size of each bank depends on the public's whim from this perspective. The theory of money creation has rightly been criticized by Gurley and Shaw [13] and Tobin [27] for ignoring that banks are firms. It should be possible to describe bank operations explicitly with the same models of the individual firm and industry as are used with other producers. A more adequate description of bank reactions can then help in clarifying these puzzles in the money creation process.

Other micro models of banking following lines which are more or less familiar for nonbanking pursuits have been presented recently. Klein's model [17] was for purposes other than reconciling the theory of money creation with the theory of the firm. Pesek [20] had this as one of his objectives, but his paper and the present one differ, among other ways, in certain matters of emphasis.<sup>1</sup> The tasks here are to show that, rather than being determined one-sidedly, the equilibrium money stock results from meaningful interaction of the public's tastes with the price-output decisions of individual banks and

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1. The Pesek [20] article was brought to my attention when this analysis was already virtually completed. The reserve externality which below is termed the "cost effect" is noted by Pesek but he does not appear to regard it as pivotal for determining individual bank and industry deposits. His argument relies more heavily on the real balance effect and portfolio risks, [pp. 376-380] which we would treat as adventitious.

of the industry, and that the accepted theory of money creation is consistent with their operations. The analysis sheds new light on how reserves function in controlling deposits, and also on the issue of the "uniqueness" of banks. The models used involve static profit maximization under certainty. While risk and dynamic adjustment problems are thus elided, these do not play an essential role in the multiple expansion theory.<sup>2</sup>

The remainder of this section is concerned with how bank output may be specified and with some characteristics of financial and nonfinancial firms. Individual bank behavior and the cost externality associated with the reserve requirement are examined in Section II. In Section III the focus is on earnings and cost adjustments in the attainment of systemwide equilibrium and requisite actions of the central bank when it has the objective of price stability. Deposit creation per se is discussed in Section IV, while Section V considers the function of external controls as a basis for distinguishing between money and other intermediary claims.

Students of banking who seek analogies with nonfinancial firms are confronted with the problem of finding a comparably simple expression for the product of this industry. Often the nominal quantity of deposits has been selected, [17], [20] and this will be used here. Some questions understandably arise, however. Why use a value magnitude rather than a physical one? Why focus on a stock variable rather than the associated flows or service yields? Isn't credit also a form of bank output? [1], [12], [15]. These matters will be examined briefly. (1) Participants in banking markets customarily describe the industry's outputs in terms of financial instruments, and the conventional fixity of deposit dollars in terms of the unit of account makes their quantity a highly tractable counterpart of physical output measures. (2) Deposit yields are less convenient as an output measure because of their multi-dimensional character. They take the form of various services associated with the use of deposits both as a means of payment and a store of value. Rather than constructing an outright index of such services, it seems preferable to regard them as a vector of product dimensions subject (at least partly) to variation by the firm. Deposit services may be likened, for example, to body styling, sales effort, the availability of distributors' outlets, etc. for automobiles, or to kernel texture, color, gluten content and other properties for wheat. In standard price theory, changes in such qualities are often ignored or attention is given just to sales effort. Some years ago, however, Scitovsky [25] suggested a more general method of treatment: the relevant output properties can be included explicitly in the demand and cost functions.<sup>3</sup> Such an approach will be followed in this paper. (3) Bank credit is closely related to deposits, because the "instant repurchase clause," as Pesek and Saving [21, p. 80] so aptly phrase it, restricts bank asset acquisitions largely to forms with finite maturities and whose values are fixed in money terms. Without diminishing

2. See Klein [17] for a discussion of how the risks of default in assets and volatility in deposits can be incorporated.

3. Others have also pointed to the analytical gains in modifying traditional price theory so as to incorporate the qualitative features of goods. See for example, [5] and [19].

the importance of credit for other analytical problems in banking, it can be relegated to a supporting role when the focus is on money creation since credit composition is of less relevance than the total volume.

We postulate initially that currency is issued only by the central bank, and commercial banks are the sole producers of demand deposits. Other forms of customer claims on banks will be ignored until Section V. Deposits are attractive to holders because in comparison with currency they are relatively free from the dangers of loss, theft and misappropriation both in the making of payments and while being stored; individual payment orders on deposit accounts can be made in virtually any amount; cancelled checks and other bank statements facilitate recordkeeping, etc. Other bank services include the collection of payments between distant points, the issuance of identification cards and of guaranteed payment orders (certified checks, drafts, and the like), and the location of offices convenient to account holders. For generality, the payment of interest on deposit balances may also be permitted.<sup>4</sup> The yield on deposits varies inversely with the price level, but this feature is shared with other goods which can serve as value stores; in keeping with the present micro orientation, we shall assume the central bank controls the money supply so as to achieve price level stability at full employment. With the demographic makeup of the population and yields on other intermediary claims given too, these elements need not be shown explicitly in the demand function for deposits.

Deposits are like other financial claims in that the issuing firm derives little or no direct revenue from them or from the associated services. The relevant unit revenue stems primarily from the earning assets which the issue of claims enables them to obtain. The direct cost to society of providing these claims is virtually zero, but resource-using services and interest payments are offered as inducements to hold them. These indirect revenue, nil production cost and positive service cost features distinguish financial claims from the goods and services whose production is customarily analyzed with price theory. As Gurley and Shaw indicate [13, pp. 4, 198], the distinction between so-called "financial" and "non-financial" firms can be rationalized by the tendency of the former to acquire mostly financial assets with the funds attracted, whereas the latter predominantly obtain real assets. The basis for distinguishing between money and nonmonetary financial claims will be examined in Section V.

