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A Portfolio Balance Model of the Open Economy*

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I. Introduction

This paper develops a framework in which to investigate the effects of macroeconomic policies. The key building blocks are those of Metzler (1968, 1973) in the form of a wealth saving relation and the emphasis on portfolio considerations; the model in its dynamic aspects is extended in a manner suggested in the work of *Foley/Sidrauski* (1971) and *Mussa* (1973), where the asset accumulation implied by short-run equilibrium is pursued over time.

A large body of literature on the implications of asset mobility for macroeconomic policy has been accumulated during the last decade. Following the work of *Mundeli* (1968) on capital mobility and the policy mix, that literature has primarily taken a perspective of stabilization policy and therefore espoused a short-run view of the economy in describing it in terms of the IS-LM model – more or less appropriately modified – to accommodate the openness of the economy and the mobility of assets.[1] Alternative routes with a longer time perspective, though still maintaining the assumption of a perfectly elastic supply of output at current prices, have been offered by *McKinnon* (1969), *Tower* (1972) and *Branson* (1972).

The approach taken here assumes flexibility of relative prices, full employment and continuous market clearing, thereby assuming away a host of interesting short-run problems and substituting a set of issues that center on the time path of the economy, the endogeneity of asset supplies and the long-run effects of policies.[2]

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This is a revised version of a paper presented at the 4th Seminar on Monetary Theory and Policy, Konstanz, Germany, June 1973. In preparing this paper 1 had the benefit of extensive suggestions from Michael Mussa, whose approach has helped me formulate some of the issues discussed here. I wish to acknowledge, too, the suggestions for revision I have received from Jacob Frenkel.

[1] For a recent survey, see *von Neumann-Whitman* (1970). Earlier literature includes Jones (1968), *McKinnon/Oates* (1966), *Roper* (1969) and *Swoboda* (1972).

[2] For work along these lines, see for example *Allen* (1972), *Boyer* (1971), *Frenkel* (1970), *Lee* (1972) and *Mussa* (1971).

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In sections 2 and 3 of this paper the basic model and its equilibrium properties are developed. Section 4 considers three applications of the model, and in section 5 some observations on possible extensions and limitations of the model are offered.

II. The Model

The home country produces two commodities, consumption goods and investment goods, and technology is described by the standard neoclassical two-sector model with capital goods labor-intensive.[3] The labor force is assumed constant and capital depreciates at a constant exponential rate. With this specification the flow (supply) of physical net investment, $\dot{K}$, is a function of the relative price of capital in terms of consumption goods, q, and the stock of real capital, K. Furthermore, by the Stolper-Samuelson theorem the relative price of capital is inversely related to the yield on real capital, r, so that we can write the rate of investment as a function of the yield on capital and the stock of capital,[4]

$$\dot{K} = \dot{K}(r, K), \qquad \dot{K}_r < 0; \quad \dot{K}_K < 0. \tag{1}$$

To each rate of interest there exists a corresponding stock of capital, $\bar{K}$, such that net investment is zero ($\dot{K} = 0$),

$$\bar{K} = \bar{K}(r), \quad \bar{K}_r < 0. \tag{2}$$

The value of investment, I, and the capital stock, k, measured in terms of consumption goods is defined in (3) and (4),

$$I \equiv q\dot{K} = I_r < 0; I_K < 0, \tag{3}$$

$$k \equiv qK = k(r, K), \quad k_r < 0; \; k_K < 0, \tag{4}$$

and substituting (2) in (3) defines the steady state value of the capital stock, $\bar{k}$, as a reduced form function of the yield on real capital.[5]

$$\bar{k} = \bar{k}(r), \quad \bar{k}_r < 0. \tag{5}$$

[3] The structure of the two-sector model is readily available in various places and hence is dealt with briefly here. See, for example, *Foley/Sidrauski* (1971).

[4] We assume that capital accumulation is exclusively financed by the issue of equity – one share per unit of physical capital.

[5] Throughout this paper a bar over a variable denotes its steady state value.

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On the demand side we will assume a saving function of the stock adjustment variety according to which the planned level of saving is proportional to the excess of desired (target) wealth, $\overline{w}$ over actual wealth, w, both measured in terms of consumption goods,[6]

$$S = \phi\,(\overline{w} - w), \tag{6}$$

where the desired level of wealth in turn is a function of the yield on real capital r, and the yield on debt, I,

$$\overline{w} = \overline{w}(r,i), \quad \overline{w}_r > 0; \ \ \overline{w}_i > 0. \tag{7}$$

We assume that there are three assets: money, real capital or equity and debt. Accordingly actual wealth is defined as the sum of real balances, m, real capital holdings, k, and real debt holdings, b, all measured in terms of consumption goods,

$$w = m + b + k. \tag{8}$$

Asset preferences of the private sector are characterized by eqs. (9) to (11) which state that the demands for the three assets are proportional to actual wealth and where the shares, by the budget constraint on asset holdings, add up to unity,[7]

$$m^d = \alpha(r,i)w, \tag{9}$$

$$b^d = \gamma(r,i)w, \tag{10}$$

$$k^d = \beta(r,i)w. \tag{11}$$

We assume that debt is short-term and indexed in terms of consumption goods, so that the capital value is essentially independent of the interest rate and the real value is independent of the price level.[8] For subsequent references it will be useful to define the sum of real money and debt holdings, v, hereafter referred to as 'financial assets',

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[6] This type of saving behavior was assumed in Metzler's classical article, see *Metzler* (1973), and subsequently in *Jones* (1969). The particular functional form of (6) would be implied by a savings function that is linear in asset yields and wealth.

