A Contribution to the Liquidity Preference Theory of Interest (*)

I

In the long controversy which succeeded Keynes's presentation of the Liquidity Preference Theory predominant attention was given to the interrelationship between national income and the rate of interest. In the Keynesian framework the level of income determines the transactions demand for money and, thereby, exerts an important influence on the rate of interest which, in turn, is one of the main determinants of the level of income through its effect on investment expenditure. This interrelationship was stressed in the well-known early Keynesian models developed by Professors A. H. Hansen, J. R. Hicks, O. Lange, and F. Modigliani; more recently it has been emphasized by Professors Lindahl and Schneider and Mr. I. O. Scott (1).

The nature and significance of the demand for and supply of money have, by contrast, received considerably less attention. This is particularly surprising because a large number of intricate and as yet unsolved problems still obscure some of the basic relationships of the Liquidity Preference Theory. In this paper an attempt will be made to elucidate two of these problems, namely, first, the determination of the supply of money in a model which admits of a simple banking system and, second, the nature and main determinants of the demand for idle money.

The determination of the supply of money in an economy in which not only notes and coins but also bank deposits serve as

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(1) E. LINDAHL, "On Keynes' Economic System", *The Economic Record*, 1954. I. O. SCOTT, "An Exposition of the Keynesian System", *Review of Economic Studies*, 1950-51. E. SCHNEIDER, "Einführung in die Wirtschaftstheorie", III. Teil, Tübingen, 1953, pp. 135-162.

money has recently been the subject of a controversy between Professors Gambino and Schneider in the *Quarterly Review* of the Banca Nazionale del Lavoro (2). Professor Gambino's main contention is that a rise in the amount of hoarded money in the economy is likely to be accompanied by a reduction in the public's desire for notes and coins; the excess cash (notes and coins) will flow into the banking system and thus cause an expansion of the volume of deposits. The increase in hoarding may, therefore, be entirely or partially offset by a rise in the quantity of money so that the level of income does not decline at all or only slightly. Professor Schneider, on the other hand, disagrees with this contention and maintains that the proportion of money which people demand in the form of cash (notes and coins) is determined solely by customs and institutional factors which change only slowly and may, therefore, be ignored in a short-run analysis.

An attempt will be made in this paper to introduce a version of Professor Gambino's hypothesis into the Liquidity Preference Theory. For this purpose it will be convenient to distinguish between the proportion of active money and that of passive money which the public desire to hold in the form of cash and on a priori grounds one would expect the former to exceed the latter. It appears that this distinction between the public's active and passive cash preference ratios is but a logical sequence to the Keynesian distinction between active and passive money. In section III of this paper some statistical evidence will be presented which seems to support the presumption that the proportion of active money which people demand in the form of cash exceeds that of passive money.

In most Keynesian models the demand for idle money is assumed to be a function of only the rate of interest. The second modification of the Liquidity Preference Theory to be submitted in this paper is based on the contention that the demand for idle money depends not only on the rate of interest but also on the amount of wealth in the economy and as the amount of idle money

(2) The following four articles contain the main points of this controversy: AMEDEO GAMBINO, "Liquidity in the Economy and in the Banking System", this *Review*, 1951, and "Money Supply and Interest Rate in Recent Macro-Economic Conceptions", this *Review*, 1954. ERICH SCHNEIDER, "Fundamental Errors in Recent Anti-Keynesian Literature", this *Review*, 1953 and "Money Supply and Interest Rate in Recent Macro-Economic Conceptions: A Comment", this *Review*, 1954.

is part of that wealth any change in this amount may cause a change in the demand for idle money. This effect — which is called the wealth effect of changes in the quantity of idle money — seems to have received inadequate treatment in recent expositions of the Liquidity Preference Theory (3).

To sum up: The version of the Liquidity Preference Theory to be presented in this paper makes explicit allowance for a causal relationship between, on the one hand, the supply of idle money and, on the other hand, the total supply of money (through what may be called Professor Gambino's " Cash Effect ") and the demand for idle money (through the wealth effect).

II

1. The Main Assumptions

In the Liquidity Preference Theory to be developed in this section only one rate of interest is permitted to exist: the bond rate. Hence, only money and irredeemable bonds are available for asset-holding in our economy. We may, for this purpose, imagine that the total capital stock of the economy is owned — either directly or through the medium of securities — by a number of investment trusts who issue against this wealth irredeemable bonds. The risk elements of individual capital goods are thus averaged out. This simplification has one important implication: lenders, including banks, do not ease or restrict credit; they simply buy more or fewer bonds and, thereby, affect the bond rate. We may, therefore, ignore the abstruse problem of assessing the riskiness of loans and confine our analysis to the determination of the bond rate.

Two types of asset-holders are distinguished in our economy: the private sector and the commercial banks. The activities of the central bank and other public authorities are assumed to be extraneous influences which our model is not capable of explaining.

The commercial banks, who may hold only cash (i.e. claims on the central bank) and bonds against their deposit liabilities, are

(3) I attempted to analyse the implications of the wealth effect and discussed the relevant literature in a short theoretical paper: " A note on Bond-Holding and the Liquidity Preference Theory of Interest ", *Review of Economic Studies*, June 1957.

assumed to adhere rigidly to their cash ratio. Further, only one type of bank money, namely, current accounts, is allowed for in our system.

All our variables are measured in real terms. In order to simplify the presentation of the argument we shall, therefore, express them in monetary terms and assume a constant commodity price level.

On the basis of these simplifying assumptions which render our problem a great deal more manageable we shall proceed to discuss in turn the two determinants of the bond rate, namely, the supply of and demand for assets (idle money and bonds). Our model will then be presented as a whole and the determination of the rate of interest illustrated diagrammatically. Finally, we shall endeavour to inquire into the effects of changes in the quantity of idle money on the equilibrium values of our model.

The model to be developed in this section is essentially Keynesian in character as is indicated particularly by two of its aspects. First, our theory — like all other versions of the Liquidity Preference Theory — deals with stocks and not flows of assets. Thus " demand " and " supply " (of money or bonds) are defined without reference to a time period; for instance, the demand for money is the amount of money which asset-holders desire to hold at any particular moment. This stock concept of demand is essentially different from the flow concept of, say, the demand for bread which has to be stated with reference to a time period (e.g. per day or per week). Second, idle money (i.e. money as a store of wealth) and bonds are alternative means of holding wealth. This substitutability between bonds and idle money gives rise to a " bond aspect " as well as a " money aspect " of the Liquidity Preference Theory both of which we shall endeavour to elaborate in this paper.

2. The Supply of Assets

Let us call the total number of bonds available for asset-holding in the economy B. If y is their absolute yield (per bond per period of time) and R the bond rate the price per bond is equal to $\frac{y}{R}$

which is the sum of the discounted future yields (4). The value of all bonds — which we shall call the effective supply of bonds (S_{ob}) — is, therefore, equal to $\frac{By}{R}$. The reason for expressing bonds in value terms rather than in numbers is that it enables us to add idle money to bonds and thus obtain the value of all assets available in the economy. The latter, in turn, is required as a determinant of the demand for assets.

Money held on idle account is the second asset in our model. By money we shall here mean the sum of cash (notes and coins) in the hands of the public — that is, outside the banking system — and deposits (excluding inter-bank deposits). All money is held either on idle or on active account. Similarly, the cash which the public hold may also be divided into active and passive cash. Denoting total money by M, active money by M_1, passive money by M_2, active cash outside the banks by N_1^i and passive cash outside the banks by N_2^i we can write:

$$(i) \qquad M = M_1 + M_2 = N_1^i + N_2^i + N^b \ (\beta + 1)$$

for the total quantity of money in the economy where N^b is the cash (notes, coins, and central bank deposits) available to the commercial banks and $(\beta + 1)$ the ratio which they maintain between their deposits and cash-holdings (5).

In the succeeding paragraphs we shall be concerned with an elaboration of this expression for the quantity of total money with a view to obtaining a satisfactory expression for the quantity of idle money in which we are primarily interested. In particular

(4) The sum of the discounted future yields can be expressed algebraically by the following geometric progression:

$$y\left(\frac{1}{(1+R)} + \frac{1}{(1+R)^2} + \frac{1}{(1+R)^3} + \frac{1}{(1+R)^4} + \ldots + \frac{1}{(1+R)^n}\right)$$

the solution of which is $\frac{y}{R}$. Thus if the holder of a bond is promised an annual payment of £5 and the bond rate is 4 per cent the price of the bond is £ $\frac{5}{\frac{4}{100}}$ or £125.