## II. A SHORT-RUN MODEL OF THE INDIVIDUAL BANK

The market demand function for deposits,  $D$ , depends on real income,  $y$ , the market rate of interest,  $m$ , the services per dollar of deposits (including inter-

4. A substantial literature has appeared in recent years regarding the effects of paying interest on demand deposits, including whether this deprives deposits of their "moneyness" in some sense. [1], [16], [21], [24]. That controversy is not strictly germane to the present topic, although it may be observed that paying interest most directly strengthens money's holding motive, a motive which arises because using money to reduce exchange costs involves an interval between receipts and payments, and interim transfers to nonmoney earning assets may themselves frequently be too costly at the margin. We agree with Friedman that the quantity of fiduciary money must be externally controlled for inflationary overissue to be avoided, whether or not interest is paid. See [9].

est, when paid) provided in magnitudes  $z_i$ , and the charges  $a_i$ , levied for at least some of these services.<sup>5,6,7</sup> Thus:

$$D = D(y, m, z_i, a_i) \text{ where} \quad (1)$$

$$\frac{\partial D}{\partial y} > 0; \frac{\partial D}{\partial z_i} > 0; i = 1, \dots, s.$$

$$\frac{\partial D}{\partial m} < 0; \frac{\partial D}{\partial a_i} < 0; i = 1, \dots, g \quad g \leq s.$$

Holder-users of deposits demand them because, up to the margin, they value these services more highly than those of currency combined with payments and storage services produced by non-bank firms, of currency combined with "own protection from loss," "own recordkeeping," etc., the barter and clearings alternatives in exchanges; and temporary stores of value other than money. For simplicity, assume that unit banking prevails. The effects of income (or, alternatively, wealth) and the market interest rate on deposit holdings require no elaboration in view of the extensive literature on them recently [18].

The deposit demand function facing the  $j^{\text{th}}$  individual bank is affected not only by its own menu of services and charges but also those of the  $n-1$  other banks.

$$D_j = D_j(y, m, z_{ij}, z_{ik}, a_{ij}, a_{ik}) \quad (2)$$

$$\frac{\partial D_j}{\partial y} > 0; \frac{\partial D_j}{\partial m} < 0; \frac{\partial D_j}{\partial z_{ij}} > 0; \frac{\partial D_j}{\partial z_{ik}} < 0; \frac{\partial D_j}{\partial a_{ij}} < 0; \frac{\partial D_j}{\partial a_{ik}} > 0$$

$i = 1, \dots, s$  for services;  $i = 1, \dots, g, g \leq s$  for service charges;  $j, k = 1, \dots, n; j \neq k$ .

Each bank is required to hold cash reserves,  $R_j$ , in some uniform, legally fixed minimum proportion,  $r$ , to deposits, with  $0 < r < 1$ . Reserves are composed of (perfectly interchangeable) vault cash and deposits at the central bank. While industry-wide reserves,  $R$ , may be treated as socially costless to produce, the restriction on their total quantity which the central bank imposes in furtherance of its price stability objective implies that the  $j^{\text{th}}$  bank's cost of attracting reserves is an increasing function of the deposits at other banks. In keeping with banking custom, no interest is paid on reserves.<sup>8</sup> Let the collection of checks and the associated reserve transfers take place instantaneously, so bank statements need not be complicated with (nonearning) cash items in process.

5. Operationally services may be expressed in terms of such indices as the volumes of checks collected locally and at distant points, checks certified or guaranteed, deposits accepted, statements and other reports issued, the location of offices and the like, and of course the deposit interest rate when that is paid. Some of these elements have been utilized elsewhere; see [3], [17].

6. As noted already, the price level and other standard influences on demand are regarded as given here and need not be explicitly shown.

7. The order of specification of the service elements is arbitrary; when  $g < s$ , we can let the first  $g$  elements be those involving service charges and  $g + 1, \dots, s$  be those for which no charges are levied.

8. The subsequent results can easily be modified to take into account modifications in legal reserve ratios and interest.

The solvency and liquidity protection which individual banks need when they extend credit under fractional reserves will be treated in simplified fashion. Assume the credit market instruments banks acquire are risk-free, have no divisibility problems, and all have the same yield,  $p$ . In the interests of maximum profitability, banks desire to hold no excess reserves on the level of deposits they expect to retain; that is,  $D_j = R_j/r$ . When transitory deposit shifts occur among banks, the “instant repurchase clause” is honored through exchanges of the homogeneous earning assets.<sup>9</sup>

Even in the absence of default risk on earning assets, each bank requires a capital account to provide an asset buffer should its costs of providing deposit services exceed related earnings for a time. Let capital for each bank consist entirely of stockholders’ equity, in the instantaneously adjustable amount  $E_j$ . Furthermore, the expected need for the buffer can be specified as proportional to the scale of deposit operations; then capital is held in some desired relation,  $e$ , to deposits, where  $0 < e < 1$ . Assets acquired through the sale of shares can be assumed to have the same yield and risk-free nature as other earning assets.

Except for deposit interest, the service elements require real resources and at any moment existing banks will have some fixed commitments for plant, equipment, etc., and others which are variable. On grounds similar to those for non-financial industries, the conventional U-shaped short-run average cost and rising marginal cost curves may be expected to apply to each bank.<sup>10</sup> A bank’s cost function can be expressed as:

$$C_j = C_j(D_j, z_{ij}) \tag{3}$$

$$\frac{\partial C_j}{\partial D_j} > 0; \quad \frac{\partial C_j}{\partial z_{ij}} > 0$$

$$i = 1, \dots, s; \quad j = 1, \dots, n.$$

As mentioned already, the quantity of deposits supplied by each bank follows the rule  $D_j = \frac{R_j}{r}$ , and

$$R_j = R_j(z_{ij}, a_{ij}, R, D_k) \tag{4}$$

$$\frac{\partial R_j}{\partial z_{ij}} > 0; \quad \frac{\partial R_j}{\partial a_{ij}} < 0; \quad \frac{\partial R_j}{\partial R} > 0; \quad \frac{\partial R_j}{\partial D_k} < 0$$

$i = 1, \dots, s$  for services,  $i = 1, \dots, g, g \leq s$  for service charges;  $j, k = 1, \dots, n, j \neq k$ .