[7] The appropriate formulation of asset demand functions is clearly developed in *Metzler* (1973), See, too, *Friedman* (1969), *Tobin* (1969), *Mussa* (1973), and *Foley/Sidrauski* (1971).

[8] Bond holdings as specified by (10) may be negative for high values of r and low values of i, though we proceed in the text on the assumption that they are positive. Eq. (10) may be viewed as the private sector's excess demand for debt.

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$$v \equiv m + b. \tag{12}$$

The government spends at the rate G on consumption goods and levies an amount T lump-sum taxes. The budget is balanced so that

$$T = G + iB, \tag{13}$$

where B is the stock of government debt outstanding.

Finally, we recall from the definitions of the balance of payments accounts that the current account surplus equals the excess of saving over investment. The trade balance surplus equals the current account surplus less interest earnings on the excess of private debt holdings over domestic debt issue, [9]

$$(S - I) - i(b - B). \tag{14}$$

For the main part of this paper we will assume that the home country is 'small' in the sense that it can buy and sell consumption goods at a fixed foreign currency price and that it can borrow or lend in the form of debt at a fixed interest rate, i^*. An important additional assumption is that neither physical capital nor claims to income from physical capital (equity) are internationally tradeable; physical capital and the claims to the income they generate are treated as non-traded goods and accordingly their relative price, q, and the rate of return on physical capital, r, remain endogenously determined.[10]

Lastly, we assume that the home country is on fixed exchange rates, so that the domestic currency price of consumption goods is given and in the absence of domestic credit creation the balance of payments equals the rate of change of the domestic nominal quantity of money.

[9] The definition of income anticipates our subsequent assumption that claims to income from capital are non-tradeable. The assumption that taxes are lump-sum is required in order to leave realized asset yields and hence portfolio composition independent of income taxes.

[10] If physical capital were tradeable, an investment function would not be defined nor would the stock of capital located in the home country be determinate in the non-specialized region. If claims on capital were tradeable, but machines remain non-tradeable, both the stock of capital and wealth would adjust according to a stock adjustment process defined by (2) and (8). See *Dornbusch* (1971b) and *Frenkel/Fischer* (1972).

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III. Equilibrium

In this section we discuss the equilibrium of the system. The first sub-section describes the short-run equilibrium, the second investigates the dynamics of the system, while in the third sub-section the properties of long-run equilibrium are studied.

1. Short-run Equilibrium

At any point in time the physical stock of capital and the value of 'financial assets', v, are given by past accumulation; the public can vary the composition of v at the given interest rate on debt, i^*, in order to attain the desired portfolio composition in terms of money and bonds but it cannot affect the total.

The stock constraint relevant to asset choices implies that the excess demand for equity is equal to the excess supply of assets other than equity. Furthermore, since claims to income from capital are not internationally tradeable the market for equity will only be in equilibrium when the yield on capital, or the relative price of capital, is such that the existing stock is willingly held.[11]

This equilibrium condition is stated as

$$k(r, K^0) = \beta(r, i)[v^0 + k(r, K^0)], \tag{15}$$

and is shown in fig. lb as the market equilibrium schedule *kk*.[12] The schedule is negatively sloped since, given the physical stock of capital, an increase in the yield on capital creates an excess demand for equities and hence requires a reduction in the non-equity component of wealth to reduce demand and maintain market equilibrium. Given the initial level of real balances and real debt, v^0, the equilibrium yield on capital is $\tilde{r}$. At that yield wealth and the desired composition of assets are such that the existing stock of capital is willingly held. To that equilibrium yield on capital corresponds an equilibrium composition of the financial components of wealth, money and debt; given the fixed interest rate on debt in the world market and the fixed exchange rate that equilibrium composition can be instantaneously attained by trading money for debt in the world market.

At the level of flows the equilibrium yield on capital and the implied value of real wealth determine the rate of saving, $\tilde{S}$, while the yield on capital together

[11] Throughout this paper it will be assumed that equilibrium exists, is unique and occurs in the non-specialized region.

[12] Fig. 1 will be recognized as essentially Metzler's representation of short-run equilibrium in the open economy. See *Metzler* (1968, 1973).

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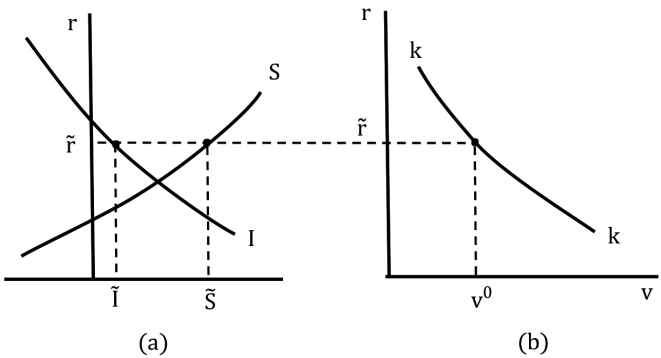

Figure 1

with the current stock of physical capital determine the rate of net investment, $\tilde{I}$.

