Monetary Policy with Full Stock Adjustment

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The effects of different types of monetary policy on prices, output, employment and interest rates in a growing economy are examined under the assumption of full stock/flow equilibrium. The introduction of time preference permits an interpretation of "monetarism".

I. A Classification of Monetary Policies

The subject of this paper are the effects of changes in the money supply on output, employment, the price level and the rates of return on bonds and capital goods. The treatment goes beyond the familiar analyses in the *Hicks/Patinkin/Tobin* tradition inasmuch as it considers, perhaps for the first time, situations of full stock/flow equilibrium. It will turn out that this leads to some striking differences in results which may require a partial re-examination of the efficacy of certain monetary policies. In general, the "monetarist" views about the effects of monetary policy are not confirmed, but it will be shown that an important special case yields most of the "monetarist" propositions.

It will be assumed that there is no banking system, leaving the government as the only supplier of money. The central bank is regarded as part of the government. All money is token money which may be visualized in the form of banknotes or of deposits which private firms and individuals maintain with the government. The government can supply money in four principal ways:

1. The money is issued in the form of transfer payments to the private sector, that is, as a free gift. This is the money "unexpectedly found in people's coffers" or "dropped from airplanes" so popular in the folklore of monetary theory. It will be called *transfer money*.
2. Money may be issued in payment for goods and services, thus financing budget deficits. This will be called *expenditure money*.
3. The government can issue money by buying bonds from the private sector, as in open market operations. In principle, the bonds can be either private bonds or government bonds already held by the private sector. Such money will be called *debt money*.

4. Finally, the money can be issued in payment for international reserves like gold or foreign exchange. If this is done at a fixed price of gold or at fixed exchange rates, we are back in the commodity money world.

The present analysis will concentrate on a closed economy, leaving three mechanisms of supplying money. They are related by the government budget constraint[1]

$$g - t = \frac{1}{p} \Delta M + \frac{1}{ip} \Delta B,$$

where

g flow of government purchases of goods and services from the private sector, in real terms,

t taxes net of transfers (including government interest), in real terms,

M money stock, in dollars,

B stock of outstanding government bonds, assumed to consist of perpetuities (consols) paying \$ 1 per year forever[2],

p price level,

i bond yield,

Δ operator denoting the change in a stock per time period.

The three money supply mechanisms can be characterized as follows:

pure transfer money: $\frac{1}{p} \Delta M = - t; \qquad g = \Delta B = 0$

pure expenditure money: $\frac{1}{p} \Delta M = g; \qquad t = \Delta B = 0$

pure debt money: $\frac{1}{p} \Delta M = - \frac{1}{ip} \Delta B; \quad t = g = 0$

There are, in addition, three policies not involving the money supply, consisting of various combinations of g, t and ΔB. However, each of the non-monetary policies can be expressed as a combination of two monetary policies. Thus tax-financed expenditures are equivalent to expenditures financed by new money combined with a reduction in the money supply through taxes. Similarly, bond-financed expenditures

[1] It is mainly *Carl Christ* (1968) who has drawn attention to the role of the government budget constraint in macroeconomic models.

[2] *Foley* and *Sidrausky* identify their "bonds" with an interest-bearing deposit which can always be withdrawn at face value (1971, p. 4). While this simplifies the exposition, it throws out the baby with the bathwater, because such deposits would clearly dominate money, and individuals would thus have no reason ever to hold money.

are equivalent to money-financed expenditures combined with a contraction in the money supply through sales of bonds. In general, with 4 policy variables linked by the government budget constraint we can define six policies, any three of which can be regarded as combinations of the other three. In the context of monetary theory it is natural to regard the three monetary policies as independent.

From this point of view, the central problem of the theory of token money supply are the *modus operandi* and the relative macroeconomic effects of a change in the money supply depending on the way it is brought about. How does, say, transfer money affect national income? Does it have a stronger effect than debt money or expenditure money? This is one of the three main issues raised by the recent debates on "monetarism" in macroeconomic policy making[3]. A "monetarist" would tend to argue that what matters (at least in a first approximation) is the change in the money supply, while it makes little difference which way this change is brought about. The "non-monetarist", on the other hand, would argue that it makes a considerable difference whether money is supplied against bonds, to pay for expenditures, or through transfers. An extreme "non-monetarist", a rare species today, would argue that this makes, in fact, all the difference, money being effective *only* if it is supplied, say, in payment for government expenditures or through a reduction in taxes, while it would be impotent if supplied against bonds. Considerable confusion could have been avoided if the participants in the "monetarist" debate had stated their propositions in the context of the government budget constraint, instead of arguing about the potency of individual policy variables as if they could be varied independently.

II. A Macroeconomic Model for Stock/Flow Equilibrium

To determine the effects of alternative monetary policies we have to embed the monetary policy variables in a macroeconomic model. Following the spirit of Tobin's approach, this will be a general equilibrium model for output and assets, the latter including money, bonds and capital goods[4]. It will exclude processes of continuing inflation. There is, of course, a vast literature on the macroeconomic effects of monetary policy, and it is still proliferating rapidly. For the most part,

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[3] Another issue is the extent to which macroeconomic fluctuations are caused by monetary policy, whatever its type, and not by factors outside the government budget constraint, like, say, private investment demand. The third question is whether monetary policy affects output and prices mainly through interest rates or also through other channels.

[4] *Tobin (1969);* see also *Tobin* and *Brainard* (1963).

no matter whether it is monetarist or non-monetarist, it is basically *Keynes*ian in the sense that in the guise of economic statics it offers, in fact, a fleeting picture of the economy in a transitory state of stock disequilibrium[5]. This is true in, at least, two respects. First, there is positive saving and investment, but the rest of the model is valid for a given capital stock. We know, therefore, that the model must somehow shift from one period to the next, but we do not know how. Second, there are usually government expenditures and taxes, but the equilibrium resulting from the model is valid for given stocks of money and bonds. We know from the government budget constraint that a budget deficit has its counterpart in a change in the supply of money and/or government bonds. Again it follows that the equilibrium determined by the model can only be temporary. These models do not tell us where the adjustment process might come to an end.

The present model is written from the complementary point of view of complete stock/flow equilibrium, thus filling a gap left by the IS/LM variety of macroeconomic theory. The dynamic analysis of the adjustment processes leading from one equilibrium to another will be left for future research. It may be conjectured that from the point of view of such a dynamic analysis the IS/LM models in the *Hicks/Patinkin* tradition will appear in their proper role as still pictures of a moving system[6]. While the present model, compared to the IS/LM models, must thus be regarded as long-run, we can only guess what this means in terms of calendar time. It may well be that, for moderate disturbances, the adjustment of the capital stock is largely completed within three years.

To reconcile full stock/flow equilibrium with positive investment and unbalanced budgets, we shall use a balanced-growth framework. First, we interpret g, t, M and B as per capita variables with population measured by the number of people in the labor force. Second, we expand the terms on the right-hand side of the government budget constraint

$$g - t = \frac{\Delta M}{M} \cdot \frac{M}{p} + \frac{\Delta B}{B} \cdot \frac{B}{ip} \, .$$

For balanced growth with stable prices, thus excluding continuing inflation, the proportionate growth of both money and bonds must equal the growth rate of the labor force δ. We can write, therefore,

[5] For representative examples see *Hicks* (1937) and *Patinkin* (1956, 1965).