The total amount of earning assets held by the  $j^{\text{th}}$  bank will be designated as  $L_j$ , on which the given earnings rate is  $p$ . Moreover,  $p = p(m)$  and in the simplest case they may be treated as identical. On each bank’s balance sheet is

9. Equivalently, “Federal funds” transactions may be made, with expected earnings and costs of these being zero for each bank.

10. Provision of the various deposit services may involve joint cost relationships, but for simplicity this will be ignored. Pesek [20] also includes reserve opportunity cost in the cost function, but it would be more appropriate to treat this as affecting the gross earnings rate. This would occur, for example, if the central bank paid explicit interest on reserves.

found the customary equality between assets and liabilities, or  $R_j + L_j = D_j + E_j$ . Since desired  $R_j$  and  $E_j$  are proportional to  $D_j$ , we have by substitution  $L_j = (1 - r + e)D_j$ . With the zero earnings rate on reserves, gross revenues,  $G_j$ , are composed of earnings on assets,  $pL_j$ , and service charges  $\sum_{i=1}^g a_{ij}z_{ij}D_j$ .

Alternatively

$$G_j = p(1 - r + e)D_j + \sum_{i=1}^g a_{ij}z_{ij}D_j \quad j = 1, \dots, n \quad (5)$$

Defining a bank's profit as  $\pi_j = G_j - C_j$ , the first order conditions for maximum profit in the short run when the  $z_{ij}$  are varied take the form:

$$\frac{\partial \pi_j}{\partial z_{ij}} = p(1 - r + e) \frac{\partial D_j}{\partial z_{ij}} + \sum_{i=1}^g a_{ij}z_{ij} \frac{\partial D_j}{\partial z_{ij}} + a_{ij}D_j - \frac{\partial C_j}{\partial D_j} \frac{\partial D_j}{\partial z_{ij}} - \frac{\partial C_j}{\partial z_{ij}} = 0; i = 1, \dots, g \quad (6)$$

$$\text{and} \quad \frac{\partial \pi_j}{\partial z_{ij}} = p(1 - r + e) \frac{\partial D_j}{\partial z_{ij}} + \sum_{i=1}^g a_{ij}z_{ij} \frac{\partial D_j}{\partial z_{ij}} - \frac{\partial C_j}{\partial D_j} \frac{\partial D_j}{\partial z_{ij}} - \frac{\partial C_j}{\partial z_{ij}} = 0; i = g + 1, \dots, s. \quad (6a)$$

Dividing each element of the central group of terms in (6) and (6a) by  $\partial D_j / \partial z_{ij}$  and rearranging, the following alternative formulations are obtained:

$$p(1 - r + e) + \sum_{i=1}^g a_{ij}z_{ij} = \frac{\partial C_j}{\partial D_j} + \left( \frac{\partial C_j}{\partial z_{ij}} - a_{ij}D_j \right) / \frac{\partial D_j}{\partial z_{ij}}; i = 1, \dots, g \quad (7)$$

$$\text{and} \quad p(1 - r + e) + \sum_{i=1}^g a_{ij}z_{ij} = \frac{\partial C_j}{\partial D_j} + \frac{\partial C_j}{\partial z_{ij}} / \frac{\partial D_j}{\partial z_{ij}}; i = g + 1, \dots, s. \quad (7a)$$

The first order conditions for maximum profitability when service charges are adjusted are as follows:

$$\frac{\partial \pi_j}{\partial a_{ij}} = p(1 - r + e) \frac{\partial D_j}{\partial a_{ij}} + \sum_{i=1}^g a_{ij}z_{ij} \frac{\partial D_j}{\partial a_{ij}} + z_{ij}D_j - \frac{\partial C_j}{\partial D_j} \cdot \frac{\partial D_j}{\partial a_{ij}} = 0; i = 1, \dots, g. \quad (8)$$

Dividing the central group of terms by  $\partial D_j / \partial a_{ij}$  and rearranging,

$$p(1 - r + e) + \sum_{i=1}^g a_{ij}z_{ij} = \frac{\partial C_j}{\partial D_j} - z_{ij}D_j / \frac{\partial D_j}{\partial a_{ij}}; i = 1, \dots, g. \quad (9)$$

In equations (7), (7a) and (9), unit revenue ( $UR_j$ ) is  $p(1 - r + e) + \sum_{i=1}^g a_{ij}z_{ij}$ , marginal cost ( $MC_j$ ) is  $\partial C_j / \partial D_j$ , and the  $\left( \frac{\partial C_j}{\partial z_{ij}} - a_{ij}D_j \right) / \frac{\partial D_j}{\partial z_{ij}}$ ,  $\frac{\partial C_j}{\partial z_{ij}} / \frac{\partial D_j}{\partial z_{ij}}$ , and  $-z_{ij}D_j / \frac{\partial D_j}{\partial a_{ij}}$  terms are what Scitovsky defines as “variation cost” ( $VC_{ij}$ ), the cost to a producer of modifying the  $i^{\text{th}}$  term of his offer sufficiently to change his quantity sold by one unit. [25, pp. 248-259]. Banks possessing monopolistic power through varying service offers will individually equate  $UR_j$  to  $MC_j + VC_j$ . But Scitovsky’s approach has even broader implications. Suppose a bank finds customer response to a service improvement is such that  $\frac{\partial D_j}{\partial z_{ij}} \rightarrow \infty$ ; hence,  $VC_{ij} \rightarrow 0$  at that point. This involves the

quality modification counterpart of the familiar Marshallian competitive result (for a qualitatively invariant product); in both situations, firms operate where  $UR_j = MC_j$ . Furthermore, when the qualitative change can be and is readily duplicated by others in the quest for profit, the resulting tendency toward dimensional standardization in the industry even in the short run makes the symmetry with the Marshallian competitive outcome even more apparent.<sup>11</sup>

11. Credit market segmentation can also be recognized, as when banks find they can affect loan interest rates by varying the quantity of credit extended to different groups of borrowers. The assumptions of homogeneity in solvency and liquidity characteristics are continued. Desired excess reserves remain at zero. To avoid undue complexity, it will also be assumed that service charge income is zero; gross revenues stem only from earning assets acquired in this case. Let there be  $b$  groups of borrowers, and each bank has monopolistic power in allocating funds among them. Loans made by the  $j^{\text{th}}$  bank to each class of borrower are in amount  $L_{tj}$ , on which the earnings rate is  $p_t$ ,  $t = 1, \dots, b$ .