Saving and investment schedules are shown in fig. 1a. The saving schedule is drawn for a given stock of financial assets, v^0, and a given physical stock of capital; it is drawn as an increasing function of the yield on capital since an increase in that rate lowers the value of the stock of capital and hence actual real wealth while at the same time raising desired wealth so that by (6) saving increases.

The investment function is drawn for a given physical stock of capital; it is drawn as a decreasing function of the yield on capital since an increase in that rate lowers the relative price of capital and hence reduces the flow supply.

The short-run equilibrium shown in fig. 1 implies accumulation of physical capital since net investment is positive, and at the same time accumulation of financial assets, money and debt, since saving exceeds investment and accordingly the current account is in surplus.

2. Dynamics

The additions to the stock of physical capital and the stock of financial assets, implied by the short-run equilibrium described in fig. 1, will over time affect the equilibrium position of the economy. The manner in which the system moves over time is defined by the equilibrium rates of physical capital formation, investment and saving.

To determine that path we solve (15) for the equilibrium yield on capital, $\tilde{r}$, as a function of the physical stock of capital and financial assets,

$$\tilde{r} = \tilde{r}(v, K). \tag{16}$$

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This yield in turn can be substituted in (1) to obtain a reduced form expression for the equilibrium rate of capital formation,

$$\dot{K} = \dot{K}(\tilde{r}, K) \equiv \sigma(K, v). \tag{17}$$

The *equilibrium* rate of investment, by (3), is

$$I = I(\tilde{r}, K) \equiv \tilde{I}(v, K), \tag{18}$$

and the equilibrium rate of saving, using (6), (7) and (8), is equal to

$$S = \varphi[\overline{w}(\tilde{r}, i) - v - k(\tilde{r}, K) \equiv \tilde{S}(v, K). \tag{19}$$

From the definition of the balance of payments accounts the equilibrium rate of increase in financial assets, $\dot{v}$ is equal to the excess of saving over investment or the current account surplus,

$$\dot{v} = \tilde{S}(v, K) - \tilde{I}(v, K) \equiv \pi(v, K). \tag{20}$$

It will be recalled that short-run equilibrium was defined by the existing stock of physical capital and the stock of financial assets; correspondingly the reduced forms for their equilibrium rates of increase stated in (17) and (20) describe the behavior of the system over time.

To understand the dynamics of the system it is convenient to consider the effects of discrete changes in the stock of physical capital and the stock of financial assets on the equilibrium rates of change of capital and financial assets. Consider first an increase in financial assets. In terms of fig. 1 this corresponds to a movement along the *kk* schedule in panel (b) and an upward shift of the saving schedule in panel (a). It follows that the equilibrium interest rate unambiguously falls; the equilibrium rate of saving decreases since actual wealth increases while desired wealth declines. The equilibrium rate of capital accumulation, both in physical and value terms, increase. Accordingly we have

$$\pi_v < 0; \qquad \sigma_v > 0. \tag{21}$$

An increase in the physical stock of capital is slightly more complicated to handle. In fig. 1a the *kk* schedule shifts upward since the increase in the physical stock of capital at the initial yield on capital and stock of financial assets creates an excess supply for equity, and accordingly the yield on capital has to increase in order to induce the public to hold a larger stock of capital. In fig. lb the investment schedule shifts to the left due to the Jones-Rybczynski effect, while the wealth effect on saving shifts the saving schedule to the left. Corresponding to the higher interest rate and capital stock there is an unambiguously lower rate of

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capital accumulation. The effect on the accumulation of financial assets is ambiguous since we have both a movement along and a shift of the saving schedule so that the equilibrium rate of saving may rise or fall. Accordingly,

$$\sigma_K < 0; \qquad \pi_K \gtrless 0. \tag{22}$$

For the local stability of long-run equilibrium we require that the following restrictions on the linearized system obtain

$$\sigma_K + \pi_v < 0 \quad \text{and} \quad \sigma_K \, \pi_v - \sigma_v \, \pi_K > 0. \tag{23}$$

The phase diagram for a stable configuration of the system of equations defined by (17) and (20) is shown in fig. 2. Steady state equilibrium will obtain at a stock of financial assets $\bar{v}$ and a stock of physical capital $\bar{K}$. The approach to equilibrium for the case shown in fig. 2 will be asymptotic.

3. *Long-run Equilibrium*

In this section we develop a description of the properties of long-run equilibrium in terms of the composition of assets and the structure of the balance of payments. Given that there is no exogeneous element of growth such as productivity change or population growth in this model, all the private sector stock and flow variables are constant in the steady state; in particular the private sector is in balance of payments equilibrium and net additions to the stock of capital, money and debt holdings are zero.

Furthermore the current account surplus will be zero so that the trade balance deficit is financed by the net interest earnings on the excess of private sector holdings of debt over public debt issue,

$$i[\gamma(\bar{r}, i)\bar{w}(\bar{r}) - B],$$

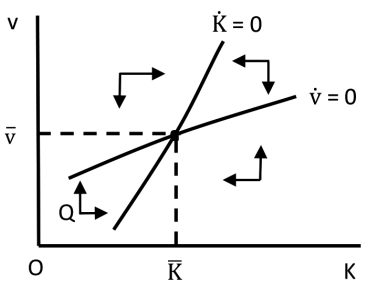

Figure 2

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where $\bar{r}$ is the steady state yield on capital. To the extent that the steady state yield on capital may be sufficiently high for domestic residents to be net issuers of debt the service account may be in deficit for any given issue of government debt. Next we observe that there is no reason to constrain the government to be a net debtor; in particular if tile government chose to take the counterpart of the private sector's position the service account would be zero and so would be the trade balance.