(5) The reciprocal of $(\beta + 1)$ is, of course, equal to the commercial banks' cash ratio. I have used the ratio of the banks' bond-holdings to cash (β) rather than their cash ratio in order to simplify some of the algebraic expressions which will be presented later on.

we shall deal with the determination of the public's cash-holdings (N_1^i and N_2^i) as well as those of the commercial banks (N^b).

The most important determinants of active and passive cash-holdings are the amounts of active and passive money held. Let us call the ratio of active cash to active money a and that of passive cash to passive money p, so that we can write:

$$(ii) \qquad N_1^i = aM_1$$

$$(iii) \qquad N_2^i = pM_2$$

for the amounts of active and passive cash held by the public.

The total quantity of cash in the economy (denoted by N), which consists of notes and coins and the commercial banks' deposits at the central bank, that is, of *all* claims on the central bank, must be in the possession of either the public or the commercial banks. This can be expressed algebraically by:

$$(iv) \qquad N = N_1^i + N_2^i + N^b$$

which, by taking the two previous equations into account, may be re-written as:

$$(v) \qquad N^b = N - aM_1 - pM_2$$

Having thus obtained values for N_1^i, N_2^i, and N^b we may proceed to substitute for them in equation (i) and obtain:

$$(ia) \qquad M = M_1 + M_2 = aM_1 + pM_2 + (\beta + 1)\ (N - aM_1 - pM_2)$$

As we are primarily concerned with money as an asset (i.e. idle or passive money) let us solve this expression for M_2:

$$(vi) \qquad M_2 = N\frac{\beta + 1}{1 + p\beta} - M_1\frac{1 + a\beta}{1 + p\beta}$$

Following Keynes (and, for that matter, many Keynesians) we shall here assume that the amount of money required for active purposes (M_1) rises and falls with the level of national income. More specifically, the amount of active money is taken to be related to national

income (Y) through the "income velocity of circulation" (V_1) in such a way that $M_1V_1 = Y$. Further, it is assumed for the sake of simplicity that V_1 remains constant throughout our argument so that any change in income causes a proportionate change in the quantity of active money. With this simplification in mind we may turn to the quantity of idle money (M_2). It is related, in the way shown by equation (vi), to the total amount of cash in the economy (N), the banks' ratio of bonds to cash (β), the public's preference ratios for active and passive cash (a and p), the level of national income (Y), and the income velocity of circulation (V_1). It thus tends to rise with ceteris paribus increases in N, β, and V_1 and with ceteris paribus decreases in a, p, and Y.

The value of all the available assets (denoted by W) in the hands of the public and the commercial banks is equal to the sum of the effective supply of bonds (i.e. the monetary value of the number of available bonds) and the supply of idle money which were both dealt with in the preceding discussion. This sum is given an algebraic expression by the following equation:

$$\text{(vii)} \qquad W = S_{vb} + M_2 = \frac{By}{R} + N\frac{\beta + 1}{1 + p\beta} - M_1\frac{1 + a\beta}{1 + p\beta}$$

The significance of the total amount of wealth available for asset-holding and the reasons for expressing it separately will become more apparent in the discussion of the demand for assets; for there the main contention will be that the amount of wealth as well as the rate of interest is an important determinant of the demand for bonds and idle money.

3. The Demand for Assets

Having determined the total amount and the composition of wealth available in the economy let us now attempt to inquire into the determinants of the desire to hold assets. Leaving the central bank out of account the private sector and the commercial banks are the two asset-holders whose behaviour we wish to examine. Let us look at them in turn.

1) Given an individual's tastes, preferences, and expectations two determinants of his asset-holding plan have to be singled out for special consideration: the bond rate and his wealth.

An individual who possesses a sum of money — say £ m — on idle account part of which he desires to exchange for bonds will spend a larger amount on bonds the higher the bond rate. There are two reasons for this: First, the higher the bond rate the larger the income which the individual can earn from bond-holdings and this makes bonds a more attractive asset than money. Second, as the current bond rate rises relatively to the expected future bond rate the prospect of a capital gain will induce the individual to move into bonds and out of money. To sum up: Given the amount of wealth at the disposal of an individual asset-holder (e.g. £ m) his demand for idle money is a decreasing function and his effective demand for bonds (the value of his bond-holdings) an increasing function of the bond rate. The effect of changes in the bond rate upon the proportion in which private asset-holders divide their wealth between bonds and money is called the *substitution effect.*

Let us now turn to the asset-holding plan of an individual who possesses £ w in money and bonds. If, at a given bond rate, his wealth were to be doubled he would have to hold his extra £ w in the form of either money or bonds or both. The effect of changes in the available wealth upon the demand for idle money and the effective demand for bonds is called the *wealth effect.* It maintains that both the demand for idle money and the (private) effective demand for bonds are increasing functions of available wealth. Only in the limiting cases in which changes in wealth are accommodated entirely by changes in *either* the demand for money *or* the effective demand for bonds is the unchanged demand independent of wealth.

The sum of the individual's demand for idle money and effective demand for bonds must be equal to the wealth available to him. Thus if he decides to hold £ n of his wealth in bonds he simultaneously decides to hold £ $(w - n)$ in money.

We may obtain aggregate demand functions for the private sector as a whole by a simple process of summation. They have the same characteristics as the individual functions: the demand

for idle money (D_m) is an increasing function of the available private wealth (W^i) and a decreasing function of the bond rate, or:

(viii) $D_m = F(W^i;\ R)$ where $F'_W i > 0$ and $F'_R < 0$

Further, the private effective demand for bonds (D^i_{vb}) is an increasing function of both private wealth and the bond rate, or:

(ix) $D^i_{vb} = f(W^i;\ R)$ where $f'_W i > 0$ and $f'_R > 0$

Again, all private wealth must be held in the form of either bonds or money so that the sum of the (private) demands for assets must be equal to private wealth:

(x) $$W^i = D_m + D^i_{vb}$$

To sum up: Given the amount of wealth available in the private sector (W^i) the private demand for money (D_m) and the private effective demand for bonds (D^i_{vb}) both vary with the bond rate, the former being a decreasing and the latter an increasing function. On the other hand, given the bond rate, any increase in private wealth must be accommodated by a rise in the demand for idle money and/or effective demand for bonds; for all wealth must at all times be held.

The effect of changes in private wealth upon the demand for idle money and the (private) effective demand for bonds can be analysed a little further. Let us denote the proportion of a change in private wealth which is accommodated by a change in the demand for idle money by k. It is the "marginal propensity to hold money as wealth changes". Hence if private wealth rises by ΔW^i the demand for idle money will rise by $k\Delta W^i$ and — since all of ΔW^i has to be accommodated — the effective demand for bonds will rise by $(1 - k)\Delta W^i$. At the one extreme, where $k = 1$, the rise in private wealth will raise the demand for idle money by the same amount whilst the effective demand for bonds remains unchanged. At the other extreme, where $k = 0$, the demand for idle money will remain unchanged and the effective demand for bonds will be raised by ΔW^i. In the intermediate cases, for which $1 > k > 0$, both the demand for idle money and the (private) effective demand for bonds will rise.

One further not very important point remains to be considered. As part of private wealth consists of bonds the value of which changes inversely with the bond rate a change in the bond rate has a wealth effect as well as a substitution effect. A reduction of the bond rate, for instance, causes a rise in the value of wealth which, in turn, raises the demand for idle money and/or the (private) effective demand for bonds; owing to the fall in the bond rate, on the other hand, the demand for idle money will rise and the (private) effective demand for bonds will fall. Substitution and wealth effects thus operate in the same direction upon the demand for money and in opposite directions upon the effective demand for bonds. The curve of the effective demand for bonds (drawn as a function of the bond rate) will have a positive slope if the substitution effect dominates and a negative slope if the wealth effect dominates. In Fig. 1, for instance, the curve of the private effective demand for bonds [curve (*f*)] is influenced predominantly by the substitution effect in its upper part and by the wealth effect in its lower part (6).

2) Having given a brief account of the private sector's demand for assets let us now turn to the asset-holding plans of the commercial banks. We may here confine our analysis to the banks' effective demand for bonds; for they do not desire to hold idle money since — as will be remembered — we defined money as the sum of cash and deposits *outside the banking system*.