As before,  $\sum_{t=1}^b L_{tj} = L_j = (1 - r + e) \sum_{t=1}^b D_{tj}$ , where  $(1 - r + e)D_{tj}$  represents the amount of deposits, adjusted for capital and reserves, which must be held to make loan  $L_{tj}$ . (This latter specification can be made irrespective of the identities of deposit holders). Gross revenue of the  $j^{\text{th}}$  bank then is

$$G_j = (1 - r + e) \sum_{t=1}^b p_t D_{tj} \tag{10}$$

and for maximum profit:

$$\frac{\partial \pi_j}{\partial p_t} = (1 - r + e)D_{tj} + (1 - r + e)p_t \frac{\partial D_j}{\partial p_t} - \frac{\partial C_j}{\partial D_j} \frac{\partial D_{tj}}{\partial p_t} = 0 \quad t = 1, \dots, b \tag{11}$$

(noting that  $\frac{\partial D_j}{\partial D_{tj}} = 1$ ).

$$(1 - r + e)p_t = \frac{\partial C_j}{\partial D_j} - (1 - r + e)D_{tj} / \frac{\partial D_{tj}}{\partial p_t} \quad t = 1, \dots, b \tag{12}$$



The reserve stipulation, as usually specified in money creation analysis, has a dual impact on individual banks: it affects the profitability of a given dollar of deposits by decreasing the associated amount of earning assets which can be acquired (the "earnings" effect on  $r$  in  $(1 - r + e)$ ), and it imposes a pecuniary externality which influences the cost per dollar of deposits (the "reserve cost" effect shown in the  $\frac{\partial R_j}{\partial D_k}$  term). The latter effect operates because

of the proportionality between deposits and reserves; banks are forced to limit deposits to those which provide their own reserve inflow.<sup>12</sup> The restriction on the quantity of reserves implies that enhanced service offers by rivals make each bank's own services less effective in attracting reserves to it. The  $j^{\text{th}}$  bank's marginal cost curve is shifted leftward thereby, under the assumption that desired excess reserves are held to zero. In a "competitive" situation, improved service dimensions (or reduced service charges) by other banks force the  $j^{\text{th}}$  bank to match them if any deposits at all are to be retained. Where the  $j^{\text{th}}$  bank possesses monopolistic power because other banks' deposits are less than

$$\frac{\partial \pi_j}{\partial z_{ij}} = (1 - r + e) \sum_{t=1}^b \frac{\partial p_t}{\partial D_{tj}} \frac{\partial D_{tj}}{\partial D_j} D_{tj} + (1 - r + e) \sum_{t=1}^b p_t \frac{\partial D_{tj}}{\partial D_j} \frac{\partial D_j}{\partial z_{ij}} \quad (13)$$

$$- \frac{\partial C_j}{\partial z_{ij}} - \frac{\partial C_j}{\partial D_j} \frac{\partial D_j}{\partial z_{ij}} = 0 \quad t = 1, \dots, b$$

$$(1 - r + e) \sum_{t=1}^b p_t \frac{\partial D_{tj}}{\partial D_j} = \frac{\partial C_j}{\partial D_j} + \left[ \frac{\partial C_j}{\partial z_{ij}} - (1 - r + e) \sum_{t=1}^b \frac{\partial p_t}{\partial D_{tj}} \frac{\partial D_{tj}}{\partial D_j} D_{tj} \right] \frac{\partial D_j}{\partial z_{ij}} \quad (14)$$

$t = 1, \dots, b$

In equation (12), the first term on the right hand side is marginal cost, and the second term is "loan price" variation cost. In equilibrium,

$$(1 - r + e)p_t + (1 - r + e)D_{tj} \frac{\partial D_{tj}}{\partial p_t} = (1 - r + e)p_u + (1 - r + e)D_{uj} \frac{\partial D_{uj}}{\partial p_u} \text{ where } t \neq u; \text{ i.e.}$$

marginal revenue is the same for each type of loan made. Since frequently  $\frac{\partial D_{tj}}{\partial p_t} < 0$ ,  $p_t > MR_t$ . If

$\frac{\partial D_{tj}}{\partial p_t} \rightarrow \infty$ , as it would when this asset is traded in a competitive market, there is a floor set on gross earnings per dollar of deposits if this asset is acquired at all; then the earning asset mix is independent of costs of attracting deposits. In equation (14), the term on the left hand side is

weighted average revenue since  $\sum_{t=1}^b \frac{\partial D_{tj}}{\partial D_j} = 1$ ; the first term on the right hand side is marginal cost and the sum of the other two terms represents variation cost.

12. The flow of derivative deposits to other banks in the multiple expansion process may be responsible for this, but no important modification results when some retention of derivative deposits is permitted; these too can be viewed as "providing their own reserves." For the definition of derivative deposits and discussion of deposit retention, see the classic work by C. A. Phillips, [22, Chap. III].

perfect substitutes, rivals' improvements shift the downward-sloping demand curve it faces leftward too. Except for the proportionality element, which stems from the reserve requirement artifice, there is no essential difference in how output is determined among banking firms as compared with those in other industries when quality variations are permitted and inputs required for this are available only at increasing cost.