The long-run equilibrium is shown in fig. 3. In the steady state actual equals desired assets and the market for equities clears. The downward sloping schedule, $\bar{k}(r)$, shows the steady state value of the capital stock – combinations of physical capital and interest rates such that net investment is zero. The schedule $\bar{w}(r, i)$ shows desired wealth such that saving is zero and the schedule $\beta\bar{w}$ shows the part of assets the public desires to hold in the form of equities. Long-run equilibrium obtains at an interest rate $\bar{r}$ where saving is zero and the demand for equities equals the steady state supply of equities. Fig. 3 shows, too, the composition of wealth between equities and other assets; the case shown is one where steady state wealth exceeds the value of the capital stock so that net holdings of the remaining assets are positive and equal to

$$\bar{v} \equiv \bar{w}(\bar{r}) - \bar{k}(\bar{r}).$$

The distribution of $\bar{v}$ between money and debt, given the interest rate on debt, is determined by the equilibrium yield on capital.

The strong assumptions about the formal structure of the model are clearly reflected in fig. 3. Technology together with the capital intensity assumption account for a negatively sloped long-run supply of capital, while the target wealth assumption makes the long-run equilibrium independent of disposable income and hence taxation. The assumption of capital mobility for debt makes the long-run equilibrium independent of the issue of public debt while the fixed exchange rate determines the price level exogenously.

IV. Some Implications of the Model

In this section we develop some of the properties of the model by enquiring into the time path of variables under the influence of specific government policies. Preceding that analysis it may be useful to enquire into the behavior of the system in the absence of any specific intervention other than the pegging of exchange rates. Under this assumption, as the discussion in section 3 above reveals, the time path of wealth, its composition and the balance of payments will depend both on the initial condition and on whether adjustment is asymptotic or cyclical. A particular path of adjustment that may be associated with the

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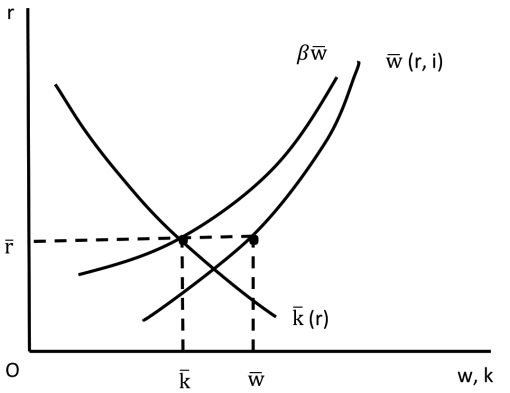

Figure 3

'monetary approach' to the balance of payments in its more extreme variant can be seen in fig. 2 for an initial stock of real capital and financial assets below their steady state level, a point *Q*. Adjustment would proceed via the accumulation of physical capital and financial assets with a falling rate of interest. To the extent that the government fails to monetize and capitalize the growth process, the adjustment implies a balance of payments surplus and a capital account deficit as the community over time increases its stock of real balances and holdings of debt.[13]

More generally, the balance of payments will be in surplus if the planned rate of addition to cash balances by the private sector exceeds the rate of domestic credit creation and the capital account will be in deficit if the rate of public debt issue falls short of the planned rate of addition to debt holdings by the private sector.

In the remainder of this part we will study the impact and long-run effects of particular government policies. The *impact* effect is defined as the effect of a policy as of a given physical stock of capital and stock of financial assets, while the *long-run* effects allow both of these quantities to come to their stationary levels.[14] We will begin with a discussion of open market operations, discuss next the effects of a devaluation and consider last the effects of taxation.

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[13] On growth and the balance of payments see *Mundell* (1965, 1971), *Komiya* (1969), *Frenkel* (19711), *Buyer* (1971), *Purvis* (1972), *Johnson* (1972), *Dornbusch* (1971a), *Mussa* (1971b) and *Allen* (1972).

[14] This particular conceptualization of the effects of a policy on the time path of variables is extensively employed in *Mussa* (1973), and is an effective substitute for the study of the entire path of variables.

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4.1. Open Market Operations

We may consider two alternative ways in which the government can conduct open market operations, purchases of debt and equity, respectively. Consider first the case where the government purchases debt and sells money. Given the assumption that the exchange rate is fixed and the home country can borrow and lend in the form of debt in the world market at a given interest rate, such a policy will have no effect whatsoever on the private sector. Indeed, the private sector will instantaneously resell its increased debt holdings in the world market, and the central bank will incur an equivalent loss of foreign exchange reserves. This is an extreme form of the endogeneity of the domestic quantity of money that has been strongly emphasized in the work of *Mundell* (1968, 1971). The only long-run effect of this policy is that the central bank has substituted interest earning assets fair reserves in its portfolio.

The previous example suggests that the absence of repercussion effects of monetary policy on the private sector relies strongly on the assumption that the government intervenes in the market for internationally tradeable assets – money and debt – and that these assets are in perfectly elastic supply in the world market under fixed exchange rates and perfect capital (debt) mobility. These extreme results will not obtain when one of the assets is not internationally tradeable.