[6] For an effort to solve similar problems both for stock/flow equilibrium and transitory processes see *Brunner* and *Meltzer* (1972). It seems that a satisfactory analysis of the transitory phases requires more explicit dynamics than *Brunner* and *Meltzer* provide.

(1) $$G - T = \frac{M}{p} + \frac{B}{ip} ,$$

where $G = \frac{g}{\delta}$ and $T = \frac{t}{\delta}$. The exogenously given growth rate δ thus appears as the rate at which the per-capita flows g and t are capitalized to make them dimensionally comparable to the per-capita stocks of money and bonds. Whenever on the following pages changes in government expenditures or transfers are mentioned, they are to be interpreted in the sense of the stock variables G and T.

The rest of the model is also in per capita terms. Let

(2) $$q = q\,(K, E)$$

be a macroeconomic production function relating the flow of output to the inputs of real capital and employment[7]. It is assumed to be quasi-concave with $q_K > 0$, $q_E > 0$, $q_{KK} < 0$, $q_{EE} < 0$, $q_{EK} > 0$. Each factor is paid its marginal product

(3) $$q_K = r$$

(4) $$q_E = \frac{w}{p} ,$$

where r is the rate of return on capital and w is the money wage rate. Unemployment is the difference between the labor force (whose per capita value is 1) and employment

(5) $$U = 1 - E.$$

There are three types of assets, namely real capital, bonds and money. For each asset, per capita demand of the private sector depends on the same set of variables[8]:

(6) $$K = K\,(H, G, r, i, z) \quad K_H > 0 \quad K_G \gtrless 0 \quad K_r > 0 \quad K_i \leqslant 0 \quad K_z \leqslant 0$$

(7) $$\frac{B}{ip} = B\,(H, G, r, i, z) \quad B_H > 0 \quad B_G \gtrless 0 \quad B_r \leqslant 0 \quad B_i > 0 \quad B_z \leqslant 0$$

(8) $$\frac{M}{p} = L\,(H, G, r, i, z) \quad L_H > 0 \quad L_G \gtrless 0 \quad L_r \leqslant 0 \quad L_i \leqslant 0 \quad L_z > 0$$

The expected signs of the partial derivatives are given on the right. The lower case letters denote the interest rates on capital, bonds, and cash balances, respectively. It will be assumed that the direct partial derivatives dominate the cross relationships in the sense that $K_r B_i > K_i B_r$,

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[7] E is employment per unit of the labor force, which may be different from unity.

[8] For bonds, this is private demand net of private supply, all bonds being assumed to consist of consols.

$B_i L_z > B_z L_i$, and $L_z K_r > L_r K_z$. $H = \frac{Ew}{\delta p}$ is human wealth, defined as real labor income $\frac{Ew}{p}$ capitalized at the rate of growth. The non-human components of wealth K, $\frac{B}{ip}$ and $\frac{M}{p}$ do not appear as arguments, because they are not given to the private sector from the outside. In fact, the demand functions for assets state that the private sector makes these non-human components what it wants them to be[9].

By analogy with H, G could be called "public wealth". As an argument in (6) - (8) it expresses the effect of government expenditures on the private demand for assets. G, like H, is given to the private sector from the outside. Taxes T, on the other hand, do not appear as an argument, because by virtue of the government budget constraint they can always be expressed in terms of G, $\frac{B}{ip}$ and $\frac{M}{p}$[10]. It is not clear *a priori* in what direction G affects the asset demands. If public wealth is regarded as a supplement to human wealth or as a complement of private assets, the partial derivatives K_G, B_G and L_G will be positive. This is a plausible assumption if, for example, the government supplies services to the private sector which otherwise would have absorbed labor. If, on the other hand, G is regarded as an offset to human wealth (wasted resources) or if it is a substitute for private assets (like public utilities), the three partial derivatives would be negative. It should be noted that K_G, B_G and L_G measure the effect of a change in G accompanied by an equal change in T; whenever one of the policy variables M, B or G is varied at given levels of the others, this implies a corresponding change in T. The *Keynes*ian balanced budget multiplier seems to imply that at least some of the three partial derivatives are

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[9] This means that there is no wealth constraint of the familiar form. While such constraints are essential aspects of stock/flow disequilibria, they are irrelevant in stock/flow equilibrium. This is one of the main differences of the present model relative to those of the *Patinkin-Tobin* variety. In an important sense, the place of the wealth constraint is taken by the government budget constraint which links financial assets to government deficits.

[10] Suppose the demand functions are initially written

$$K = K^* \left(H, K, \frac{M}{p}, \frac{B}{ip}, G, T, r, i, z\right)$$

$$\frac{B}{ip} = B^* \left(H, K, \frac{M}{p}, \frac{B}{ip}, G, T, r, i, z\right)$$

$$\frac{M}{p} = L^* \left(H, K, \frac{M}{p}, \frac{B}{ip}, G, T, r, i, z\right)$$

with $G - T = \frac{M}{p} + \frac{B}{ip}$. If the conditions for the implicit function theorem hold, this can be solved for the demand functions (6) — (8).

negative, since the effect of a balanced budget increase on saving is assumed to be negative. The present analysis shows that the signs are ambiguous, probably depending to a large extent on the exact nature of government expenditures[11].

The asset demand functions can be regarded as a description of observed behavior. Generally, we would then expect assets to be gross substitutes, so that their cross partial derivatives are negative. We shall call this the general version of the model. It may be criticized for the fact that there is no explicit relationship of interest rates with the rate of time preference of individuals. Alternatively, the asset demand functions can be assumed to be derived from optimizing behavior of individuals with a given rate of time preference Θ. This rate is defined as the one which is appropriate for the capitalization of future revenues in the absence of any cost due to uncertainty or illiquidity. To the extent that there may be no asset without such a cost, it may be an unobservable construct. In particular, Θ may be different from (and probably lower than) δ. This will be called the time-preference version of the model.

Under the time preference version an individual is assumed to demand each asset in such a quantity that the sum of the rate of return and the marginal non-interest or service yield is equal to the individual's rate of time preference at that level of E. If the service yields are u_K, u_B and u_M, the conditions are $r + u_K = i + u_B = z + u_M = \Theta$. u_M is likely to be positive, reflecting the transactions services of money, but u_B and u_K are probably negative, representing the illiquidity cost of holding bonds and real capital, with $(-u_K) > (-u_B)$ in most cases. The marginal service yields presumably fall as the quantity of the respective asset increases at given H. We thus obtain a picture like figure 1. If H changes with given rates of return, the u-curves shift upward, because at a higher level of economic activity the same amount of an asset has a higher marginal service yield. This explains why K_H, B_H and L_H are positive.

The time preference version implies that the cross partial derivatives of the asset demand functions vanish ($K_i = K_z = B_r = B_z = L_r = L_i = 0$). In effect, the net return of each asset, which is relevant for the cross effects on the demand for others assets, is always Θ, no matter

[11] The model needs no separate saving and investment functions. Investment is determined by the stock demand for capital goods and the growth rate, i. e. $I = \delta K$. Saving is the change in non-human wealth, i. e. $S = \delta (K + B / i p + M / p)$. The difference between private saving and private investment corresponds to the government deficit (in a flow sense): $S - I = \delta (B / i p + M / p) = g - t$. This shows that the model is consistent with the usual accounting definitions.