### III. INDUSTRYWIDE EQUILIBRIUM

The short-run and long-run cost configurations for banks are like other firms because their deposit services other than the interest dimension involve the utilization of real resources. Furthermore, the appearance of short-run profits (or losses) will have the well-known effects on the expansion plans of existing banks and on new entry. If entry conditions are relatively easy,<sup>13</sup> the equality

of unit revenue,  $p(1 - r + e) + \sum_{i=1}^g a_{ij}z_{ij}$ , with unit cost,  $C_j/D_j$ , will tend to

occur whether or not banks react to variation costs and individually restrict output. This is more or less standard, but some interesting issues arise concerning the equilibrium level of cost/earnings per dollar of deposits. To what extent does the adjustment process involve changes in the asset earnings rate, service charges and costs? What do bank operations imply for central bank action in order to maintain constancy in aggregate income, employment and the price level?

To avoid inflation, the central bank can permit reserve growth at private banks only if total spending and deposits are not positively related. Setting aside for the moment the question of how these two may be related, it will be recalled that with banks, including new entrants, raising their service offers in the quest for profit, more deposits and more money in total will be demanded. Also, service increases induce deposits to be substituted in place of currency holdings, thus raising bank reserves. Denote the money supply as  $M$ , currency held by the general public as  $U$ , and high-powered money as  $H$ .

$$M = D + U = R/r + U. \tag{15}$$

$$H = R + U. \tag{16}$$

Currency issued by the central bank provides basic payments and storage services with virtually no ancillary elements. Cagan [10] has suggested that currency demand depends on such things as personal tax rates,  $T$ , and population mobility,  $F$ , to which may be added deposit services and service charges. That is:

$$U = U(T, F, z_i, a_i) \tag{17}$$

$$\frac{\partial U}{\partial T} > 0 \quad \frac{\partial U}{\partial F} > 0 \quad \frac{\partial U}{\partial z_i} < 0 \quad \frac{\partial U}{\partial a_i} > 0.$$

13. Aside from legal restrictions, entry into commercial banking under present-day conditions tends to be easy. See [26, pp. 305-310].

With no intervention by the central bank, i.e.,  $H$  is constant,

$$\frac{\partial M}{\partial z_i} = \frac{1}{r} \frac{\partial R}{\partial z_i} - \frac{\partial U}{\partial z_i} > 0 \quad i = 1, \dots, s. \quad (18)$$

The equilibrium money supply tends to expand by the reciprocal of the reserve requirement when shifts from currency to deposits occur such that  $\frac{\partial R}{\partial z_i} = \frac{\partial U}{\partial z_i}$ . This generates the presumption that some contraction of  $H$  by the central bank will be required to forestall inflationary spending pressures since  $\frac{1}{r}$  is usually relatively large.

The extent of reserve gain which must be offset depends on the spending repercussions of service improvements, including deposit interest. These may conveniently be discussed in terms of Hicksian IS and LM curves, as in Figure 1, where the initial equilibrium is  $IS_0$  and  $LM_0$ .<sup>14</sup> The market interest rate is signified by  $m$  and at the outset is at  $m_0$ . Service improvements which tend to increase velocity—in general, those which foster the making of payments more frequently or more speedily—require a more than proportionate decline in  $H$  and the money supply must decline. In terms of finite changes,  $-\Delta H > \frac{1}{r} \Delta R$ . Expansion of resource-using services which strengthen the holding motive for money and therefore decrease velocity would be accompanied by a less than proportionate decline in  $H$  through central bank action; a net rise in the money supply can occur. Clearly, services which encourage deposit holding as such will be favored under these circumstances. These changes also affect the composition of final spending on goods and services since resources allocated through banks rise, but as a first approximation total output and the price level may be regarded as unchanged. That is, the IS curve is unaffected at  $IS_0$ . So the required changes in the money supply are those which retain the intersection of the LM curve with  $IS_0$  at  $m_0$ ,  $y_0$  irrespective of the effects on the slope of LM from induced velocity changes. For simplicity, the original  $LM_0$  can be utilized. With this outcome the bank earnings rate on assets,  $p$ , is unchanged; bank credit expansion may merely substitute for other sources. The results differ, however, when the explicit interest rate on deposits is not constrained to zero by law or convention; a rise in this rate, by strengthening the holding motive, can induce nonbank spending units to substitute money for new nonmonetary services and goods without increasing resource use by banks.<sup>15</sup> With the resulting decline to  $IS_1$ , the central bank can make a smaller

14. Alternatively, the final spending version of the equation of exchange,  $MV = PQ$ , could be utilized, but this fails to display interest changes directly. For discussions of IS and LM curves, see any Macroeconomics textbook, e.g. [2], [8].

15. Interest, that is, is best regarded as a transfer payment; see [23, pp. 60-66]. This mode of treatment has not achieved universal acceptance in the profession, but its appropriateness is apparent when one observes that deposit interest payments reduce the real resource-using services per deposit dollar which banks could provide with any given asset earnings rate, thus leaving more resources for alternative outputs. Similarly for other claims issuers, with a given asset earnings rate, the higher the interest or dividends paid, the less they can spend on resources to enhance the holding motive.