If β denotes the ratio of the commercial banks' bond-holdings to cash their effective demand for bonds (D^b_{vb}) can be expressed as:

(xi) $$D^b_{vb} = \beta N^b$$

where N^b, as before, stands for the cash in the possession of the commercial banks which, according to equation (v), is equal to $N - aM_1 - pM_2$, namely, the difference between the total amount of available cash and the amount required by the private sector. The previous equation may therefore, be re-written as:

(xi a) $$D^b_{vb} = \beta(N - aM_1 - pM_2)$$

(6) The reader will, no doubt, have noticed that the substitution and wealth effects discussed here are closely akin to the substitution and income effects of the theory of consumer demand.

By substituting for M_2 the value for which is determined by equation (vi) we obtain the following expression for the banks' effective demand for bonds:

$$\text{(xii)} \qquad D^b_{vb} = N\frac{\beta(1-p)}{1+p\beta} - M_1\frac{\beta(a-p)}{1+p\beta}$$

The banks' effective demand for bonds (that is, the value of their bond-holdings) is thus determined by the ratio which they maintain between bonds and cash (β) and the amount of cash at their disposal. The latter depends on the total amount of cash in the economy (N) and the amount required by the private sector which, in turn, tends to rise as the proportion of active to passive money is increased because the cash preference for active cash is assumed to exceed that for passive cash. This intricate relationship is expressed algebraically by equation (xii) which shows that D^b_{vb} rises with ceteris paribus increases in N and β and with ceteris paribus decreases in a, p, and M_1.

To sum up: In our model money is demanded only by the private sector. It tends to rise with increasing private wealth and a falling bond rate. Bonds, on the other hand, are demanded by the commercial banks as well as the private sector. The private effective demand for bonds tends to rise with private wealth and the bond rate whilst the commercial banks' effective demand for bonds depends on their ratio of bond-holdings to cash and the amount of cash at their disposal which is the difference between the total amount of cash and the amount required by the private sector.

Before proceeding to present our model as a whole we may advantageously deal briefly with some of the fundamental relationships of our system. The difference between the amount of total available wealth and the banks' effective demand for bonds (that is: $W - D^b_{vb}$) is equal to the amount of private wealth (W^i) which, as was shown earlier, must always be identically equal to the sum of the demand for money and the private effective demand for bonds. This means that the sum of all three demands for assets must be equal to the total amount of wealth which, in turn, equals the sum of the effective supply of bonds and the supply of idle money. This can be expressed algebraically as:

$$\text{(xiii)} \qquad S_{vb} + M_2 = W = D_m + D^i_{vb} + D^b_{vb}$$

In other words, although, at any particular bond rate, the commercial banks and private asset-holders may not wish to hold idle money and bonds in the proportion in which they are available, they can never hold a greater or smaller amount of wealth than is available (7).

Since commercial banks do not demand idle money the entire supply of idle money is available for private asset-holding. On the other hand, of the total effective supply of bonds (S_{vb}) the banks demand some part (D^b_{vb}) so that only the remainder, namely, $S_{vb} - D^b_{vb}$ is available for private asset-holders. The sum of this remainder, which we shall call the private effective supply of bonds (S^i_{vb}) and the supply of idle money constitute, therefore, the amount of private wealth which can be expressed algebraically in the following fashion:

$$\text{(xiv)} \qquad W^i = M_2 + S^i_{vb} \text{ or since } S^i_{vb} = S_{vb} - D^b_{vb}$$
$$W^i = M_2 + S_{vb} - D^b_{vb}$$

By substituting for M_2, S_{vb} and D^b_{vb} we can obtain the following expression for the numerical value of private wealth:

$$\text{(xv)} \qquad W^i = \frac{By}{R} + N - M_1$$

This equation should be interpreted carefully for it tells us nothing about the composition of private wealth but only its arithmetical value.

4. The Model Stated

We are now in a position to draw together the parts of our model economy with which we dealt in some detail in the preceding discussions. The bond rate in the determination of which we are interested is the outcome of the interaction of the supply

(7) An example might help to clarify this point. Let us assume that, at a given bond rate, total wealth in the economy amounts to £ 10 m made up of £ 7 m in the form of bonds and of £ 3 m in idle money. The asset-holders in the economy may desire to hold £ 5 m in money and £ 5 m in bonds at that particular bond rate, but they cannot hold more or less than £ 10 m all together.

of and demand for assets. The number of bonds in the economy is assumed to be autonomously fixed so that the effective supply of bonds (that is, their monetary value) varies with the bond rate. The supply of idle money — the second assets in our economy — depends on the amount of available cash in the economy (N), the public's active and passive cash preference ratios (a and p), the commercial banks' ratio of bond-holdings to cash (β), and on the amuont of money required for active purposes. The sum of the effective supply of bonds and the supply of idle money is the total amount of wealth available for asset-holding (8).

The commercial banks do not demand idle money and their effective demand for bonds is proportionate to the amount of cash at their disposal. The difference between total wealth and the commercial banks' effective demand for bonds is the amount of wealth available for private asset-holding. Given this amount of private wealth the (private) demand for idle money and the private effective demand for bonds vary with the bond rate, the former inversely and the latter directly. At any given bond rate, on the other hand, both the demand for idle money and the private effective demand for bonds vary directly with private wealth. Further, the sum of the private demands for assets must equal private wealth and, hence, the sum of all three demands for assets is equal to total wealth.

Equilibrium and, hence, the equilibrium bond rate are established when asset-holders hold voluntarily all the available idle money and bonds and have no desire to change the composition of their holdings. Until a state of equilibrium is reached asset-holders lower or raise the bond rate in their attempts to obtain the desired composition of asset-holdings. In more technical language, the equilibrium condition postulates that the demand for idle money should equal its supply and the total (i.e. private and commercial banks') effective demand for bonds its effective supply.

(8) Professor Gambino kindly pointed out to me that ultimately all money (active as well as passive) should be regarded as wealth so that both the demand for and supply of active money would have to be added to the amount of wealth in our model. Since, however, the demand for active money is in the present context taken to be interest inelastic and always equal to its supply their inclusion would leave our results unaffected. For that reason, wealth, according to the definition used in this paper only embraces " money as a store of wealth " and not " money as a medium of exchange ".

The model is illustrated diagrammatically in Fig. 1 (9). The bond rate is measured along the vertical axis and along the horizontal axis idle money is measured to the right and the value of bonds to the left. Curve (c) is the supply of idle money and curve (d) the demand for it. Curve (b) is the total effective supply of bonds and curve (e) the total effective demand for bonds. The latter is made up of the private effective demand for bonds — curve (f) — and the commercial banks' effective demand for bonds which is measured by the horizontal difference between curves (f) and (e).

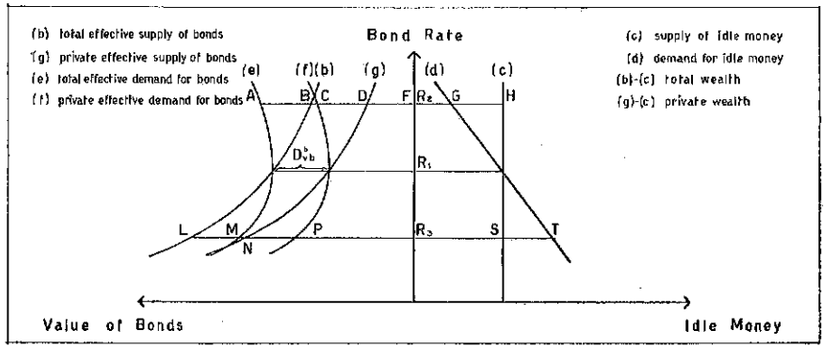

Fig. 1

Total wealth, available in the economy, being the sum of the supply of idle money and the effective supply of bonds, is equal to the horizontal difference between the supply curves (b) and (c). Curve (g) is the private effective supply of bonds; it is obtained by subtracting the banks' effective demand for bonds [the difference between curves (e) and (f)] from the total effective supply of bonds [curve (b)]. Private wealth in the economy, being equal to the sum of the supply of idle money and the private effective supply of bonds, is, therefore, measured by the horizontal difference between curves (g) and (c).

At a bond rate of R_2, for instance, total available wealth amounts to BH of which AF is desired in the form of bonds and FG in the form of money. The total effective demand for bonds

(9) In the Appendix the model is presented as a set of seven simultaneous equations which may be helpful to those readers who are interested in its formal relationships.