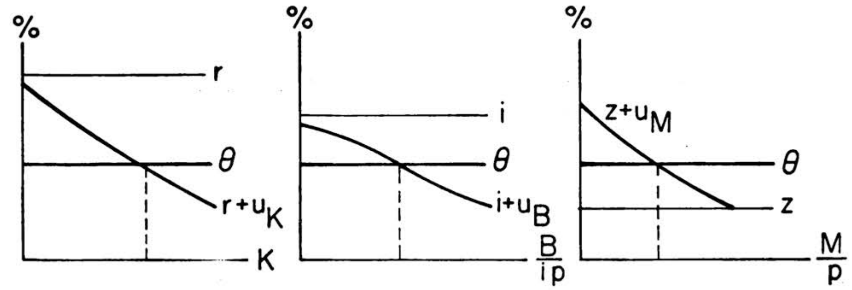

Fig. 1

what happens to its gross return. An increase in the own-rate of return, on the other hand, still has the usual positive effect, the quantity demanded increasing to the extent necessary to let the marginal utility fall just by the amount the rate of return has gone up. It will hardly come as a surprise that the use of the time preference version will turn out to have far-reaching consequences for the macroeconomic effects of money. Specifically, it can be shown to produce most of the monetarist propositions. For the short run, the time preference version would be hard to defend theoretically. Many empirical studies of asset behavior also have found negative cross interest elasticities of asset demand functions. However, as a long-run equilibrium interpretation, the time preference version requires serious consideration.

The model can be interpreted as a full-employment system by assuming $U = 0$, while considering prices and wages as flexible. Alternatively, we can assume that either prices or wages are rigid and given as a legacy of the past. We thus obtain an underemployment system. The transition from underemployment to full employment will not be discussed. In either case, the model determines all variables once the policy variables G, M and B and the yield on money z are fixed. It is different from the IS-LM framework inasmuch as it contains three independent assets instead of only two, accounts for the capacity effects of capital, and offers a consistent treatment of stock/flow aspects.

III. The Effect of Changes in the Money Supply under Full Employment

We now turn to the comparative statics of the model set out in the previous section. What we want to determine are the effects of changes in the money supply on prices, output, employment, and interest rates. In the present section, we shall consider the case of full employment, where the flexibility of wages always sees to it that employment is equal to the available labor force. We thus have $E = 1$.

The government has a choice whether it wants to assign a fixed interest rate to cash balances, while bond yields are determined by the market ($dz = 0$), or whether it wants to stabilize the bond yield by appropriate variations in the rate on cash balances ($di = 0$). We shall here use the first assumption, first, because it corresponds more closely to real conditions, the interest on currency being virtually fixed at zero, second, because it seems more natural, the interest rate on currency not being a market rate in any case. It should be noted that the assumption of a fixed interest rate on money, as *Tobin* (1969, pp. 25 f) has pointed out, makes all the difference for any special position money may have in the macroeconomic system. Once we assume that the government holds the bond yield constant by announcing appropriate variations in the rate on currency, all the effects we usually ascribe to variations in the money supply become valid for bonds, and vice versa. For example, the effects usually expected from open market purchases of bonds would now be attained by open market sales[12]. At the same time, we have to realize that it is not just an accident that governments have tended to fix the rate on money rather than the bond yield. Bond yields are determined in a competitive market in which variable money prices are paid for bonds with given coupons. There is no analogous market for currency, the money price of money being equal to one by definition. Any variation in the yield on currency, therefore, can only come about by variations in the coupon payments (usually zero) determined by the issuing authority. To the extent money does have a special position in the system, it is because its money price is fixed.

To determine the effects of changes in monetary policies on the endogenous variables of the system, we want to express the changes in endogenous variables dr, di, dp, etc. as functions of the changes in policy variables dM, dB and dG. Differentiating (3) and (4) with $dE = dz = 0$, we obtain

$$q_{KK}\, dK = dr$$

$$q_{KE}\, dK = l/p\, dw - w/p^2\, dp \ ,$$

whence

$$dH = \frac{N}{\delta}\, q_{KE}\, dK = \frac{N}{\delta}\, \frac{q_{KE}}{q_{KK}}\, dr \ .$$

Taking the total differentials of (6) - (8) and making appropriate substitutions for dH, dw and dK, we obtain three equations determining dr, di and dp in terms of dM, dB and dG:

[12] These statements can be checked by performing the analysis of this and the following section for the case $di = 0$ and comparing the results with those given in the text.

$$\left(K_H \frac{N}{\delta} \frac{q_{KE}}{q_{KK}} + K_r - \frac{1}{q_{KK}}\right) dr + K_i \, di = - K_G \, dG \tag{10}$$

$$\left(B_H \frac{N}{\delta} \frac{q_{KE}}{q_{KK}} + B_r\right) dr + \left(B_i + \frac{B}{i^2 p}\right) di + \frac{B}{ip^2} \, dp = \frac{1}{ip} \, dB - B_G \, dG \tag{11}$$

$$\left(L_H \frac{N}{\delta} \frac{q_{KE}}{q_{KK}} + L_r\right) dr + L_i \, di + \frac{M}{p^2} \, dp = \frac{1}{p} \, dM - L_G \, dG \tag{12}$$

Using *Cramer*'s rule, the effect of a change in one of the policy variables on the right-hand side, j, on one of the endogenous variables on the left-hand side, i, is determined as

$$\frac{di}{dj} = \frac{\Delta_{ij}}{\Delta} ,$$

where Δ_{ij} is the determinant formed from the matrix of coefficients on the left-hand side after replacing column i by column j, while Δ is the determinant from the matrix of coefficients on the left-hand side.

In general, it will not be possible to determine the sign of di/dj on the basis of the previous assumptions about the partial derivatives of the model. More definite results can be obtained if we restrict the analysis to sets of coefficients which satisfy certain stability requirements. Suppose $dM = dB = dG = 0$, but there is excess demand in the market for real capital $K(H, G, r, i) - K = \varrho$, while the bond and money markets are in equilibrium. This excess demand will, under plausible dynamic assumptions, lower the rate of return r. Stability requires that this fall in r reduces the excess demand for capital, that is $d\varrho/dr > 0$, where dr is considered as exogenous. But

$$\frac{d\varrho}{dr} = \frac{\Delta}{\Delta_{r\varrho}} = \frac{\Delta}{\left(B_i + \frac{B}{i\,2p}\right)\frac{M}{p2} - L_i \frac{B}{ip2}} > 0 .$$

It turns out that $\Delta_{r\varrho}$ is positive by virtue of the normal assumptions about the partial derivatives. It follows that $\Delta > 0$ is necessary for stability.

A similar test can be applied to the bond market. Suppose there is excess demand in the bond market

$$B(H, G, r, i) - B / i\,p = \beta .$$

It is plausible to make the dynamic assumption that this will lower the rate of interest on bonds. Stability then requires that this fall in i reduce β, that is, $d\beta/di > 0$. We find

$$\frac{d\beta}{di} = \frac{\Delta}{\Delta_{i\beta}} = \frac{\Delta}{\left(K_H \frac{N}{\delta} \frac{q_{KE}}{q_{KK}} + K_r - \frac{1}{q_{KK}}\right) \frac{M}{p^2}} > 0$$

But we already know that $\Delta > 0$ is necessary for stability. It follows that $\Delta_{i\beta} > 0$, which implies that the expression in brackets is also positive.