Consider now the case where the government purchases real capital (equity) with domestic money. Since claims to real capital are not internationally tradeable the private sector cannot reverse the operation by recourse to the world market and accordingly we expect real effects on the private sector equilibrium from this operation. The impact effect of this open market operation is to create an excess demand for equities and an excess supply of financial assets at the initial yield on capital thereby causing the relative price of capital to rise and its yield to decline. Associated with that lower yield on capital we have a decline in the rate of saving and an increase in the rate of investment, and thus a current account deficit. These short-run real elects depend crucially on two assumptions: that equity is not tradeable and that it is an imperfect substitute in portfolios for money and/or debt.

The long-run effects of this open market operation are shown in fig. 4. They derive from the fact that the steady state supply of equity to the private sector is reduced at each level of the yield on capital by the government's holdings of equity, thereby shifting the schedule $\overline{k}(r)$ to the left to $\overline{k'}(r)$. Neither the desired stock of wealth, $\overline{w}(r)$, nor the long-run demand for equity, $\beta\overline{w}(r)$, are affected by the policy change. The new long-run equilibrium implies a lower equilibrium yield on capital, $\overline{r}'$, and corresponding to that lower yield a higher stock of real capital, $\overline{k^n}$. The private sector's equilibrium level of wealth declines and so does the privately held stock of equity.

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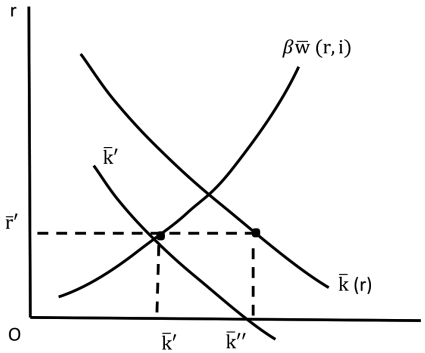

Figure 4

While the *share* of financial assets in wealth increases, net holdings of financial assets may decline. To derive definite results about the change in financial assets and the composition of further restrictions on the demand functions in (9)–(11). In particular, we might assume that a decline in the steady state rate of interest implies an increase in financial asset holdings and that the composition of financial assets between money and debt is independent of the yield on capital. Under these circumstances the open market purchase of capital would lead in the steady state to increased holdings of financial assets, a cumulative foreign exchange reserve gain on the part of the central bank and an increased net creditor position on the part of the private sector and, correspondingly, an increased trade alarm deficit in the steady state.

So far we have not discussed the manner in which the government disposes of the income on the portion of the capital stock. One manner of disposition is to rebate the proceeds via transfers to the public. Alternatively the government might spend them directly or reduce taxes without affecting the aggregate results. If instead the government used the proceeds to reduce the public debt or the nominal quantity of money, private sector equilibrium would continue to be described by fig. 4 while the balance of payments accounts would acknowledge the government's activities; absorption inclusive of the government would fall short of aggregate disposable income thereby financing debt or reserve acquisition by the government.

2. The Effects of a Devaluation

In this section we investigate the time path of the system following an unanticipated currency depreciation. The effect of a devaluation on the part of the home country is to reduce the real value of the domestic nominal quantity of money, and thus the real value of financial assets and wealth at the initial level of the

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yield on capital. The decline in the real value of money causes an excess demand for real balances and an excess supply of debt and equity. Domestic residents will instantaneously sell off (issue) debt to recover part of their real money holdings while at the same time attempting to sell off equity. Since in the aggregate the physical stock of capital has to be held, the aggregate attempt to sell off equity will cause their relative price to decline and their yield to increase to the point where the community is willing to hold the existing stock of capital, and accordingly the excess demand for financial assets and in particular money is zero.

Corresponding to this higher yield on real capital and the lower real value of wealth there is a higher rate of saving and a lower rate of investment or a decline in absorption and an improvement in the current account. It follows that the impact effect of a devaluation is to cause both an instantaneous balance of payments surplus due to the exchange of debt for money as well as an equilibrium rate of accumulation of financial assets at a rate equal to the excess of saving over investment.[15]

The time path of financial assets and the physical stock of capital can be seen in fig. 5 on the assumption that adjustment is asymptotic.[16] The devaluation lowers instantaneously the real value of financial assets from their initial steady state level to point Q. At point Q the current account is in surplus so that net accumulation of financial assets takes place while negative levels of net investment, due to the increase in the interest rate, cause the physical stock of capital to decline. Over time the accumulation of financial assets causes interest rates to start falling back toward their initial level thereby causing the disinvestment process in physical capital to be reversed. At the same time the community starts recovering their initial level of wealth which, together with the declining interest rates, causes saving to decline over time, thereby lowering the rate at which financial assets are acquired. The adjustment path is asymptotic in the sense that financial assets, after their initial decline, keep increasing without overshooting, while the physical stock of capital initially declines in order then to recover its initial steady state level.

As in any homogeneous system a devaluation will have only transitory real effects and will not influence in any manner the long-run real equilibrium of the system. Furthermore it operates exclusively via the effect of a reduction in the real value of money on equilibrium interest rates and wealth and thereby on portfolio composition and the desired levels of saving and investment.

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[15] A similar line of argument is developed in *Salop* (1973). In earlier work, *Dornbusch* (1973), I have found it useful to analyze the effects of devaluation in a world where money is the only marketable asset and where a devaluation operates via a direct effect of the reduction in the real value of money on absorption. I owe the emphasis on the asset market effects of a devaluation to *Mussa* (1971a,b).