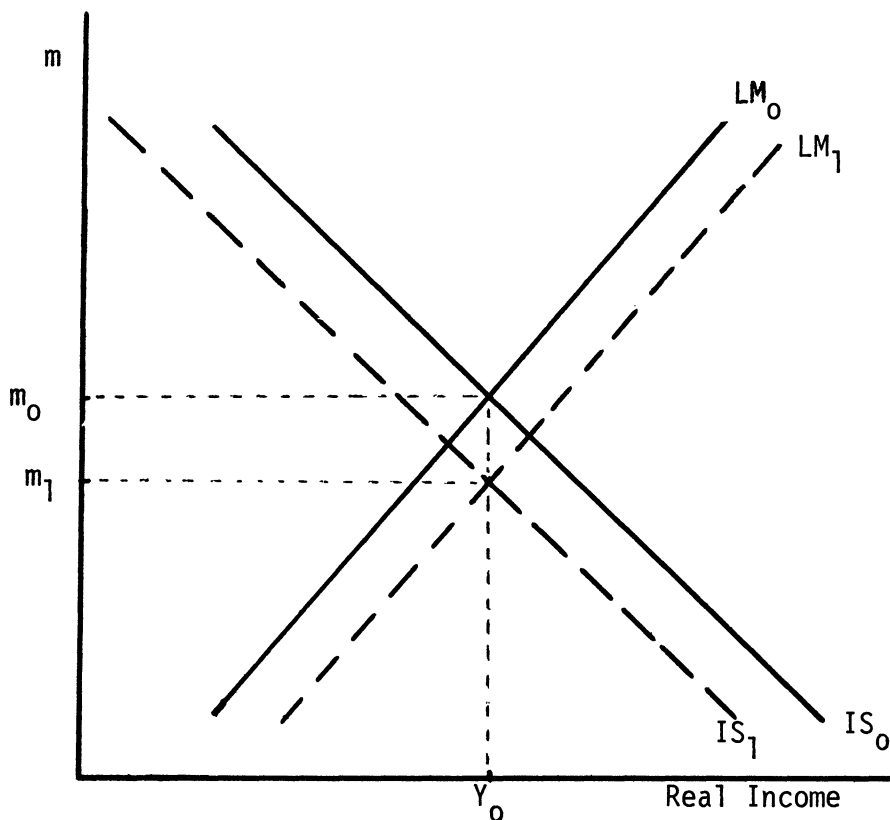


FIGURE 1

reduction in  $H$  than previously; the money supply must increase sufficiently to shift the LM curve to, say,  $LM_1$ . In this instance, the equilibrium interest rate falls (to  $m_1$ ) and so also would the bank earnings rate on assets,  $p$ .

When banks raise service charges, this tends to promote an outflow of reserves to currency holdings. With  $H$  given,

$$\frac{\partial M}{\partial a_i} = \frac{1}{r} \frac{\partial R}{\partial a_i} - \frac{\partial U}{\partial a_i} < 0 \quad i = 1, \dots, g \quad (19)$$

where, once again,  $\frac{\partial R}{\partial a_{ij}} = \frac{\partial U}{\partial a_{ij}}$ . An expansion of high-powered money by the central bank would be indicated in this event, with no impact on the position of the IS curve, because only the composition of output will be affected. As long as entry conditions keep the number of banks relatively large, cross-responses and reserve losses to currency will tend to restrain service charges from being anything more than a minor determinant of revenues and of resource utilization in banking.

The resource cost of implementing deposit interest payments may be treated as negligible; it would probably be less defensible to take the same position with respect to currency (at least in the more commonly used denominations).

This analysis reveals that, with easy entry, a substantial part of the adjustment under fractional reserve banking involves unit costs of providing bank services rising to the level of earnings from assets and service charges. Indeed, the "filling up" of costs will be the predominant result when (1) the elasticity of demand for deposits with respect to the "own" deposit interest rate is low or interest is not paid on deposits, or (2) the market interest elasticity of final spending demand, e.g., on investment, is sufficiently high to offset much of the adverse effects on the equilibrium interest rate if (1) does not hold.

#### IV. MONEY CREATION

Now we are ready to examine how the money creation paradigm operates in the banking system. Suppose the industry has achieved long-run equilibrium

where  $p(1 - r + e) + \sum_{i=1}^g a_{ij}z_{ij} = C_j/D_j$  for each bank. Let the central bank expand reserves, e.g., through open market purchases of securities, in order to accommodate growth in real output of the economy at stable prices. This growth, say, involves no change in the real equilibrium interest rate. The actual amount of reserves provided will be influenced by currency drains, but there is no need to repeat here the analysis of the preceding section relating to currency changes. The present remarks will be restricted to deposits alone where competition reigns.

The injection of reserves is felt at the outset by banks whose customers (or who themselves) have sold securities to the central bank. They experience an external economy in that existing levels of services per unit of deposits enable them to attract more reserves than formerly; their marginal cost curves shift downward and to the right. This is shown for a representative bank in Figure 2 by the movement from  $MC_1$  to  $MC_2$ . The profit objective induces the bank to move along  $MC_2$  by raising services in order to equate unit revenue with marginal cost at  $D_2$ . From each dollar of additional deposits acquired, the requisite amount of reserves is set aside and the balance (after capital provision) is used to acquire loans and investments. Since typically the spending of credit-based dollars involves reserves flowing to other banks, they too encounter reduced costs, expand services, increase credit extension, etc. As described earlier, the service expansions made by each bank in the stepwise assimilation of reserves impose an external diseconomy on other banks. Their marginal cost curves, having been shifted downward by the initial reserve influx, move back toward the original levels since  $\partial C_j / \partial D_k > 0$ ,  $j, k = 1, \dots, n, j \neq k$ . Service charges may be adjusted too, of course, but the essential property even in the short run is that, as long as deposits are not expanded to the full multiple of reserves, at least some banks will find marginal cost is below the earnings rate at their current deposit levels and therefore they will find it profitable to grow. With efficient money markets, excess reserves will approach the desired zero level promptly, although service competition may result in further deposit churning. The new equilibrium outcome in the long run may involve larger deposits per bank or simply expansion of the number of banks for the usual reasons. Manifestly, bank