Finally, we will want to require that the economy be stable at any positive value of government bonds, including $B = 0$. This means that

$$\Delta\,(B = 0) = \frac{M}{p^2} \left[\left(K_H \frac{N}{\delta} \frac{q_{KE}}{q_{KK}} + K_r - \frac{1}{q_{KK}} \right) B_i - \left(B_H \frac{N}{\delta} \frac{q_{KE}}{q_{KK}} + B_r \right) K_i \right] > 0$$

These stability requirements shall be needed to sign the effects of monetary policies.

(a) Transfer Money

We begin with transfer money, that is $dM > 0$, $dB = dG = 0$. The effect on the price level is found to be

$$\frac{dp}{dM} = \frac{\Delta_{pM}}{\Delta} = \frac{1}{\Delta} \frac{1}{p} \left[\left(K_H \frac{N}{\delta} \frac{q_{KE}}{q_{KK}} + K_r - \frac{1}{q_{KK}} \right) \left(B_i + \frac{B}{i^2 p} \right) - \left(B_H \frac{N}{\delta} \frac{q_{KE}}{q_{KK}} + B_r \right) K_i \right] > 0$$

The expression in square brackets is equal to $\Delta\,(B = 0)$ plus a term which we know from the stability conditions to be positive. But $\Delta\,(B = 0)$ is also positive. It follows that Δ_{pM} is positive. Since $\Delta > 0$, an increase in the money supply results in a higher price level. We can know more. If $B > 0$, the proportionate increase in prices is less than the proportionate increase in the money supply. This follows from the observation that Δ is the sum of $\frac{M}{p} \Delta_{pM}$ and another term

$$A = -\frac{B}{ip^2} \left[\left(K_H \frac{N}{\delta} \frac{q_{KE}}{q_{KK}} + K_r - \frac{1}{q_{KK}} \right) L_i - \left(L_H \frac{N}{\delta} \frac{q_{KE}}{q_{KK}} + L_r \right) K_i \right] > 0$$

which, on inspection, turns out to be also positive. Thus

$$\frac{dp}{dM} \cdot \frac{M}{p} = \frac{\Delta_{pM}}{\Delta} \cdot \frac{M}{p} = \frac{\Delta_{pM}}{\frac{M}{p} \Delta_{pM} + A} \cdot \frac{M}{p} = \frac{\Delta_{pM}}{\Delta_{pM} + A\,\frac{p}{M}} < 1$$

If there are government bonds, the quantity theory of money is generally not valid.

We now consider the special case $B = 0$. In this case $A = 0$ and thus $(dp/dM)\,(M/p) = 1$. This is the quantity theory of money. Its content can be expressed in the following proposition. If money is the only exogenously given financial asset of the private sector, then, starting from an equilibrium situation, an increase in the money supply by a given percentage will result in a new equilibrium in which prices are higher by the same percentage. In this sense, the quantity theory enjoys very wide acceptance among economists holding the most diverse views on economic policy, including both "monetarists" and their opponents. In particular, it should be noted that the quantity theory in no way depends on the assumption that interest rates have no influence on the demand for money.

We now want to pay special attention to the time preference version of the model. This version means that $K_i = B_r = L_r = L_i = 0$. It turns out that in this case $A = 0$ and thus

$$\frac{dp}{dM} \cdot \frac{M}{p} = \frac{\Delta_{pM}}{\Delta} \cdot \frac{M}{p} = 1 \ ,$$

whatever the amount of B. The quantity theory becomes valid even in the presence of other financial assets. Those who stress the significance of the quantity theory for economies with large non-monetary government debt thus seem to imply that the time preference version of our model is a reasonably good approximation to reality. It is in this context that the interest elasticity of the demand for cash balances is important, because the assumption $L_i = 0$ helps to make A equal to zero. By the same token, a zero elasticity of the demand for capital with respect to the bond yield ($K_i = 0$) also helps to support he quantity theory for a world with bonds.

By the same methods we used for prices, we can determine the effect of transfer money on the bond yield:

$$\frac{di}{dM} = \frac{\Delta_{iM}}{\Delta} = -\frac{1}{\Delta}\,\frac{1}{p}\left(K_H \frac{N}{\delta}\,\frac{q_{KE}}{q_{KK}} + K_r - \frac{1}{q_{KK}}\right)\frac{B}{ip^2} < 0 \ .$$

We can thus be sure that, in general, the bond yield falls if the money supply is increased. However, in the special case of $B = 0$, the bond yield will be unchanged. Under the time preference version we have

$$\frac{di}{dM} = -\frac{I}{ip}\,\frac{B}{M}\,\frac{1}{\left(B_i + \dfrac{B}{i^2 p}\right)} \ .$$

This can be neatly simplified by using elasticities:

$$\varepsilon_{iM} = \frac{di}{dM} \cdot \frac{M}{i} = - \frac{\frac{B}{ip}}{iB_i + \frac{B}{ip}} = - \frac{1}{B_i \frac{i}{B/ip} + 1} = - \frac{1}{\varepsilon_{Bi} + 1}$$

Under the time preference version with $B > 0$, an increase in the money supply still lowers the bond yield, despite the fact that the quantity theory holds. If there are government bonds outstanding, a change in price affects their real value. Therefore, bond yields must change in a compensating way to equalize the (changed) supply and the (changed) demand for real bonds. It is not correct to say, therefore, that whenever the quantity theory holds a change in the money supply has no real effects on the economy.

The effect of a change in transfer money on the rate of return on capital is

$$\frac{dr}{dM} = \frac{\Delta_{rM}}{\Delta} = \frac{1}{\Delta} \frac{1}{p} K_i \frac{B}{ip^2} < 0 \; .$$

In general, an increase in the money supply will thus result in a lower equilibrium level of capital returns. Since $dK = 1/q_{KK}\, dr$, this will be associated with a higher capital stock and thus higher output. Also, since $dH = (N/\delta)\,(q_{KE}/q_{KK})\, dr$, human capital will typically increase. A change in the money supply by "dropping money from airplanes" has real effects on output and the value of labor services even in full employment equilibrium. These effects disappear, however, if either $K_i = 0$ or $B = 0$ (or both). Whenever the quantity theory of money holds either because there are no government bonds or because the time preference version applies, an increase in the money supply has no effect on the rate of return on real capital[13].

(b) Debt Money

If the government issues money to buy bonds, we have $dB = -\, i\, dM$. The results are the same as those for an increase in transfer money accompanied by a reduction in outstanding bonds through negative transfers (that is, taxes). The differences, if any, between transfer money and debt money can thus be determined by considering the effects of a change in bonds through transfers.

[13] The difference in results for i and r arises, of course, because a price change affects the real value of bond holdings, but not of the capital stock.

An increase in bonds by giving them away free produces a rise in prices:

$$\frac{dp}{dB} = \frac{\Delta_{pB}}{\Delta} = -\frac{1}{ip}\left[\left(K_H \frac{N}{\delta}\frac{q_{KE}}{q_{KK}} + K_r - \frac{1}{q_{KK}}\right)L_i - \left(L_H \frac{N}{\delta}\frac{q_{KE}}{q_{KK}} + L_r\right)K_i\right] > 0$$

Consequently, if money is supplied through open market operations, the increase in prices must be less than in the case of transfer money. In this, quite limited, sense debt money is less "inflationary" than transfer money.

In fact, there appears to be no *general* reason why the price effects of bond retirement could not be conceivably stronger than those of issuing money. As a consequence, we cannot be quite sure that an expansion of the money supply through open market operations will increase prices at all, and it seems logically conceivable that it may actually lower them. In such a case, the monetarist position would be the opposite of the truth; to lower prices, we would have to increase the money supply (by reducing the bond supply). Empirical observation would have to show whether this is a relevant case. Under the time preference version, since $K_i = L_i = 0$, we have $\Delta_{pB} = 0$. Again, money is all that matters; the monetarist position is vindicated.