[16] See above, section 3.2.

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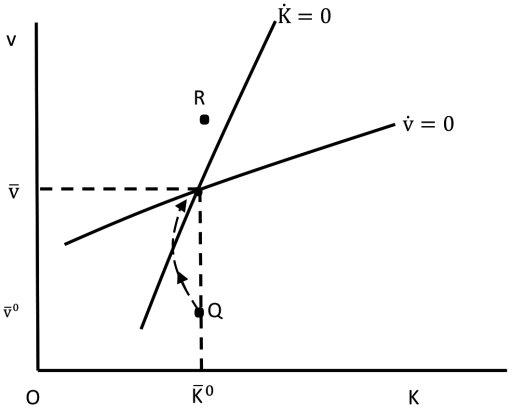

Figure 5

So far we have considered a devaluation from an initial position of long-run equilibrium, an unlikely position for circumstances giving rise to a devaluation.

Consider alternatively an initial position of short-run equilibrium at point *R* in fig. 5. Here we have a balance of payments deficit and net decumulation of assets together with accumulation of capital. An appropriately chosen rate of devaluation can bring the system instantaneously back to full equilibrium rather than pursue the path of disequilibrium and a cycle in the stock of capital.

3. Taxation

In this section we investigate the effects of a particular form of taxation on the equilibrium position of the system. The analysis is confined to a tax on lending abroad. The purpose of the analysis is to highlight the fact that taxation affects asset choices and thereby the equilibrium position of the economy as well as the balance of payments and its composition.

Consider now a tax on lending and borrowing in the world market. The tax introduces a spread between domestic borrowing and lending rates and the world interest rate on debt. Assuming that after the imposition of the tax the home country remains a net creditor, the tax will reduce the realized return on debt holdings and thereby induce a shift in portfolios from debt to money and equity.[17]

[17] The assumption that the home country remains a net lender, or for that purpose a net borrower, is required to maintain a relationship with the world interest rate since the possibility of a segmentation of the capital market arises from the spread between the re-

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The impact effect of the policy is to cause a shift in portfolios from debt to money and equities. The shift toward equities creates an excess demand that will cause their yield to decline while the shift out of debt into money generates an instantaneous jump in the central bank's holdings of foreign exchange.

The tax policy causes, too, a current account deficit since it raises investment by lowering the yield on capital while reducing the rate of saving in response to the decline in asset yields and the increase in actual real wealth.

The long-run effects of the policy change are ambiguous; the decline in the yield on debt would, other things equal, raise the share of money and equity in wealth and lower that of debt holdings. The long-run yield on capital, however, is endogenous and may reverse these conclusions. To derive a definite set of results we may impose further structure on the long-run asset demand functions,

$$\bar{m}^d \equiv \alpha(r,i)\bar{w}(r,i) = \bar{m}^d(r,i), \qquad \bar{m}^d_r < 0; \qquad \bar{m}^d_i < 0, \tag{23}$$

$$\bar{b}^d \equiv \gamma(r,i)\bar{w}(r,i) = \bar{b}^d(r,i), \qquad \bar{b}^d_r < 0; \qquad \bar{b}^d_i < 0, \tag{24}$$

$$\bar{k}^d \equiv \beta(r,i)\bar{w}(r,i) = \bar{k}^d(r,i), \qquad \bar{k}^d_r < 0; \qquad \bar{k}^d_i < 0. \tag{25}$$

With this additional structure the decline in the return on debt increases the long-run demand for equity at each level of the yield on capital, and hence raises the equilibrium long-run stock of capital and value of equity while lowering the equilibrium long-run level of wealth. The reduction in the yield on alternative assets lowers the opportunity cost of holding money and invites substitution toward money sufficiently so to increase long-run holdings of money despite the decline in wealth. The long-run holdings of debt, finally, decline in absolute terms.

The cumulative balance of payments effect of the policy is to generate a net increase in foreign exchange reserves on the part of the central bank, assuming no domestic credit creation, and a deterioration in the net creditor position together with an improvement in the long-run balance of trade.

V. Some Further Observations

In this part we propose to sketch the implications of alternative assumptions or extensions of the model as well as draw attention to the limitations of our approach.

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turn to lending road, $i^*(1-t)$, and the cost of borrowing abroad, $i^*(1+t)$, a spread that may be sufficient to leave the domestic capital market in autarchy.

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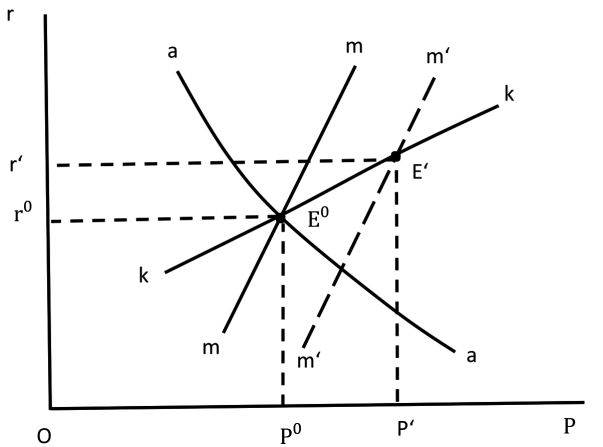

Figure 6

Consider first some possible extensions. We might wish to consider the case where neither debt nor capital is internationally mobile and enquire into the long-run effects of an open market sale of debt. The effects of such a policy, assuming the long-run gross substitutability of assets described in eqs. (23) to (25), is to raise the yield on both capital and debt and to reduce both the stock of capital and of real balances thus implying a cumulative balance of payments deficit.