(AF) is made up of the private effective demand (CF) and the commercial banks' effective demand (AC). The private effective supply of bonds is equal to DF ($=BF-AC$) being equal to the difference between the total effective supply and the banks' effective demand. Hence, private wealth amounts to DH of which private asset-holders desire to hold CF in the form of bonds and FG in the form of money. At R_2 there is, therefore, an excess supply of money amounting to GH which is offset by an equal excess (effective) demand for bonds of AB which, in turn, is equal to the excess private (effective) demand for bonds of CD. The equilibrium bond rate is R_1 at which there is neither an excess supply nor an excess demand. At any lower bond rate — say R_3 — there is an excess demand for money (ST) which is offset by an equal excess (effective) supply of bonds (LM) which, in turn, is equal to the excess private (effective) supply of bonds (NP).

5. Changes in the Quantity of Idle Money

The next step in our analysis is an inquiry into the effects of changes in the supply of idle money on the equilibrium values of our variables and, in particular, upon the equilibrium bond rate. In a closed economy the supply of idle money may be changed (i) by means of open-market operations undertaken by the central bank; (ii) by changes in the amount of money required for active purposes; in our model (where the income velocity of circulation and the price level are assumed to be constant) this may only be caused by variations in people's expenditures, that is, by changes in the level of national income; (iii) in certain circumstances by budget surpluses or deficits which are accommodated by the destruction or creation of cash (notes, coins, and commercial banks' deposits at the central bank); such budget surpluses and deficits involve a change not only in government expenditure but also in the quantity of money and thus have a monetary as well as fiscal impact on the economy; whether and to what extent the quantity of idle money is changed depends on the effects of the budget gap on the level of income and, hence, on the amount of money required for active purposes. In the case of a budget deficit, for instance, the stock of idle money will be increased if the increase in the

total money supply exceeds the rise in the amount of active money which is due to the rise in the level of expenditure.

Since our model does not embrace expenditure flows the monetary effects of budget surpluses and deficits can be analysed only on some assumption about the change in the demand for active money which is caused by the budget gap. In the present context such an assumption would necessarily be very arbitrary. For this reason we shall confine our analysis to open-market operations and movements of money between the active and passive spheres. Moreover, our analysis of movements of money between the active and passive spheres can also be used in an inquiry into the monetary effects of budget gaps and the reader will find no difficulty in elaborating the latter on any particular hypothesis concerning the demand for active money.

1) The essential characteristic of open-market operations is that variations in the quantity of money are brought about through changes in the amount of cash which are accompanied by *equal but opposite* changes in the total effective supply of bonds. Thus if the central bank aims at increasing the quantity of money in the economy it purchases bonds with cash (notes, coins, and its own deposits). This means that we have to consider two facets of open-market operations: on the one hand, there is an increase in the quantity of cash (and, hence, of money) and, on the other hand, there is an equal decrease in the effective supply of bonds (value of the stock of available bonds). This two-sidedness of open-market operations deserves to be stressed because on account of it — as will become apparent later — open-market operations tend to be much more effective in changing the bond rate than other means of increasing or decreasing the supply of idle money.

Since open-market operations influence the economy in our model only through the asset sphere and do not affect *directly* either consumption, investment or government expenditure (and, hence, the demand for active money) we may assume, for the sake of simplicity, that the amount of money required for active purposes remains unchanged throughout the present argument. On the basis of this assumption let us endeavour to examine the effects of an increase in the quantity of cash (ΔN) which is accompanied by a simultaneous and equal decrease in the effective supply of bonds (ΔS_{vb}).

In Fig. 2 let R_1 be the initial bond rate at which the demand curves (d), (f), and (e) intersect the supply curves (c), (g), and (b). This equilibrium position is now disturbed by open-market operations undertaken by the central bank which augment the stock of cash in the economy by ΔN and simultaneously reduce the effective supply of bonds by ΔS_{vb} (which is equal to ΔN). Curve (b) therefore shifts to (b'). Moreover, since the commercial banks have no reason to reduce their bond-holdings (which depend, as will be remembered, on N^b and β neither of which have fallen) the central

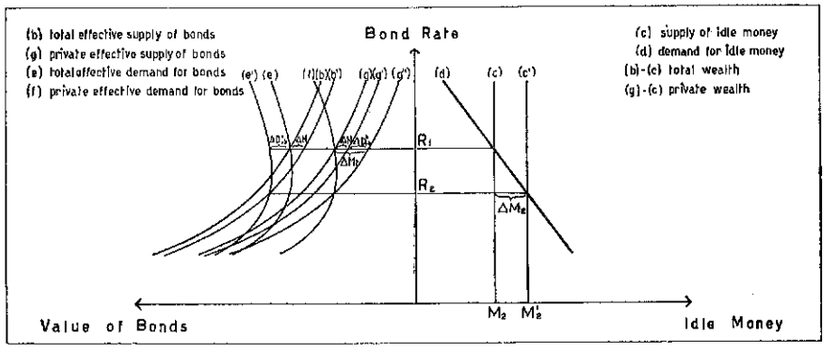

Fig. 2

bank can obtain bonds only from the private sector, so that the private effective supply of bonds falls also by ΔS_{vb} ($=\Delta N$); curve (g), therefore, shifts to (g'). Part of the cash which the central bank has introduced into the economy is held by the private sector whilst the remainder is made available to the commercial banks who are thus enabled to create new money by buying bonds to the value of ΔD^b_{vb}. The total effective demand for bonds thus rises by ΔD^b_{vb} from (e) to (e'). The banks' bond-holdings can, however, only be increased at the expense of private holdings so that the private effective supply of bonds falls further from (g') to (g''). The total reduction in the private effective supply of bonds thus amounts to $\Delta S_{vb}+\Delta D^b_{vb}$ or $\Delta N+\Delta D^b_{vb}$. The supply of idle money rises by the amount of extra cash held by the private sector plus the increase in the volume of deposits. The latter, however, must be backed entirely by extra cash and bonds and this means that the rise in the supply of idle money can also be measured by the sum of the rise

in the amount of cash in the economy (ΔN) and the rise in the banks' effective demand for bonds (ΔD^b_{vb}), or in symbols: $\Delta M_2 = \Delta N+\Delta D^b_{vb}$. The rise in the supply of idle money from curve (c) to curve (c') is, therefore, equal to the fall in the private effective supply of bonds from curve (g) to curve (g''). The amount of private wealth, which we defined as the sum of the supply of idle money and the private effective supply of bonds, thus remains unchanged or, in terms of Fig. 2, the horizontal difference between curves (g'') and (c') is the same as that between curves (g) and (c). The conclusion that the amount of private wealth is unaffected by open-market operations is particularly significant in one respect: The (private) demand for money (D_m) and the private effective demand for bonds (D^i_{vb}) (which depend, as was elaborated earlier on the amount of available private wealth as well as the bond rate) cannot undergo any alteration on account of the wealth effect. There is, therefore, no reason why the demand for money — curve (d) — and the private effective demand for bonds — curve (f) — should change their positions. Although the amount of private wealth has neither increased nor decreased its composition has experienced a change which must bring about a change in the bond rate. In order to induce the private sector to hold the extra ΔM_2 and to give up ΔS_{vb} the bond rate has to fall to R_2 where the demand curves (d), (f), and (e') intersect the supply curves (c'), (g''), and (b'). If s denotes the slope of the demand curve for money (namely: $\frac{\Delta R}{\Delta D_m}$) the bond rate is reduced by an amount equal to $\Delta R = s\Delta M_2$ (10).

This discussion of open-market operations which yields no startling or novel result is only justifiable because it throws some light on the somewhat neglected "bond aspect" of the Liquidity Preference Theory (11). Further, it serves to emphasize that open-market operations as a means of changing the quantity of idle money are essentially different from movements of money between the idle and active spheres to which we shall now turn our attention.

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(10) Open-market operations are subjected to a slightly more rigorous algebraic treatment in the Appendix.

(11) Professor Schneider is among the notable exceptions who have stressed the bond aspect of the Liquidity Preference Theory. I have profited greatly from his writings which

2) A reduction in the amount of money required for active purposes is the second means of increasing the quantity of idle money to be considered in this paper. Such a reduction in the quantity of active money can be brought about in our model, in which prices and the income velocity of circulation remain constant, only by a fall in the level of national income.

As we are not interested in the present discussion, in the effects of changes in the total amount of cash (N) or in the total effective supply of bonds (S_{vb}) let us assume that these two variables remain constant throughout the argument. Further, we shall work on the hypothesis that the public's active cash preference ratio (a) exceeds their passive cash preference ratio (p) so that a reduction in the quantity of active money prompts the private sector to deposit some cash with the commercial banks thus enabling them to create new money. With these two assumptions in mind let us examine the manner in which the variables of our system adjust themselves to a reduction in the quantity of active money.