Before leaving the price effects of bonds, we note that in the absence of government currency ($M = 0$), the quantity theory is valid for bonds, just as it is valid for money in the absence of bonds:

$$\frac{dp}{dB} \cdot \frac{B}{p} = \left(\frac{\Delta_{pB}}{\Delta}\right)_{M=0} \cdot \left(\frac{B}{p}\right) = 1$$

This illustrates the fact that the quantity theory is not specific to money. It is valid for any exogenous change in all financial assets in the same proportion, no matter how money and bonds are initially combined.

The effects of transfer bonds on the two interest rates are unambiguously positive[14]:

$$\frac{di}{dB} = \frac{\Delta_{iB}}{\Delta} = \frac{1}{\Delta}\frac{1}{ip}\left(K_H \frac{N}{\delta}\frac{q_{KE}}{q_{KK}} + K_r - \frac{1}{q_{KK}}\right)\frac{M}{p^2} > 0 \,,$$

[14] *Brunner/Meltzer* (1972) have noted that a debt-financed budget deficit raises interest rates. The following section will show that it makes a difference whether debt is incurred to increase expenditures or to lower taxes.

$$\frac{dr}{dB} = \frac{\Delta_{rB}}{\Delta} = -\frac{1}{\Delta}\frac{1}{ip}K_i\frac{M}{p^2} > 0 \ .$$

It follows that an increase in the supply of debt money always lowers both interest rates, the reduction in bonds reinforcing the effect of the increase in money. As a consequence, the capital stock, the output and the real value of labor resources increase also. The clear-cut sign of the interest effect is in contrast to the somewhat ambiguous price effect. While in the case of debt money, lower interest rates will usually be associated with higher equilibrium prices, the opposite association cannot be entirely ruled out. Open market operations which raise interest rates cannot automatically be relied upon to lower the price level.

Under the time preference version, the effect of debt money on the bond yield is the same as in the general case, since the expression for di/dB contains no cross partial derivatives. The effect on capital returns, however, vanishes, and the effects on the capital stock and output vanish with it. This agrees well with the monetarist view that in full-employment equilibrium an increase in the money supply has no "real" effects no matter whether it is brought about by transfers or through open market operations.

Instead of determining the change in interest rates produced by an exogenous change in debt money, we can reverse the question and consider the effects on the money supply and prices of an exogenous change in the bond yield. In this case, the government announces a certain interest rate and buys (or sells) all the bonds offered (or demanded) at that rate. *Wicksell* argued that by setting a bond yield below the "natural" rate the government would initiate a continuing inflationary spiral. The present model does not confirm this view. For every bond yield, there is a finite quantity of money and a finite equilibrium price level, both in the general model and in the time preference version. In most cases, a lower bond yield will probably result in higher prices. In the time preference version, we can be sure about this, but in the general model we cannot exclude the possibility that a lower interest rate actually results in lower prices. In a stationary economy with stock/flow equilibrium there does not seem to be a *Wicksell* process[15], and lower interest rates do not necessarily lead to higher prices exept if we adopt the time preference version.

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[15] On this question also see *Niehans* (1965, section II), where, however, the possibility that higher interest rates may conceivably result in higher prices was not recognized. This was due to the neglect of financial asset markets.

(c) Expenditure Money

Money issued to pay for government expenditures can be regarded as an increase in transfer money accompanied by an increase in tax-financed expenditures. The total effect can thus be determined by adding the effect of a balanced-budget increase to the effect of transfer money. The main characteristic of the results is their ambiguity. Inspection of (10) - (12) reveals that the sign of the effects of G on r, i and p depends crucially on the signs of K_G, K_B and K_L, and little can be said about these signs *a priori*.

The effect of government expenditures on the price level can be written as

$$\frac{dp}{dG} = \frac{\Delta_{pG}}{\Delta} = -\frac{1}{\Delta}(L_G S_1 + B_G S_2 + K_G S_3) \gtrless 0,$$

where S_1, S_2 and S_3 are positive on the basis of previous assumptions about partial derivatives and stability conditions. It follows that $dp/dG > 0$, if $L_G < 0$, $B_G < 0$, $K_G < 0$. This means that a balanced-budget increase raises prices if its effects on the demands for private assets are negative. On the other hand, if L_G, B_G and K_G were all positive, a balanced-budget increase would produce a fall in prices. This is intuitively plausible. If government expenditures raise the demand for money and bonds in real terms, while their nominal amounts are fixed, a fall in prices is necessary to keep supply and demand in balance. This fall is brought about by the efforts of individuals to sell goods for more money. With respect to capital goods, $K_G > 0$ means that government expenditures stimulate the private sector to make more capital goods available to producers, which tends to lower prices. In fact, the effect of government expenditures is the same as if the government itself had supplied free capital goods to industry. It is conceivable, of course, that the three partial derivatives are of different sign, depending on the nature of the government expenditures. In this case the ambiguity gets worse.

In view of this ambiguity, the price effects of expenditure money may be either weaker or stronger than those of transfer money. The way money is supplied may indeed matter, but we do not know which way. The time preference version does nothing to remove the ambiguity, except for the fact that B_G becomes irrelevant, being everywhere associated with cross partial derivatives. Monetarism thus seems to imply the view that the effects of government expenditures on the demand for private assets, whatever their sign, are too small to be relevant.

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The situation is the same for the effects of balanced budget expenditures on interest rates, output and human capital. In all these cases, the signs of K_G, B_G and L_G are of crucial importance. It may be left to the interested reader to work out the various cases.

In summary, we find that in a full-employment economy it generally matters a great deal whether money is supplied through transfers, through the bond market or to finance expenditures. While most of the effects have the commonly expected direction, it turned out that we cannot rely on the deflationary effect of restrictive open market operations without empirical information. However, if we adopt the time preference view and if, in addition, we regard the asset demand effects of balanced budget changes as negligible, the monetarist position seems to be justified in all important points. We are then correct in asserting that what matters is money and not the way it is created.

IV. The Effect of Changes in the Money Supply with Fixed Wages

We now reinterpret the basic model for the case of under- or overemployment. In a static framework with full stock/flow equilibrium this can be done by assuming either rigid prices or rigid wages. We shall here concentrate on wage rigidity, while commodity prices are assumed to be market-clearing. This seems to be a more relevant idealization of economic reality than the reverse assumption. On the other hand, employment is now variable, the difference between the labor supply and employment being unemployment (possibly negative). Of course, the case of unemployment with fixed wages, though considered here in a static framework, is already a (Keynesian) waystation to dynamic analysis.