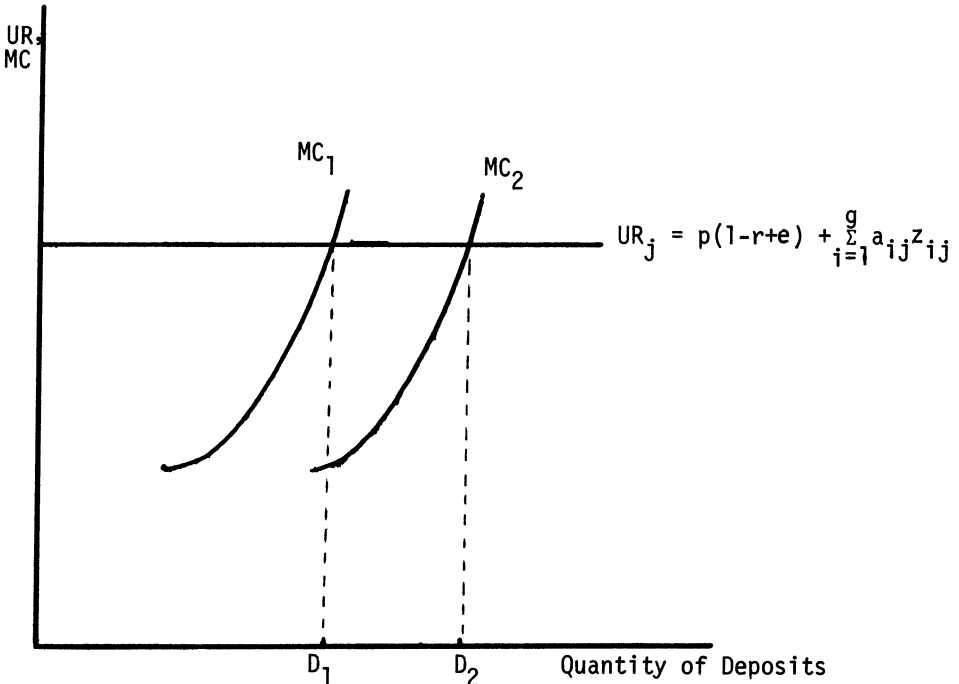


FIGURE 2

operations under existing technology and customer preferences jointly determine the ultimate lodgment of deposits. Bank size is neither a happenstance nor solely the result of the public's tastes.

V. FIDUCIARY MONEY AND OTHER INTERMEDIARY CLAIMS:  
HOW DO THEY DIFFER?

The demand deposit model, with minor modifications, could just as well be used to describe the market outcome for any other intermediary claim subject to a reserve requirement. Time deposits, savings and loan accounts, and national bank currency issues prior to 1935 are obvious examples. The reserve requirement need not be legally imposed, either; more or less strict adherence to a conventional ratio would be sufficient.

It was noted earlier, at the end of Section II, that a reserve requirement impinges on issuers of intermediary claims in two ways. By the "earnings effect," the gross earnings rate per dollar of claims is reduced through forcing institutions to hold larger quantities of nonearning or low earning assets than individual self-interest would dictate. The "reserve cost" effect involves a pecuniary externality per dollar of claims when the quantity of the reserve asset is restricted, i.e., the reserve asset is available to the industry in less than perfectly elastic supply or at the limit is perfectly inelastic. If neither of these influences is present, the requirement is not an effective constraint.<sup>16</sup>

16. An example would be the specification of a minimum fraction of mortgage holdings to total resources at savings and loan associations when self-interest motivates them to hold a larger propor-

A fractional reserve requirement imposed solely or predominantly for its earnings effect—where the reserve asset is highly or perfectly elastic in supply—has an impact which varies directly with the height of the required ratio. One might then ask why the central bank or government bothers to levy low ratios on intermediary claims such as on savings and loan shares, or for that matter on commercial bank time deposits and more recently on commercial paper liabilities of bank affiliates. [4, p. 75] The ready availability of reserves from other uses means that the reserve cost externality associated with these claims tends to be weak. The earnings effect, in itself, is not a necessary element in limiting issue of these types of claims to finite amounts; a determinate outcome is assured without a reserve requirement on these because, *ceteris paribus*, even the nominal demand for them is less than perfectly elastic with respect to the service dimensions, including interest paid. The costs of pressing these claims on holders sooner or later become excessive, and often issuers find that their ability to attract holders is contingent upon an instant or near-term redemption clause which affects not only the total claims outstanding of the individual institution but also those of the entire industry. With the equilibrium quantity of these claims affected rather little by the earnings effect (and reserve cost effect), the principal justification for stipulating a reserve ratio must lie in the modest contribution which discretionary changes in the ratio provide for stabilization of the industry or the overall economy.

On the other hand, exogenous control over the total quantity of demand deposits (or currency) may be rationalized on more substantial (though still practical) grounds. The demand for real money balances has the conventional negative slope with respect to the rate of change in the price level, but nominal money demand can be highly elastic. Holder-users dispose of excess nominal balances without changing the total in existence by exchanging them for final output and other assets, thereby bidding up absolute prices. If money producers can generate assets which are mutually acceptable in settling claims among themselves, and are not exposed to external drains, lack of outside control over money issues paves the way for inflation. Of course, unbridled inflation can be brought to an end by public repudiation of the payments medium and resort to less efficient means of accomplishing exchanges (barter or clearing arrangements). Less pathogenic instances of monetary instability may arise when bank reserve assets are finite in supply but subject to sporadic changes. Shifts in the public's tastes between demand deposits and fiduciary currency or gold have figured importantly in historical monetary disturbances. So also have changes in the desired ratio of bank reserves to outstanding deposits. More control over bank demand deposits than over other intermediary claims can thus be rationalized in terms of a less stable supply function and/or a less stable derived demand for reserve assets and their

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tion. The emergence of large amounts of non-earning excess reserves at commercial banks during the late 1930's is another example, but analysis of this episode would require consideration of the risks associated with acquiring earning assets in these years. That would take us well beyond the scope of this paper.

effects on the stability of the relation between nominal and real balances.<sup>17</sup> But these indicate a difference of degree between monetary and nonmonetary claims, not of essence.