In Fig. 3 let R_1 be the initial bond rate at which the demand curves (d), (f), and (e) intersect the supply curves (c), (g), and (b). The rise in the quantity of idle money from M_2 to M'_2 by ΔM_2 consists of a direct shift of money from the active sphere plus the newly created money which is possible because of the excess of a over p which causes a rise in the commercial banks' cash-holdings. Since, however, the commercial banks can create new money only by purchasing bonds their effective demand for bonds must rise by an amount equal to the newly created money, namely by ΔD^b_{vb}. In Fig. 3 the creation of new money, therefore, raises the supply curve of money from (c) to (c') and simultaneously the total effective demand for bonds from (e) to (e'). Since, however, the banks' bond-holdings can be increased only at the expense of private bond-holdings the private effective supply of bonds is reduced by the same amount (namely: ΔD^b_{vb}) from (g) to (g'). The creation of new money thus leaves the amount of private wealth unchanged and, therefore, the demand for money — curve (d) — and the private effective demand for bonds — curve (f) — cannot change

first induced me to undertake the research some results of which are published in this paper. It seems to me, however, that the bond aspect can only be dealt with adequately if the demand for and supply of bonds are expressed in *value terms* rather than in numbers of bonds. See particularly: E. Schneider, "Einführung in die Wirtschaftstheorie", II. Teil, Tübingen, 1949, pp. 238-242 and III. Teil, Tübingen, 1953, pp. 54-72.

their positions on account of the wealth effect. Owing to the creation of new money the rate of interest declines from R_1 to R_2 by an amount which is equal to $s\Delta D^b_{vb}$ (where s is the slope of the demand curve for money, i.e. $\frac{\Delta R}{\Delta D_m}$). The remainder of the increase in the supply of idle money which is not newly created but simply transferred from the active sphere (and, hence, equal to ΔM_1) is not offset by a decrease in the private effective supply of bonds and

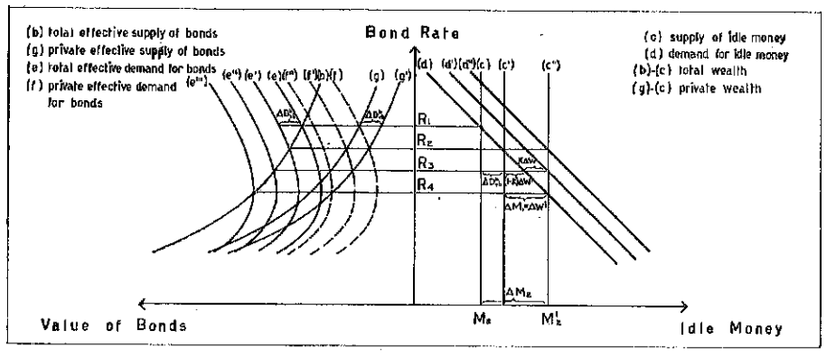

Fig. 3

thus constitutes an increase in private wealth. The private sector may desire to hold this increase in private wealth entirely in bonds, or entirely in money, or partly in money and partly in bonds. This is, of course, the wealth effect of a change in the quantity of private wealth upon the demand for assets which is particularly emphasized in this paper. If the private asset-holders wish to hold the increase in private wealth ($\Delta W^i = \Delta M_1$) entirely in bonds, so that $k = 0$ (k being the marginal propensity to hold money as wealth changes), the demand curve for money (d) will remain unchanged and the private effective demand for bonds will rise from (f) to (f'') by ΔW^i and, consequently, the total effective demand for bonds will rise by the same amount from (e') to (e''') and the bond rate will fall to R_4. At the other extreme, if the private asset-holders wish to keep the entire increase in private wealth in the form of idle money, so that $k = 1$, the demand curve for money will rise by ΔW^i from (d) to (d''): the private and total effective demands for bonds will remain unchanged at (f) and (e')

respectively; and the bond rate will fall no further than R_2. If, thirdly, the private asset-holders desire to hold the increase in private wealth partly in money and partly in bonds, so that $0 < k < 1$, both the demand for money and the private effective demand for bonds — and, hence, the total effective demand for bonds — will rise somewhat. In Fig. 3, for instance, the demand for money rises from (d) to (d') the private effective demand for bonds from (f) to (f') and, hence, the total effective demand for bonds from (e') to (e''). Consequently, the bond rate falls to R_3 (12).

A general formula for the fall in the bond rate can be derived from Fig. 3 in the following way: The bond rate falls, *in the first instance*, from R_1 to R_2 by $s\Delta D^b_{vb}$ (where s is the slope of the demand curve for money and ΔD^b_{vb} the amount of newly created money); thereafter, as can be seen in Fig. 3, it falls by a further $s(1-k)\Delta W^i$. Its total decline, therefore, amounts to $\Delta R = s(\Delta D^b_{vb} + (1-k)\ \Delta W^i)$. Since $\Delta M_2 = \Delta D^b_{vb} + \Delta W^i$ our formula can be rewritten as: $\Delta R = s(\Delta M_2 - k\,\Delta W^i)$, or: $\Delta R = s(\Delta M_2 - k\Delta M_1)$. (13).

This concludes our analysis of the effects of changes in the supply of idle money on the equilibrium values of our system. The manner in which the bond rate is affected can best be restated by comparing the two formulae which express the extent to which the bond rate has to fall (rise) in response to an increase (decrease) in the quantity of idle money:

(xvi) $$\Delta R = s\Delta M_2$$

(if ΔM_2 is effected by open-market operations)

(xvii) $$\Delta R = s\Delta M_2 - sk\Delta M_1$$

(if ΔM_2 is effected by movements of money between the active and passive spheres).

Thus a given rise in the quantity of idle money is likely to reduce the bond rate by more if it is effected by open-market operations than if it is brought about by a reduction in the quantity of active

(12) Throughout this paper I have used the terms "demand" and "supply" to describe both "quantity demanded and supplied" (at a given bond rate) and "demand and supply schedule". The reader is asked to overlook this terminological looseness which is only warranted by the clumsiness of the terms "quantity demanded" and "quantity supplied".

(13) The same expression can be derived algebraically as is shown in the Appendix.

money. The fall in the bond rate will be the same only if the marginal propensity to hold money as wealth changes (k) is zero; for in that case equation (xvii) reduces to equation (xvi). Changes in the quantity of idle money will have no effect on the bond rate if the slope of the demand curve for money (s) is zero no matter how they are brought about. Further, a rise in the supply of idle money which is due to a fall in the quantity of active money will always cause some reduction in the bond rate if $a > p$; for in that case the commercial banks are enabled to create new money and thereby reduce the bond rate. Should, however, $a = p$, so that no new money can be created (that is $\Delta M_2 = \Delta M_1$) the bond rate will only be reduced if $k < 1$.

6. Conclusions

The main object of the preceding theoretical discussions was to incorporate two refinements into the Liquidity Preference Theory of Interest: first, the possibility of changes in the volume of money owing to a difference between the active and passive cash preference ratios; and, second, the possibility of a wealth effect of changes in the quantity of idle money upon the demand for it (if the former are due to movements of money between the active and idle spheres).

As a rule writers on monetary theory do not distinguish between active and passive cash. Further, they seem to regard the determinants of the public's cash preference as outside the scope of economics and more or less constant. The credit for directing attention to the variability of the public's overall cash preference must go to Professor Gambino. In this paper an attempt was made to elaborate Professor Gambino's "Cash Effect" by distinguishing between the public's preference for active cash and their preference for passive cash. In economies with highly developed banking systems the proportion of passive money which is held in the form of cash is likely to be very small. Whilst it is not unknown that in rural districts some idle cash is kept in stockings and mattresses by people who — being either odd or above the age of 80 — have no confidence in banks the vast majority of private asset-holders prefer to keep their idle money in the form of deposits mainly for reasons of security. The public's preference

for active cash, on the other hand, seems to be fairly high even in countries, like the United Kingdom, where banking facilities are extensive and the use of cheques even for small payments is quite usual. Cash still has one important advantage compared with "cheque money": it is legal tender and its use as a means of payment involves no risk for the payee. As these conclusions are not particularly startling it is surprising that they have not been taken into account by monetary theorists. One might conjecture that this omission is due to the failure of monetary theory to take *full* account of the Keynesian (and post-Keynesian) distinction between active and passive money. Pre-Keynesian monetary theory regarded all money as active and on this basis a constant preference ratio for cash is justifiable. After the concepts of active and passive money had been developed in order to explain variations in the velocity of circulation the notion of a single cash preference was, however, not modified. This, it seems to the present writer, is inconsistent: once we distinguish between active money and passive money we must also distinguish between an active cash preference ratio and a passive cash preference ratio. If this view is correct Professor Gambino's "Cash Effect" (as presented in this paper) is the logical sequence to the Keynesian differentiation between active and passive money whereas Professor Schneider's contention that there is only one cash preference ratio appears as rather pre-Keynesian. If the problem is looked at from this point of view Professor Gambino's insistence on his anti-Keynesian position and Professor Schneider's claim to represent the pro-Keynesian school seem to be somewhat paradoxical. This is not surprising for economic theory and its interpretations have grown so complex that attributes like anti-Keynesian or pro-Keynesian are almost meaningless without further qualification.