With the new set of assumptions, the total differential of the wealth definition becomes

$$dH = \frac{w}{\delta p}\, dE - \frac{Ew}{\delta p^2}\, dp = \frac{H}{E}\, dE - \frac{H}{p}\, dp.$$

Taking the differential of the demand function for capital and substituting for dH, we obtain

$$dK = K_H \frac{H}{E}\, dE - K_H \frac{H}{P}\, dp + K_G\, dG + K_r\, dr + K_i\, di.$$

This can be substituted into the marginal conditions for the capital and labor markets, properly differentiated. Together with the demand functions for bonds and money we thus have four equations determining dE, dr, di, and dp in terms of dM, dB and dG:

$$\left(q_{KK} K_H \frac{H}{E} + q_{KE}\right) dE + (q_{KK} K_r - 1)\, dr + q_{KK} K_i\, di - q_{KK} K_H \frac{H}{p}\, dp = - q_{KK} K_G\, dG \tag{13}$$

$$\left(q_{KE} K_H \frac{H}{E} + q_{EE}\right) dE + q_{KE} K_r\, dr + q_{KE} K_i\, di + \frac{w}{p^2}\left(1 - q_{KE} K_H \frac{Hp}{w}\right) dp = - q_{KE} K_G\, dG \tag{14}$$

$$B_H \frac{H}{E}\, dE + B_r\, dr + \left(B_i + \frac{B}{i^2 p}\right) di + \frac{B}{ip^2}\left(1 - B_H \frac{H}{B/ip}\right) dp = \frac{1}{ip}\, dB - B_G\, dG \tag{15}$$

$$L_H \frac{H}{E}\, dE + L_r\, dr + L_i\, di + \frac{M}{p^2}\left(1 - L_H \frac{H}{M/p}\right) dp = \frac{1}{p}\, dM - L_G\, dG \tag{16}$$

We now introduce two sets of additional restrictions on the parameters of this system. The first set relates to the wealth elasticities of asset demands. It will be assumed that they are all equal to one. Thus

$$\frac{B}{ip^2}\left(1 - B_H \frac{H}{B/ip}\right) = \frac{M}{p^2}\left(1 - L_H \frac{H}{M/p}\right) = 0 \text{ and } K_H \frac{H}{K} = 1 \; .$$

There is no general reason why a given individual should conform to this assumption. However, there is also no general reason why the deviations should be in one direction rather than in the other. We would thus expect that for the economy as a whole the deviations would be relatively minor. Indeed, in the case of money, for which empirical research is most extensive, scale elasticities have been found to be close to unity.

Second, we shall assume that the production function is of Cobb-Douglas type $q = K^\alpha E^{1-\alpha}$, whence

$$\frac{q_{KE}}{q_{KK}} \cdot \frac{E}{K} = \frac{q_{EE}}{q_{KE}} \cdot \frac{E}{K} = -1 \; ,$$

$$\left(q_{KK} K_H \frac{H}{E} + q_{KE}\right) = q_{KK} \frac{K}{E}\left(K_H \frac{H}{K} + \frac{q_{KE}}{q_{KK}} \frac{E}{K}\right) = 0 \; ,$$

$$\left(q_{KE} K_H \frac{H}{E} + q_{EE}\right) = q_{KE} \frac{K}{E}\left(K_H \frac{H}{K} + \frac{q_{EE}}{q_{KE}} \frac{E}{K}\right) = 0 \; .$$

The justification is again that empirical results support this assumption as a rough idealization of reality. To the extent that the results of the following analysis are qualitative in nature, relating to the signs of comparative-static effects, these restrictions are not crucial in the sense that the results would be valid even if they were not precisely satisfied. However, if the deviations become larger, there may come a point at which the results cease to hold.

With these restrictions the matrix of coefficients on the left-hand side of (13) - (16) becomes

$$\begin{array}{cccc} dE & dr & di & dp \\ 0 & q_{KK} K_r - 1 & q_{KK} K_i & -q_{KK} K_H \dfrac{H}{p} \\ 0 & q_{KE} K_r & q_{KE} K_i & \dfrac{w}{p^2}\left(1 - q_{KE} K_H \dfrac{Hp}{w}\right) \\ B_H \dfrac{H}{E} & B_r & B_i + \dfrac{B}{i2p} & 0 \\ L_H \dfrac{H}{E} & L_r & L_i & 0 \end{array}$$

where

$$\frac{w}{p^2}\left(1 - q_{KE} K_H \frac{Hp}{w}\right) = \frac{w}{p^2}\left[1 - \left(q_{KE} \frac{K}{q_E}\right)\left(K_H \frac{H}{K}\right)\right] = \frac{w}{p^2}(1-\alpha) > 0 \ .$$

Inspecting this matrix, we find that the additional assumptions are significant mainly in two respects. First, they imply that changes in the price level, with interest rates and employment unchanged, do not effect excess demand in the money and bond markets. Of course, a fall in prices will increase the supply of real cash balances and bond holdings, but this is just matched by the increase in demand due to the increase in human wealth at given wages. Second, the equilibrium between the marginal product and the price of each factor is not affected by changes in employment, these changes being just matched by proportionally equal changes in capital goods and thus leaving marginal products unchanged. Taking the determinant of the above matrix of coefficients, we find that $\Delta < 0$ by virtue of the signs of coefficients[16].

(a) Transfer Money

Within this framework, the effect of transfer money ($dM > 0$, $dB = dG = 0$) on employment is now determined as

[16] This negative sign is consistent with stability of the system in the sense that the fall in interest rates which may be expected to result from excess demand in the bond market tends to eliminate the latter.

$$\frac{dE}{dM} = \frac{\Delta_{EM}}{\Delta} = -\frac{1}{\Delta}\frac{1}{p}\left\{q_{KK}\frac{w}{p^2}\left[K_i B_r - K_r\left(B_i + \frac{B}{i2p}\right)\right]\right.$$
$$\left. + \left(\frac{w}{p^2} - q_{KE} K_H \frac{H}{p}\right)\left(B_i + \frac{B}{i2p}\right)\right\} > 0 \; .$$

For sets of coefficients consistent with our assumptions, this expression is positive. It follows that an increase in the money supply produces an expansion of employment. We are not surprised that it is also accompanied by a fall in both interest rates:

$$\frac{dr}{dM} = \frac{\Delta_{rM}}{\Delta} = \frac{1}{\Delta}\frac{1}{p}\left(q_{KK} K_i B_H \frac{H}{E}\frac{w}{p^2}\right) < 0 \; ,$$

$$\frac{di}{dM} = \frac{\Delta_{iM}}{\Delta} = -\frac{1}{\Delta}\frac{1}{p} B_H \frac{H}{E}\left[\frac{w}{p^2} q_{KK} K_r - \left(\frac{w}{p^2} - q_{KE} K_H \frac{H}{p}\right)\right] < 0 \; .$$

We may be somewhat surprised, however, to find that prices will fall:

$$\frac{dp}{dM} = \frac{\Delta_{pM}}{\Delta} = -\frac{1}{\Delta}\frac{1}{p} B_H \frac{H}{E} q_{KE} K_i < 0$$

The reason is easy to find. The fall in interest rates calls forth an increase in capital per unit of labor and thus an increase in the marginal productivity of labor. At fixed money wages, this implies a reduction in the marginal cost of production which, under the pressure of competition, will be reflected in lower prices. The crucial link in this causal chain is, of course, the rigidity of wages. Once wages begin to give way, as they can hardly fail to do sooner or later, we approach the full employment case, considered above, with its rising prices. At present, it is important to realize that as long as wages are indeed rigid, there is no reason to expect that an increase in the money supply will lead to higher equilibrium prices. By the same token, a restriction of the money supply cannot be expected to be effective against inflation. The experiences in the initial phases of expansionary policies, as for example in the early 'sixties, and in the early phases of restrictive periods, as in the late 'sixties and early 'seventies, seem to be consistent with the theoretical analysis.