Neither the specification of a reserve ratio nor control of the overall quantity of reserve assets, separately or jointly, is a necessary condition for control of the nominal money stock. Nor can any claim for special support of them rest on grounds of allocation efficiency. Yet they can be effective for achieving the narrow objective of fixing the size of the money stock. As pointed out above, the way in which the reserve mechanism operates at the individual bank level is primarily through the reserve cost effect as banks adjust deposit services to attract customers.<sup>18</sup> This means that the equilibrium quantity of money is not entirely a demand-determined magnitude; it is a function of bank service offers as well.<sup>19</sup>

A few years ago, Tobin [27] contrasted the traditional view of bank deposit creation with the new or Gurley-Shaw view of banks as issuers of intermediary claims. The wide acceptance quickly given to the new view is testimony to the misgivings many economists had about the "magic" of private money issue. By tracing how bank deposit operations take place, we have shown that the new view is correct in asserting the similarity of banks with other firms. Yet there is nothing inconsistent in this with the older view that money appears where less or none existed previously and that the process of multiple expansion is meaningful. The lesson here is not that the reserve mechanism is necessary to control private money issue, but that given the desirability of controlling the nominal quantity of fiduciary money, it can be accomplished, among other ways, through reserves which affect the earnings and cost rates of private banks.

#### REFERENCES

1. David A. Alhadeff. *Monopoly and Competition in Banking*, Berkeley and Los Angeles: University of California Press, 1954.
2. Martin J. Bailey. *National Income and the Price Level*, 2nd ed., New York: McGraw-Hill Book Publishing Co., 1971.
3. Frederick W. Bell and Neil B. Murphy. *Costs in Commercial Banking: A Quantitative Analysis of Bank Behavior and Its Relation to Bank Regulation*; Research Report No. 41, Boston: Federal Reserve Bank of Boston, April 1968.
4. Board of Governors of the Federal Reserve System, *Annual Report*, 1970.
5. Hans Brems. *Quantitative Economic Theory, A Synthetic Approach*, New York: John Wiley and Sons, Inc., 1968, chapter 14.

17. Reserve-ratio variation is emphasized by Guttentag and Lindsay [14] in their analysis of why banks are different, but changes in reserves are discussed by them also.

18. This would also hold for currency issues by private banks subject to an overall reserve control. This type of claim offers a narrower range of service possibilities for attracting customers than demand deposits, but competition and entry will tend to raise bank costs to the level of earnings in this case as well. Each banking office requires real resources to operate, and a restricted quantity of even interest-bearing reserve assets (e.g. government securities under the National Banking Act) will tend to force the price of this asset upward. It seems preferable to regard the latter as a cost effect, rather than one of earnings rate reduction because of the "quasi-rent" repercussion of the reserve requirement.

19. This point tends to be ignored in the monetary literature, although Friedman and Schwartz [11], for example, claim only that the real quantity is "primarily" demand-determined.



6. Karl Brunner. "A Schema for the Supply Theory of Money," *International Economic Review*, 2:1; January 1961, 79-109.
7. Phillip Cagan. *Determinants and Effects of Changes in the Stock of Money 1875-1960*, National Bureau of Economic Research, New York: Columbia University Press, 1965.
8. Thomas F. Dernburg and Duncan M. McDougall. *Macroeconomics*, 3rd ed., New York: McGraw-Hill Book Co., 1968.
9. Milton Friedman. *A Program for Monetary Stability*, New York: Fordham University Press, 1959.
10. Milton Friedman and Anna Jacobson Schwartz. *A Monetary History of the United States 1867-1960*, National Bureau of Economic Research, Princeton: Princeton University Press, 1963.
11. Milton Friedman and Anna Jacobson Schwartz. *Monetary Statistics of the United States*, National Bureau of Economic Research, New York: Columbia University Press, 1970.
12. Stuart I. Greenbaum. "Competition and Efficiency in the Banking System—Empirical Research and its Policy Implications"; *Journal of Political Economy*, 75:4, Part II. (August 1967), 461-479.
13. John G. Gurley and Edward S. Shaw. *Money in a Theory of Finance*, Washington, D.C.: The Brookings Institution, 1960.
14. Jack M. Guttentag and Robert Lindsay. "The Uniqueness of Commercial Banks," *Journal of Political Economy*, 76:5 (September/October 1968) 991-1014.
15. Paul M. Horvitz. "Economies of Scale in Banking," *Private Financial Institutions*, a monograph prepared for the Commission on Money and Credit, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963, 1-54.
16. Harry G. Johnson. "Problems of Efficiency in Monetary Management," *Journal of Political Economy*, 76:5 (September/October 1968), 971-990.
17. Michael A. Klein. "A Theory of the Banking Firm," *Journal of Money, Credit and Banking*, III:2, Part 1 (May 1971), 205-218.
18. David Laidler. *The Demand for Money: Theories and Evidence*, Scranton, Pa.: International Textbook Co., 1969.
19. Kelvin J. Lancaster. "A New Approach to Consumer Theory," *Journal of Political Economy*, 74:2 (April 1966), 132-157.
20. Boris P. Peseck. "Bank's Supply Function and the Equilibrium Quantity of Money," *Canadian Journal of Economics*, III:3 (August 1970), 357-383.
21. Boris P. Peseck and Thomas R. Saving. *Money, Wealth, and Economic Theory*, New York: Macmillan Co., 1967.
22. Chester A. Phillips. *Bank Credit*, New York: Macmillan Co., 1921.
23. Earl R. Rolph. *The Theory of Fiscal Economics*, Berkeley and Los Angeles: University of California Press, 1954.
24. Thomas R. Saving. "Transactions Costs and the Demand for Money," *American Economic Review*, LXI:3, Part 1 (June 1971), 407-420.
25. Tibor Scitovsky. *Welfare and Competition*, London; George Allen and Unwin, 1952.
26. Bernard Shull and Paul M. Horvitz. "Branch Banking and the Structure of Competition," *National Banking Review*, 1:3 (March 1964), 301-341.
27. James Tobin. "Commercial Banks as Creators of 'Money'," in Deane Carson, editor, *Banking and Monetary Studies*; Homewood, Illinois: Richard D. Irwin, Inc., 1963, 408-419.