The wealth effect of changes in the supply of idle money (brought about by changes in the amount of active money) upon the demand for idle money has already been indicated or taken into consideration by some writers on the Liquidity Preference Theory (14). Other expositions of that theory seem to assume

(14) As far as I am aware Dr. Frank H. Hahn, Dr. Börje Kragh, Professors Don Patinkin and James Tobin and Mr. Ralph Turvey have considered this point. I have discussed their writings, to most of which Professor Harry G. Johnson has kindly drawn my attention, elsewhere (*op. cit.*).

implicitly that the marginal propensity to hold money as wealth changes (k) is zero so that a given increase in the quantity of idle money reduces the bond rate to the same extent no matter whether it is brought about by open-market operations or by a reduction in the amount of money required for active purposes (15). The theory presented in this paper, on the other hand, admits of a marginal propensity to hold money which is larger than zero, so that a change in the supply of idle money — if it is accompanied by a change in the amount of private wealth — causes a change in the demand for it. If the marginal propensity to hold money is large the bond rate will change only a little in response to changes in the supply of idle money. In such a case open-market operations are a much more effective means of affecting the bond rate because —since they do not alter the amount of private wealth — they cannot have a wealth effect on the demand for idle money.

The full importance of the modified version of the Liquidity Preference Theory presented in this paper can only be appraised if it is incorporated into a larger theoretical structure. Its main conclusion, however, is that changes in the quantity of idle money effected by open-market operations are essentially different from those brought about by movements of money between the active and passive spheres. The customary Keynesian presentation of the latter has to be modified by taking into account two factors which operate in opposite directions. Thus a rise in the quantity of idle money (made possible by a fall in the quantity of active money) causes, first, a rise in the total quantity of money and this is an expansionary factor and, second, a rise in the demand for idle money which, on the other hand, makes for contraction.

Whilst no claim is made that the model submitted in this paper does more than illustrate the difference between open-market operations and movements of money between the active and passive spheres its inclusion of and emphasis on the "bond aspect" may possibly contribute to a fuller understanding of some related problems. It may, for instance, be used to illustrate the exact nature

(15) For instance, Professor Lindahl in his treatment of the Keynesian system seems to imply that $k=0$ for he argues that the effect of a given increase in the supply of idle money is the same independently of whether it is effected by a reduction in wages or direct open-market operations (*op. cit.*).

of the similarities and differences between the Liquidity Preference and Loanable Funds Theories which have occupied the minds of so many economists in recent years. Further, it may be useful for the analysis of some monetary aspects of economic growth. In the course of economic growth, both the stock of capital and the level of national income grow and this is shown in our model by a rise in the effective supply of bonds and a fall in the supply of idle money which, ceteris paribus, tend to raise the rate of interest. If, therefore, the monetary authorities desire to stabilise the rate of interest as well as the price level they have to increase the total quantity of money at a rate which provides not only enough active money, to keep the commodity price level from falling but also sufficient idle money in order to prevent the rate of interest from rising. These suggestions of the uses to which the model can possibly be put are intended to be very tentative. However, they serve to emphasize that all the propositions put forward in this paper attain significance only in a comprehensive macro-economic context.

III

7. Introduction

In this part of the paper we shall endeavour to present some statistical evidence in support of the hypothesis that the public's preference for active cash exceeds their preference for passive cash. As it is impossible to distinguish in practice between active and passive money (or active and passive cash) without very arbitrary assumptions some simplifications have to be adopted. In the first place, we shall use only one cash preference ratio which is defined as the ratio of cash to money (outside the banking system). Secondly, the proportion of money held on active account — that is, the "degree of activeness" of money — will be measured by the velocity of circulation which is defined as the ratio of gross national product to money. For the United Kingdom, the size of daily bank clearings will also serve as an indicator of the "degree of activeness" of money. Thus if our hypothesis (regarding the excess of the preference ratio for active cash over that for passive cash) is to be correct the overall cash preference ratio and the velocity of circulation should both change in the same direction: As a larger

proportion of the total quantity of money is held on active account — that is, as the velocity of circulation rises — the proportion of it which the public desire to hold in the form of cash — the overall cash preference ratio — should rise.

Since individuals and firms hold a large part of their idle money in the form of deposit and savings accounts it seems to be appropriate to define for the present purpose money as the sum of cash outside the banking system and the total of current, deposit, and savings accounts (excluding inter-bank deposits) (16).

The statistics which will be put forward refer to the years 1950 to 1956 and to both the United Kingdom and the Federal Republic of Germany.

8. The British Evidence

The cash preference ratios which prevailed in the United Kingdom in the period 1950-56 are given in Table I. They show

TABLE I

MONEY SUPPLY AND CASH PREFERENCE IN THE UNITED KINGDOM

Year	Cash	Total Money	Cash Preference
	(*in £ million*)		(*in per cent*)
1950	1,244	10,844.3	11.47
1951	1,291	10,803.2	11.95
1952	1,370	10,783.2	12.70
1953	1,462	11,007.5	13.28
1954	1,551	11,282.9	13.75
1955	1,657	11,266.4	14.71
1956	1,765	11,149.4	15.83

Sources: The figures have been calculated from statistics published in the *Annual Abstract of Statistics* 1956 and the *Monthly Digest of Statistics* both of which are issued by H.M.S.O. The figures for Scottish banks deposits were obtained from M. GASKIN, "Scottish Banking Trends 1950-56", *Scottish Journal of Political Economy*, February 1957. Savings deposits are taken to consist of the deposits in the Ordinary Departments of the Trustee Savings Banks and those at the Post Office Savings Bank.

(16) Professor Sayers kindly advised me to stress the arbitrariness of my — and, indeed, of any — definition of money. Exactly where the line between money and securities is to be drawn is extremely difficult to decide because it is ultimately determined by subjective

a steady yet marked rising tendency. Over the whole period the ratio rose by 4.3 percentage points which constitutes a rise of over one third.

The figures for the velocity of circulation in Table II show that money has become considerably more active during the seven years under consideration. The relative increase in the velocity of circulation amounts to well over one half. Moreover, the rise has been taking place steadily without any fluctuations.

TABLE II

VELOCITY OF CIRCULATION IN THE UNITED KINGDOM

Year	Gross National Product	Money	Velocity of Circulation
	(*in £ million*)		
1950	11,636	10,844.3	1.073
1951	12,793	10,803.2	1.184
1952	13,928	10,783.2	1.292
1953	14,858	11,007.5	1.350
1954	15,906	11,282.9	1.410
1955	16,803	11,266.4	1.491
1956	18,002	11,149.4	1.615

Sources: The figures for Gross National Product (at factor cost) were obtained from the *Annual Abstract of Statistics* 1956 and the *Economic Survey*, April 1957 both of which are published by H.M.S.O.

Another indicator of the "degree of activeness" of money is the proportion of bank money which is turned over daily. In Table III the average daily clearings of the London Clearing Banks have been expressed as a percentage of their net deposits. Over the seven years considered the percentage of deposits cleared daily has risen by 3.4 points and this represents a relative rise of nearly two thirds.

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factors: in other words, it depends on what people regard as money and what they regard as securities and their opinion may well change from time to time. The results of the present empirical investigation do not, however, depend on my rather wide definition of money; roughly the same conclusions emerge if money is taken to consist only of cash and current accounts.