An alternative set of questions would relate to the exchange rate regime, and we might wish to investigate the effects of policy changes under flexible exchange rate changes. To suggest an example consider the effects of an open market purchase of debt, under flexible exchange rates and perfect debt mobility as shown in fig. 6.

The schedule *mm* shows combinations of the domestic price level and the yield on real capital such that the given nominal quantity of money is willingly held. Similarly the *kk* schedule corresponds to equilibrium in the equity market. The *mm* schedule is positively sloped since an increase in the price level creates an excess demand for real balances and has to be accompanied by an increase in the opportunity cost of holding money in order to maintain monetary equilibrium. The *kk* schedule is positively sloped since an increase in the price level lowers real wealth and thus the demand for equities and hence calls for an increase in the yield on capital in order to induce the public to hold the existing stock. Along the schedule *aa* saving is equal to investment. The schedule is negatively sloped since an increase in the price level lowers real wealth and hence raises saving and therefore requires a decline in the yield on capital which reduces saving and raises investment thus restoring the equality of saving and investment or

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equivalently current account equilibrium. We note that three schedules are drawn for a given nominal quantity of money and a given stock of debt holdings.

At the initial long-run price level (exchange rate) and yield on capital at E^0 the exchange of assets leaves private wealth unchanged and creates an excess demand for debt and an equal excess supply of money; the equity market remains in equilibrium at E^0 and saving at that point remains equal to investment; the excess supply of money, however, shifts the money market equilibrium schedule from *mm* to *m'm'* since now a higher price level and/or lower yield on equity is required to induce the public to hold a larger nominal quantity of money. The short-run equilibrium condition in the flexible exchange rate model is that the market for both money and equity clear; perfect debt mobility notwithstanding the community cannot trade stocks of debt for stocks of money in the world market since money is no longer an internationally traded asset as it would be under fixed rates. The attempt by the private sector to sell money for debt in the world market causes the exchange rate and hence the price levels to increase, thereby reducing real wealth and causing an excess supply of equity which gives rise to a decline in the relative price of equity to the point where the community is satisfied to hold the existing stock of debt and physical capital as well as the nominal quantity of money. In fig. 6 this short-run asset market equilibrium obtains at point *E'*. Corresponding to the higher price level and yield on capital at *E'* we have a reduction in investment and an increase in saving and hence a current account surplus that serves to finance the acquisition of debt over time by the private sector in the world market.

The endogeneity of the private sector's holdings of debt in the long-run implies that an open market operation will have no long-run real effects and that the long-run price level will increase in the same proportion as the nominal quantity of money. Two points of this analysis are important to recognize. One is the crucial role the conditions of asset market equilibrium impose on the determination of exchange rate changes rather than the specification of an independent (and ad hoc) flow of capital function. The second aspect that is worth noting is the role played by the non-tradedness of capital and equity which implies that an open market operation has short-run real effects on the yield on capital.

Rather than pursue further applications of the model it is time now to reconsider some of the building blocks of the formulation offered here. The approach essentially amounts to assuming a convenient set of consistent reduced form behavioral equations and to explore the implications of those assumed properties. On the convenience side one would primarily point to the assumptions about technology and hence the investment function and the implied steady state equity supply function, $\overline{k}(r)$, the Metzleric saving function that defines steady state wealth, $\overline{w}(r,i)$, and the stock demand function for capital, βw, that jointly defines the steady state of the system, and thus close the time path of the model in

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an unambiguous manner. Convenience notwithstanding these assumptions impose an extraordinary amount of structure on the model and by implication on the propositions that can be derived from the model. Given their vital role in this respect it stands to reason that one might wish to establish these (reduced form) behavioral assumptions from more primitive considerations about intertemporal maximization by households and firms and the circumstances that give rise to the portfolio diversification implied by the asset demand functions. Strong assumptions are made in three further respects. One is the assumption that wage payments, transfers and taxes are not capitalizable and negotiable, and consequently changes in relative prices and the financing of government activities have effects that are implied specifically by that assumption. The next assumption, of import particularly with respect to the time path of the system, is that of static expectations, though this assumption may be somewhat less objectionable. Finally, the strong differentiation between equity and debt that is assumed in this model runs counter to the substantial evidence on institutional intermediation and again would require support in terms of more basic considerations of risk or borrowing constraints on intermediaries. Among the more rewarding features of this formulation one might wish to list the emphasis on the time path of variables under the influence of a policy rather than the impact effect. There is, too, the emphasis on the endogeneity of asset supplies with the obvious and possibly trivial implication that policy goals may be served in the short-run by varying the relative supplies of assets while in the long-run what has to be affected is the attractiveness of holding or reproducing alternative assets. Next we wish to draw attention to the role played by the assumption that equity is non-traded and is an imperfect substitute for debt in portfolios. While this formalization may be excessive for most practical purposes it does suggest nevertheless that the aggregation in the theoretical literature may be misleading in its description of the transmission mechanism of monetary changes in the open economy; non-traded assets unquestionably loom large in any economy and the choice of asset in which the central bank intervenes is bound to be of consequence.[18]

References

Allen, P. R. (1972): Money and growth in open economies, Review of Economic Studies 39 (118), pp. 213–219.