With these results we now compare those for the time preference version. It turns out that employment, capital and output all expand at the same rate as the money supply, while the rate of return on capital and the price level remain unchanged. The latter statement follows immediately from Δ_{rM} and Δ_{pM} for $K_i = 0$. To permit the reader to check the first statement more easily, we write the determinant Δ as modified for the time preference version:

$$\Delta^* = L_H \frac{H}{E}\left(B_i + \frac{B}{i^2 p}\right)\left[q_{KK}\frac{w}{p^2}K_r - \left(\frac{w}{p^2} - q_{KE}\, K_H \frac{H}{p}\right)\right] < 0$$

With corresponding modifications for the numerators, we obtain

$$\frac{dE}{dM} = \frac{\Delta^*_{EM}}{\Delta^*} = \frac{1}{pL_H \frac{H}{E}} = \frac{E}{M}\cdot\frac{1}{L_H \frac{H}{M/p}} = \frac{E}{M}\,,$$

$$\frac{dK}{dM} = \frac{1}{q_{KK}}\frac{dr}{dM} - \frac{q_{KE}}{q_{KK}}\frac{dE}{dM} = \frac{K}{E}\frac{dE}{dM} = \frac{K}{M}\,,$$

$$\frac{dq}{dM} = \frac{q}{K}\frac{dK}{dM} = \frac{q}{M}\,.$$

These results amount to a quantity theory for output and money income. It should be noted that the constancy of prices is not assumed, but derived from the model. Under the time preference version, monetarists are thus justified in using the quantity theory both for unemployment with rigid wages and for full employment. Bond yields, however, are still inversely related to the money supply:

$$\frac{di}{dM} = \frac{\Delta_{iM}}{\Delta} = -\frac{B_H}{L_H}\cdot\frac{1}{B_i + B/i^2 p} = -\frac{B_H \frac{H}{M/p}}{L_H \frac{H}{M/p}}\cdot\frac{1}{B_i + \frac{B}{i^2 p}} = -\frac{B_H \frac{H}{M/p}}{B_i + \frac{B}{i^2 p}} < 0$$

This means that the bond yield falls just enough to increase the real value of bond holdings to the extent necessary to satisfy the increased demand for bonds due to higher human wealth. The important point is that under the time preference version lower bond yields have no repercussions in the market for real capital goods. It is still true that a higher money supply is associated both with an increased demand for real capital and a lower bond yield, but the "transmission mechanism" involves no causal effect of the latter on the former. This agrees well with the frequent assertion of monetarists that what they call the traditional Keynesian model overemphasizes the effect of bond yields on real capital demand at the expense of other (often ill-defined) elements of the transmission mechanism.

(b) Debt Money

We now return to the general model to analyze the effects of debt money, assuming $(1/ip)\,dB = -(1/p)\,dM$ and $dG = 0$. Again this can be done most efficiently by considering the effects of transfer bonds (that is, $dB > 0$, $dM = dG = 0$) and subtracting them from the effects of transfer money. For transfer bonds, the employment effect is positive:

$$\frac{dE}{dB} = \frac{\Delta_{EB}}{\Delta} = \frac{1}{\Delta}\,\frac{1}{ip}\left[q_{KK}\,\frac{w}{p^2}\,(K_i\,L_r - K_r\,L_i) + \left(\frac{w}{p^2} - q_{KE}\,K_H\,\frac{H}{p}\right)L_i\right] > 0\,.$$

A free gift of bonds in an economy with fixed wages increases employment. Subtracting this (after multiplication by i) from the employment effect of transfer money, we obtain the employment effect of open market operations:

$$\frac{dE}{dM}\,(dB = -\,idM) = \frac{1}{\Delta}\,\frac{1}{p}\left\{q_{KK}\,\frac{w}{p^2}\left[K_r\left(B_i + \frac{B}{i2p}\right) - K_i\,B_r + K_r\,L_i - K_i\,L_r\right]\right.$$
$$\left. -\left(\frac{w}{p^2} - q_{KE}\,K_H\,\frac{H}{p}\right)\left[\left(B_i + \frac{B}{i2p}\right) + L_i\right]\right\}$$

The sign of this expression is ambiguous, depending on the size of the terms involving cross partial derivatives relative to those involving direct effects only. More information about the coefficients than was contained in our assumptions is necessary to make sure that open market operations have the "normal" effects on employment. If by monetary policy we mean open market operations, we do not need "liquidity traps" and the like to make it look ineffective as a means to stimulate employment. We do not have to be Keynesians to follow Keynes in doubting the effectiveness of monetary policy.

For interest rates, on the other hand, the effects of open market operations are clear: Transfer bonds raise both rates. Debt money thus lowers both rates even more than transfer money. It is interesting to note that the effect of open market operations on interest rates is not a reliable indicator of its employment effect; lower interest rates may conceivably be accompanied by lower employment.

The price effect of open market operations is equally clear. For the same reason that transfer money, with rigid wages, lowers prices, transfer bonds make them rise: The rise in interest rates calls forth a lower capital intensity of production, thus lowering the marginal product of labor and raising prices. With open market operations, the reduction in bonds thus reinforces the price decline due to the increase in the money supply. With fixed wages, there is indeed little hope that restrictive open market operations will result in lower prices once full equilibrium is reached again.

The time preference version provides a radical simplification of the picture. With vanishing cross effects in the demand functions, the matrix of coefficients looks as follows

dE	dR	di	dp
0	x	0	x
0	x	0	x
x	0	x	0
x	0	0	0

where x denotes a non-zero entry. It can easily be checked that transfer bonds now have no effects on E, r, and p[17]. It follows that with respect to employment, capital returns, and the price level, the monetarist position is validated: It makes no difference whether money is created through transfers or by open market operations. The only difference is for bond yields, where the effect of open market operations remains stronger than that of transfer money. However, in the time preference view of the world the bond market is a side show with no significance for the real variables.

(c) *Expenditure Money*

We finally consider the effects of money issued to pay for public expenditures. We remember that we can regard it as transfer money combined with an increase in expenditures balanced by taxes. For the balanced-budget effect on employment with fixed wages, the picture is very similar to that for prices under full employment. The crucial expression is Δ_{EG}, which is obtained by replacing the column of coefficients for dE by that for dG. It is clear that the signs of K_G, B_G and L_G again play a decisive role. If they are all positive, a balanced-budget increase, with the usual assumptions about coefficients, is sure to reduce employment. If they are all negative, employment will expand. Negative signs of L_G and B_G mean that an increase in employment is necessary to compensate for the fall in the demand for money and bonds caused by government expenditures. For capital goods, a negative sign means that less capital will be available to producers, who will thus employ more labor. It follows that the expansive effect of expenditure money on employment may be either stronger or weaker than that of transfer money with hardly a definite presumption one way or the other. Under the time preference version, K_G and B_G drop out of the solution, being associated with cross partial derivatives of

[17] For the effect of B on E, the third entry in the first column becomes x, while the rest of the column consists of zeros. In the case of r, the same is true for the second, and in the case of p, for the fourth column. In each case, the determinant is zero.

the demand function. L_G remains as the only relevant expenditure coefficient. The monetarist proposition that, with fixed wages, the effect of money on employment is the same no matter how it is created, is thus shown to flow logically from the double proposition that (1) the time preference version is valid, and (2) balanced government expenditures have no effect on the demand for real cash balances.