TABLE III

AVERAGE DAILY LONDON CLEARINGS AS A PROPORTION OF DEPOSITS

Year	Net Deposits of London Clearing Banks	Average Daily Clearings	Average Clearings as Percentage of Deposits
	(*in £ million*)		
1950	5,811	308.0	5.30
1951	5,930	354.3	5.97
1952	5,857	359.0	6.13
1953	6,024	403.2	6.69
1954	6,239	470.0	7.53
1955	6,185	497.1	8.04
1956	6,013	524.1	8.71

Sources: The figures were obtained from the *Monthly Digest of Statistics* (H.M.S.O.). Deposits are net of "balances with, and cheques in the course of collection on, other banks in the United Kingdom and the Irish Republic". The deposits of the London Clearing Banks amount to approximately 90 per cent of all current and deposit accounts in the United Kingdom.

The time series of the three ratios — namely, the overall cash preference, the velocity of circulation, and the percentage of deposits cleared daily — are plotted in Fig. 4. The degree of correlation

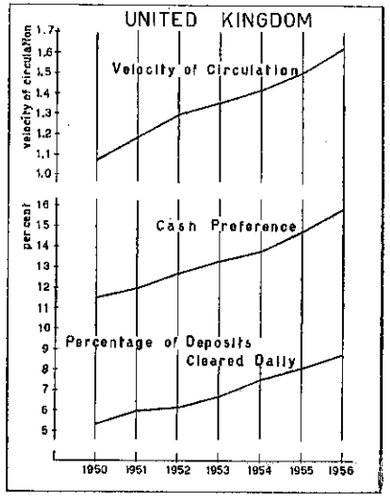

Fig. 4

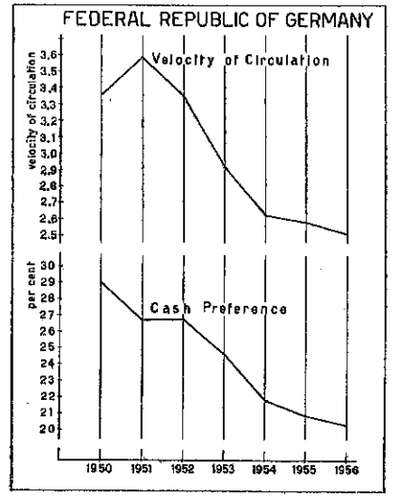

Fig. 5

between them is strikingly high: over the seven years under consideration money in the United Kingdom has become much more active and simultaneously the proportion of money which the public desire to hold in the form of cash has risen; both developments have been smooth and uninterrupted.

9. The German Evidence

Let us now turn to an examination of the statistical evidence of the overall cash preference ratio and the velocity of circulation

CASH PREFERENCE AND VELOCITY OF CIRCULATION IN THE FEDERAL REPUBLIC OF GERMANY — TABLE IV

Year	Cash (*in DM million*)	Money (*in DM million*)	Cash Preference (*in per cent*)	Gross National Product (*in DM million*)	Velocity of Circulation
1950	7,768	26,722	29.07	89,800	3.36
1951	8,430	31,607	26.67	113,600	3.59
1952	10,073	37,620	26.78	126,000	3.35
1953	11,354	45,935	24.72	134,300	2.92
1954	12,142	55,463	21.89	145,500	2.62
1955	13,297	63,640	20.89	164,000	2.58
1956	14,508	71,537	20.28	180,200	2.52

Sources: The figures for cash and money are monthly averages calculated from statistics published in the *Monthly Reports* of the Bank Deutscher Länder. The figures for Gross National Product (at market prices) were obtained from the *Monthly Report*, January 1957.

in Western Germany in the years 1950 to 1956. The figures presented in Table IV show that both the cash preference ratio and the velocity of circulation have declined by nearly one third. However, in contrast to the development in the United Kingdom the decline of neither has been uninterrupted: The velocity of circulation *rose* in 1951 considerably above its 1950 average and the cash preference ratio *rose* in 1952 slightly above its 1951 average. For the remaining four years (1953-1956) both the velocity of circulation and the cash preference ratio display a fairly smoothly declining trend.

The two series are plotted in Fig. 5 which illustrates that in 1951 and 1952 the velocity of circulation and cash preference ratio

moved in opposite directions. This irregularity was most probably due to the Korea Boom which was associated in Germany with a strong inflationary pressure on prices and a considerable change in the distribution of national income. Thus in 1950 62.7 per cent of national income consisted of wages and salaries; this percentage fell to 60.3 in 1951 and has been rising ever since (62.2 per cent in 1952 and 66.6 per cent in 1956). The irregularity in 1951 and 1952 may, therefore, be due to the redistribution of national income in favour of firms and high income recipients who as a general rule have a lower cash preference ratio than people with low incomes. However, no claim is made that the change in the relative distribution of national income is the sole cause of the irregularity in 1951-1952; a more detailed analysis which would be beyond the scope of this paper might reveal a more intricate relationship between the cash preference ratio, the velocity of circulation and one or two other factors.

10. Conclusions

The theoretical discussions in the second section of this paper were based on the a priori assumption that the public's preference for active cash exceeded their preference for passive cash so that as money was transferred from the passive to the active spheres relatively more cash was required. The statistical evidence presented in the third section of this paper lends some support to our theoretical hypothesis. Money has become more active in the United Kingdom over the last seven years and simultaneously the public's preference for cash has risen. In the Federal Republic of Germany, on the other hand, money has become less active and the public's preference for cash has declined. The time series of the velocity of circulation and the cash preference ratio for the United Kingdom display a higher degree of correlation than those for the Federal Republic. It would appear that in the years 1951-1952 the cash preference ratio in Western Germany was not predominantly determined by the velocity of circulation but possibly by a relative redistribution of national income.

The empirical analysis of this section has demonstrated quite unambiguously that the assumption of a constant (overall) cash preference ratio is inadequate and that monetary theory should,

therefore, abandon it. In this paper an attempt was made to substitute for it the concepts of the public's preference for active cash and their preference for passive cash. It is by no means claimed that this device is capable of explaining all variations in the (overall) cash preference ratio but it may constitute a small advance in this somewhat neglected branch of monetary theory.

Liverpool

FRANK P. R. BRECHLING

APPENDIX

This Appendix is designed to give the interested reader some insight into the formal relationships of the theoretical model which was developed in section II of this paper. First of all, we shall present the model as a set of seven simultaneous equations and then we shall attempt to elaborate algebraically the effects of changes in the quantity of idle money on the initial equilibrium values of our system.

The Model Stated

The following seven simultaneous equations can be used to illustrate the formal framework of our model:

(a) $W=\frac{By}{R}+M_2$ (total available wealth)

(b) $M_2=N\frac{\beta+1}{1+p\beta}-M_1\frac{1+a\beta}{1+p\beta}$ (supply of idle money)

(c) $W^i=\frac{By}{R}+N-M_1$ (private wealth)

(d) $D_m=F(W^i;R)$ (demand for idle money)

(e) $D^i_{vb}=W^i-D_m$ (private effective demand for bonds)

(f) $D^b_{vb}=W-W^i$ (banks' effective demand for bonds)

(g) $D^i_{vb}+D^b_{vb}=\frac{By}{R}$ or: $D_m=M_2$ (equilibrium condition)

If the values of B, y, N, a, β, p, M_1, and F are given the seven equations are sufficient to determine the following seven unknown variables: W, M_2, R, W^i, D_m, D^i_{vb}, and D^b_{vb}.

The equilibrium condition (*g*) stipulates that either the demand for idle money should equal its supply or the total effective demand for bonds its (effective) supply. The equality of one implies the equality of the other. This can be proved by re-writing equations (*a*), (*e*), and (*f*) as: $D_m+D^i_{vb}+D^b_{vb}=\frac{By}{R}+M_2$; if $D_m=M_2$ then $D^i_{vb}+D^b_{vb}=\frac{By}{R}$ and vice versa.

Changes in the Supply of Idle Money

1. *Open-Market Operations.* In section II we discussed open-market operations on the assumption that the quantity of active money remained unchanged throughout the argument. This assumption can be expressed algebraically as $\Delta M_1=0$. With this simplification in mind let us look at the effect of an increase in the quantity of cash (ΔN) which is accompanied by an equal decrease in the total effective supply of bonds (ΔS_{vb}).