Boyer, R. (1971): The dynamics of an open, monetary economy: Growth and the balance of payments, unpublished Ph.D. dissertation (University of Chicago, Chicago, Ill.).

[18] The issue raised here closely parallels the discussion in *Cagan* (1958) and *Tobin* (1961); it parallels, too, the role of non-traded hoods, as opposed to assets, in the transmission mechanism of monetary changes that was forcefully made by *Hawtrey* (1928) and has recently been revived.

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Branson, W. (1972): Macroeconomic equilibrium with portfolio balance in open economics, unpublished manuscript (Institute for International Studies, Stockholm).

Cagan, P. (1958): Why do we use money in open market operations? Journal of Political Economy, Feb.

Dornbusch, R. (1971a): Notes on growth and the balance of payments, Canadian Journal of Economics, Aug.

Dornbusch, R. (1971b): Notes on two-sector small country growth, Center for Mathematical Studies in Business and Economics Report 7154 (University of Chicago, Chicago, Ill.).

Dornbusch, R (1973): Money, devaluation and nontraded goods, American Economic Review, Dec.

Foley, D./*Sidrauski,* M. (1971): Monetary and fiscal policy in a growing economy (Macmillan, New York).

Frenkel, J. A. (1970): Money, wealth and the balance of payments in a model of accumulation, unpublished Ph.D. dissertation (University of Chicago, Chicago, Ill.).

Frenkel, J. A. (1971): A theory of money, trade and the balance of payments, Journal of International Economics, May.

Frenkel, J. A./*Fischer*, S. (1972): International capital movements along balanced growth paths: Comments and extensions, Economic Record, June.

Friedman, M. (1969): The optimum quantity of money (Aldine, Chicago, Ill.) Ch. 2.

Hawtrey, R. G. (1928): The gold standard and the balance of payments, Economic Journal, pp. 50–68.

Johnson, H. G. (1972): The monetary approach to balance of payments theory, Journal of Financial and Quantative Analysis, March.

Jones, R. W. (1968): Monetary and fiscal policy for an economy with fixed exchange rates, Journal of Political Economy, July/Aug.

Jones, R. W. (1969): Portfolio balance and international payments adjustment, in: R. A. Mundell and A. Swoboda, eds., Monetary problems of the international economy (University of Chicago Press, Chicago, Ill.).

Komiya, R. (1969): Economic growth and the balance of payments, Journal of Political Economy, Jan./Feb.

Lee, J. (1972): Money, trade and capital movement for a growing small economy, unpublished manuscript (University of Rochester, Rochester, N.Y.).

McKinnon, R. (1969): Portfolio balance and international payments adjustment, in: R. A. Mundell and A. Swoboda, eds., Monetary problems of the international economy (University of Chicago Press, Chicago, Ill.).

McKinnon, R./*Oates,* W. (1966): The implications of international economic integration for monetary, fiscal and exchange rate policy, Studies in International Finance, no. 16 (International Finance Section. Princeton, N.J.).

Metzler, L. (1968): The process of international adjustment under conditions of full employment: A Keynesian view, in: H. Johnson and R. Caves, eds., Readings in international economics (Irwin, Homewood, Ill.).

DOI https://doi.org/10.3790/ccm.52.4.457 | Generated on 2025-07-13 07:57:51
OPEN ACCESS | Licensed under CC BY 4.0 | https://creativecommons.org/about/cclicenses/

Metzler, L. (1973): Wealth, saving and the rate of interest, in his 'Collected Papers' (Harvard University Press, Cambridge, Mass.).

Mundell, R. A. (1968): International economics (Macmillan, New York).

Mundell, R. A. (1971): Monetary theory (Goodyear, Pacific Palisades, Calif.).

Mussa, M. (1971a): Twice the transfer problem plus David Hume, unpublished manuscript (University of Chicago, Chicago, Ill.).

Mussa, M. (1971b): A simple general equilibrium model of trade and the balance of payments, unpublished manuscript (University of Chicago, Chicago. Ill.).

Mussa, M. (1973): A study in macroeconomic dynamics: A. Metzleric approach, unpublished manuscript (University of Rochester, Rochester, N.Y.).

Purvis, D. (1972): More on growth and the balance of payments: The adjustment process, Canadian Journal of Economics, Nov.

Roper, D. (1969): Macroeconomic policies and the distribution of tile world money supply, Quarterly Journal of Economics, May.

Salop, J. (1973): The exchange rate and the terms of trade, unpublished manuscript (Board of Governors of the Federal Reserve System, Washington, DC.).

Swoboda, A. (1972): Equilibrium, quasi-equilibrium and macroeconomic policies under fixed exchange rates, Quarterly Journal of Economics, Feb.

Tobin, J. (1961): Money, capital and other stores of value, American Economic Review, May.

Tobin, J. (1969): A general equilibrium approach to monetary theory, Journal of Money, Credit and Banking, Feb.

Tower, E. (1972): Monetary and fiscal policy under fixed and flexible exchange rates in the n, Journal of Money, Credit and Banking, Nov.

Von Neumann-Whitman, M. (1970): Policies for internal and external balance, Special Papers in international Economics, no. 9 (International Finance Section, Princeton, NJ.).

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