V. Concluding Remarks

In summary, it has been shown that the macroeconomic effects of monetary policy, once we wait for the reestablishment of stock/flow equilibrium, may be quite different from what we are used to expect. In general, without special assumptions about time preference, there is little support for the monetarist view that the money supply is practically all that matters; indeed it seems to matter considerably how a change in the money supply is brought about. With full employment, if there is a government debt, new money used to increase transfers or to lower taxes will raise prices, lower bond yields and stimulate capital formation and output. In the absence of government bonds, of course, the quantity theory applies. Money created through expansionary open market operations affects bond yields, capital formation and output in the same direction as transfer money, but more so. Its effect on the price level, however, is weaker, and we cannot logically exclude the possibility that prices may actually fall. This implies that a restrictive open market policy, though resulting in higher interest rates, may have disappointing price effects. If the new money is used to pay for government expenditures, the effects are again different from transfer money, but the direction of the difference depends on whether the expenditures stimulate or discourage the private demand for assets. This implies that the macroeconomic effect of a balanced-budget change is theoretically ambiguous; with full stock adjustment the Keynesian balanced-budget multiplier cannot be relied upon.

Applying the general model to underemployment with rigid wages, we will not be surprised to find that transfer money increases employment and lowers the yields on bonds and capital goods, but we also find that the price level will rather fall than rise. Conversely, as long as wages are indeed rigid, which may not be for long, a contractive monetary policy will fail to have deflationary results. With unemployment and rigid wages, transfer money tends to produce either the best or the worst of both worlds. Expansionary open market operations would have the expected effects on asset yields, but their effect on employment is nevertheless uncertain; lower interest rates may well be associated with lower employment. At the same time, prices would fall even more than with transfer money. In the case of expenditure money, the difference relative to transfer money again depends on the reaction of private asset demand to government activity[18].

Once we suppose that interest rates are anchored (though not equal) to the rate of time preference, things are remarkably simplified. Under full employment, the quantity theory is valid for transfer money even in the presence of government bonds, and the effects on real capital, output and the return on real capital (though not those on the bond yield) disappear. Open market operations now have the same effects as transfer money. The money supply is all that counts; it does not matter how it is brought about. For expenditure money the time preference assumption does nothing to remove the ambiguity. However, the monetarist position is restored once we assume that government activity has little effect on private asset demand. For unemployment with rigid wages, the time preference assumption leads to the conclusion that employment, the capital stock and output all expand in proportion to the money supply. The quantity theory of prices becomes a quantity theory of output. Bond yields, it is true, still fall, but there is no "transmission mechanism" leading from bond yields to output. Except with respect to bond yields, which now do not matter much anyhow, these conclusions are exactly the same for transfer money and for open market operations. Again the money supply is all that matters. If the new money is used to finance expenditure, a possible difference can only occur in the rather improbable case that government activity has a large effect on the demand for money even at constant wealth and rates of return. Monetarists have never, to my knowledge, based their propositions on specific assumptions about time preference, the effect of government expenditures on private asset demand, and full stock/flow equilibrium. It seems remarkable, however, that these assumptions yield a consistent body of monetarist conclusions. Is this, after all, what monetarism is about?

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[18] It is interesting to compare these conclusions with the estimates obtained by *Carl Christ* (1973) from an econometric model for the United States with a similar government budget constraint for the period 1891 - 1970. These estimates can be used to compare the effect of an increase in the money supply on nominal national income (but not on real income and the price level separately), depending on whether the money is used to pay transfers (or lower taxes), to pay for government expenditures, or for open market operations. Inasmuch as expenditure money consistently shows a stronger effect than transfer money (implying a positive balanced-budget multiplier), the monetarist view is contradicted. On the other hand, the estimated coefficients of changes in the public debt turn out to be much smaller than those for transfer money and mostly not significant, thus supporting another part of the monetarist approach.

Summary

The effects of monetary policy on prices, output, employment and interest rates are examined under the assumption of full stock/flow equilibrium. Section 1 defines three types of monetary policy in the context of a government budget constraint, depending on whether the money is issued through transfers or tax reductions, through open market operations, or to pay for government expenditures. In section 2, the government budget constraint is incorporated in a general equilibrium model of a growing economy. The distinctive feature of his model is the assumption of full stock/flow equilibrium, which sets it off from the familiar IS/LM-curve models in the *Hicks/ Patinkin/ Tobin* tradition. Special attention is paid to the case where asset yields are dominated by time preference; this is called the time preference version of the model. Section 3 determines the comparative-static effects of each of the three monetary policies on output, the price level and the rates of return on bonds and capital goods under full employment. Section 4 presents the corresponding analysis for unemployment with rigid wages. It is found that the macroeconomic effects of increases in the money supply are generally different depending on how the new money is created. Some of the effects are also quite different from what one is used to expect on the basis of the familiar disequilibrium models. In particular, the efficacy of open-market operations as stabilization tools appears in doubt. In the time preference version, however, most of the monetarist propositions are validated. What matters, then, is only the amount of new money and not the way it is created. Monetarism offers a simplified view of the macroeconomic system; whether the simplification is justified seems to depend largely on the role of time preference.

Zusammenfassung

Der Aufsatz untersucht die Wirkungen der Geldpolitik auf Produktion, Preisniveau, Beschäftigung und Zinssätze unter der Voraussetzung vollständigen Gleichgewichts von Güterströmen und Güterbeständen. Je nachdem, ob neues Geld durch Transferleistungen und Steuersenkungen, durch Offenmarktoperationen oder zur Finanzierung von Staatsausgaben geschaffen wird, werden im ersten Abschnitt, auf dem Hintergrund der staatlichen Budgetrestriktion, drei Arten der Geldpolitik unterschieden. Im zweiten Abschnitt wird die staatliche Budgetrestriktion in ein makroökonomisches Gleichgewichtsmodell einer wachsenden Wirtschaft eingebaut. Von den Modellen mit den wohlbekannten IS/LM-Kurven in der Tradition von *Hicks, Patinkin* und *Tobin* unterscheidet sich dieses Wachstumsmodell vor allem durch die Voraussetzung vollen Bestandsgleichgewichts. Der Möglichkeit, daß die Vermögensakkumulation letzten Endes durch die Zeitpräferenz beherrscht ist, wird besondere Aufmerksamkeit geschenkt. Der dritte Abschnitt gilt der Bestimmung der komparativ-statischen Wirkungen der Geldpolitik auf Produktion, Preisniveau und Zinssätze unter Vollbeschäftigung je nach der Technik der Geldvermehrung. Daran schließt sich im vierten Abschnitt die entsprechende Untersuchung für den Fall der Unterbeschäftigung mit starren Löhnen. Es zeigt sich, daß die makroökonomischen Wirkungen der Geldpolitik im allgemeinen verschieden sind, je nachdem wie das Geld geschaffen wird. Einige dieser Wirkungen erweisen sich auch als recht verschieden von den herkömmlichen, aus Ungleichgewichtsmodellen abgeleiteten Erwartungen. Insbesondere erscheint die Wirksamkeit der Offenmarktpolitik

als Stabilisierungsinstrument in Frage gestellt. Falls jedoch die Zinssätze von der Zeitpräferenz beherrscht werden, entspricht das Bild in allen wesentlichen Zügen den monetaristischen Postulaten. Worauf es ankommt, ist dann einzig das Maß der Geldschöpfung und nicht ihre Technik. Der Monetarismus bietet ein vereinfachtes Bild des makroökonomischen Systems an; ob sich die Vereinfachung rechtfertigt, scheint wesentlich von der Rolle der Zeitpräferenz abzuhängen.

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