To start with, two of our variables — namely the supply of idle money and the banks' effective demand for bonds — are affected only by the rise in the amount of cash and not by the fall in the effective supply of bonds. The amounts by which they deviate from their original equilibrium values can be obtained by transforming equations (vi) and (xii) (making allowance for $\Delta M_1=0$):

(xviii) $\Delta M_2=\Delta N\frac{\beta+1}{1+p\beta}$

(xix) $\Delta D^b_{vb}=\Delta N\frac{\beta(1-p)}{1+p\beta}$

Both the rise in the quantity of idle money (ΔM_2) and that in the banks' effective demand for bonds (ΔD^b_{vb}) are thus multiples of the rise in the quantity of cash (17); moreover, the values of both multipliers rise with a fall in p and a rise in β. Further, as was shown in section II, the rise in the quantity of idle money must be equal to the sum of newly created money (which is backed by bonds and, therefore, equal to ΔD^b_{vb}) and the rise in the quantity of cash (ΔN). This relationship can be proved algebraically by simply adding ΔN to the value

(17) Many of the formulae presented in this paper contain multipliers which are very similar to those in the writings of other economists. Thus the multiplier in equation (xviii) namely, $\frac{\beta+1}{1+p\beta}$ is formally identical with Professor Schneider's "Money-Creation Multiplier" $\frac{1}{r+c(1-r)}$ if $r=\frac{1}{\beta+1}$ and $c=p$. The essential difference between the two is that Professor Schneider's c refers to the public's preference for all cash whereas my p only to their preference for passive cash. See E. SCHNEIDER, "The Determinants of the Commercial Banks' Credit Potential in a Mixed Money System", this *Review*, 1955, p. 124.

of ΔD^b_{vb} in equation (xix) the result of which is the value of ΔM_2. This can be expressed as:

(xx) $$\Delta M_2 = \Delta D^b_{vb} + \Delta N$$

The other relevant variables in our system respond both to the increase in the quantity of cash and to the decrease in the effective supply of bonds. Thus by adjusting equations (vii) and (xv) — again making allowance for $\Delta M_1 = 0$ — we obtain expressions for the changes in total and private wealth:

(xxi) $\Delta W = \Delta M_2 - \Delta S_{vb}$ or, since $\Delta S_{vb} = \Delta N$ and owing to equation (xx) $\Delta D^b_{vb} = \Delta M_2 - \Delta N$:

(xxi a) $$\Delta W = \Delta D^b_{vb}$$

(xxii) $\Delta W^i = \Delta N - \Delta S_{vb}$ or since $\Delta S_{vb} = \Delta N$
$\Delta W^i = 0$

Whilst open-market operations augment total wealth in the economy by ΔD^b_{vb}, that is, the amount by which commercial banks increase their bond-holdings, the amount of private wealth remains unaffected. In other words, the entire increase in wealth is absorbed by the commercial banks and the amount of wealth available to the private sector undergoes no change. This conclusion is particularly significant in one respect: the demand for money (D_m) and the private effective demand for bonds (D^i_{vb}) cannot change *on account of the wealth effect.*

Although the amount of private wealth has experienced no alteration its composition has been changed by open-market operations in the following way: On the one hand, there is an increase in the supply of idle money amounting to ΔM_2 and, on the other hand, there is an equal decrease in the private effective supply of bonds ($\Delta S^i_{vb} = \Delta S_{vb} + \Delta D^b_{vb} = \Delta M_2$). In the new equilibrium position the demand for money (D_m) must, therefore, have risen so as to absorb ΔM_2 and the private effective demand for bonds (ΔD^i_{vb}) must have fallen in order to set free ΔS_{vb}. Other things remaining the same, this can only happen through a fall in the bond rate, that is, *through the operation of the substitution effect.* The deviation of the bond rate from its initial equilibrium value (ΔR) depends on the responsiveness of the demands for assets to changes in the bond rate. Let us measure the responsiveness of the demand for idle money to changes in the bond rate by $\frac{1}{s}$ where s is defined as $\frac{\Delta R}{\Delta D_m}$, that is as the fall in the bond rate which is necessary to induce a unit rise in the demand for idle money: s is, of course, the slope of the demand curve for idle money. In our case the demand for idle money has to be raised by ΔM_2 (that is, $\Delta D_m = \Delta M_2$) so that the bond rate has to be reduced by $s\Delta M_2$ if a new equilibrium position is to prevail. This solution is, of course, identical with the one set out in subsection 5 and expressed by equation (xvi), namely:

(xvi) $$\Delta R = s\Delta M_2$$

Hence, the greater the responsiveness of the demand for idle money to changes in the bond rate — that is, the smaller s — the smaller will have to be the reduction of the bond rate for a given increase in the supply of idle money. The same reasoning and opposite results apply (other things remaining the same) to decreases in the quantity of idle money brought about by open-market operations.

2. *Movements of Money between the Active and Passive Spheres.* Since we are now not interested in the effects of changes in the amount of cash available in the economy or in the effective supply of bonds let us assume that these two variables remain constant throughout the argument; this assumption can be expressed algebraically as $\Delta N = 0$ and $\Delta S_{vb} = 0$. The effect of a reduction in the quantity of active money on the supply of idle money and the banks' effective demand for bonds can then be traced by adjusting equations (vi) and (xii):

(xxiii) $$\Delta M_2 = \Delta M_1 \frac{1 + a\beta}{1 + p\beta}$$

(xxiv) $$D^b_{vb} = M_1 \frac{\beta\,(a - p)}{1 + p\beta}$$

If we are correct in supposing that the public's preference for active cash (a) exceeds their preference for passive cash (p) the supply of idle money rises by more than the fall in the quantity of active money, that is, $\Delta M_2 > \Delta M_1$, the difference being due to the creation of new money in the form of deposits which the commercial banks are able to undertake because their cash reserves have been augmented on account of the flow of money from the active to the idle spheres (18). All newly created money must, of course, be backed entirely by additional bond-holdings and this means that the excess of ΔM_2 over ΔM_1 is equal to the increase in the banks' bond-holdings (ΔD^b_{vb}), or:

(xxv) $$\Delta M_2 = \Delta M_1 + \Delta D^b_{vb}$$

The amount of total wealth in our economy must rise by the increase in the supply of idle money; algebraically this result can be derived from equation (vii):

(xxvi) $$\Delta W = \Delta M_2$$

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(18) This dependence of the total supply of money on the quantities of idle and active money seems to me to be the essence of what we may conveniently call Professor Gambino's "Cash Effect". He describes it in the following fashion: "Hoarded saving in involving an increase in the credit extended by the public to the banks, constitutes, explicitly or otherwise, one of the conditions required for the banks to extend more credit to the public...". See Amedeo Gambino, "Money Supply and Interest Rate in Recent Macro-Economic Conceptions", this *Review*, 1954, p. 124.

Private wealth experiences on the one hand a rise in the quantity of idle money of ΔM_2 and, on the other hand, a decline in the private effective supply of bonds which is caused by the rise in the commercial banks' bond-holdings and is, therefore, equal to ΔD^b_{vb}. Private wealth thus rises by $\Delta M_2 - \Delta D^b_{vb}$ which, in accordance with equation (xxv), is equal to ΔM_1. Equation (xv) can be used to prove this point algebraically; after making allowance for $\Delta N = 0$ and $\Delta S_{vb} = 0$ we obtain:

(xxvii) $$\Delta W^i = \Delta M_1$$

The rise in the amount of private wealth has to be absorbed by a rise in the demand for money and/or in the private effective demand for bonds. If k denotes the marginal propensity to hold money as wealth changes private asset-holders will wish to hold $k\Delta W^i$ in the form of money and $(1 - k)\ \Delta W^i$ in the form of bonds.

In order for equilibrium to be re-established the bond rate must fall until the private sector is prepared to hold the entire increase in idle money. The demand for idle money has already experienced an increase *on account of the wealth effect* which amounts to $k\Delta W^i$ or $k\Delta M_1$. This means that the demand for money has to rise further by $\Delta M_2 - k\Delta M_1$ and this can only happen *on account of the substitution effect*, that is, by a fall in the bond rate. The magnitude of this fall in the bond rate depends on the responsiveness of the demand for idle money to changes in the bond rate which is measured — as will be remembered from our discussion of open-market operations — by $\frac{1}{s}$ (where $s = \frac{\Delta R}{\Delta D_m}$). Since the desired rise in the demand for idle money is equal to $\Delta M_2 - k\Delta M_1$ we can write:

(xxviii) $$\Delta R = s\ (\Delta M_2 - k\Delta M_1)$$

for the fall in the bond rate necessary to establish the new equilibrium position. This expression is, of course, identical with equation (xvii) which was derived from Fig. 3.

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