CENTER OF PLANNING AND ECONOMIC RESEARCH

33

# THE BALANCE OF PAYMENTS EXCHANGE RATES, AND ECONOMIC POLICY

*By*

POLLY R. ALLEN AND PETER B. KENEN

ATHENS 1978

# THE BALANCE OF PAYMENTS EXCHANGE RATES, AND ECONOMIC POLICY

CENTER OF PLANNING AND ECONOMIC RESEARCH

33

# THE BALANCE OF PAYMENTS EXCHANGE RATES, AND ECONOMIC POLICY

(A SURVEY AND SYNTHESIS OF RECENT DEVELOPMENTS)

*By* Professors

POLLY R. ALLEN AND PETER B. KENEN

ATHENS 1978

*K. MICHALAS S.A.*
*Vlachaki 44*
*N. PSIHIKO TEL. 67 12 700*

*Opinions or value judgements expressed in this book are those of the authors and do not necessarily represent those of the Center of Planning and Economic Research.*

# *CENTER OF PLANNING AND ECONOMIC RESEARCH*

*The Center of Planning and Economic Research (KEPE) was founded in 1961 as an autonomous public organisation, under the title "Center of Economic Research", its basic objective being research into the problems of the operation, structure and development of the Greek economy. Another of its objectives was the training of young Greek economists in modern methods of economic analysis and research. For the establishment and operation of the Center considerable financial aid was provided by foreign foundations.*

*During 1964, the Center of Economic Research was reorganised into its present form, as the Center of Planning and Economic Research. In addition to its function as a Research and Training Institute, the Center, in its new form, was assigned the following tasks by the State: (1) The preparation of economic development plans at a national and regional level, (2) the evaluation of public investment programmes, and (3) the study of short-term developments in the Greek economy and advising on current problems of economic policy.*

*For the realisation of these aims, the KEPE, during its first years of operation (1961-1966) collaborated with foreign scientists and foundations. The latter helped in*

*the selection of foreign economists who joined the Center to carry out scientific research into the problems of the Greek economy and in the organisation of an exchange programme, including the post-graduate training of young Greek economists at universities abroad.*

*The Center has also developed a broad programme of scholarships for post-graduate studies in economics. Thus, in collaboration with foreign universities and international organisations, a number of young economists from Greece are sent abroad each year, to specialise in the various fields of economics. In addition, the KEPE organises a series of training seminars and lectures, frequently given by distinguished foreign scholars invited for that purpose to Greece.*

*In addition to the above, the KEPE maintains contact with similar institutions abroad, and exchanges publications and information concerning developments in methods of economic research, thus contributing to the promotion of the science of economics in the country.*

*The first version of this paper was presented by one of the authors, Peter B. Kenen, Professor of Economics at the University of Princeton, in a lecture delivered at the Center of Planning and Economic Research in June 1977. When invited to publish the lecture, Professor Kenen suggested that we offer in its place the present version, which embodies work which he and his coauthor, Professor Polly R. Allen, have done since the lecture was delivered.*

# THE BALANCE OF PAYMENTS, EXCHANGE RATES, AND ECONOMIC POLICY

## (A Survey and Synthesis of Recent Developments)

This paper has two objectives. First, we review recent developments in the theory of the balance of payments and exchange-rate determination. The character and focus of the theory have been altered dramatically during the last decade, under the influence of changes in our thinking about money and macroeconomic policy and under the influence of events in the real world. We try to identify the principal changes that make the theory look quite different than it did a decade or so ago. Second, we will show how changes in the theory affect familiar propositions in the theory of economic policy. For this purpose, we shall use a model on which we have been working and will develop thoroughly in our forthcoming book, *Asset Markets, Exchange Rates, and Economic Policy.* We will illustrate the uses of the model by showing (1) how a small, open economy responds to external disturbances and (2) what the responses tell us about the validity of the assertion that a flexible exchange rate insulates an open economy against disturbances coming from abroad.

# I

In a recent book review, Gottfried Haberler suggested that there is need for a new synthesis of balance-of-payments theories. "What would be welcome", he wrote, "is an updated version of Meade's classic treatise."[1] He went on to call for a marriage of Meade's approach, which stressed the roles of price and expenditure effects with what he described as the "valid elements" of the monetary approach rehabilitated by Johnson, Mundell, and others, which stresses the requirements of long-run equilibrium in the money market.[2] Our book is in part an attempt to respond to Haberler's suggestion, but our strategy is different from the one he suggested. Our model borrows its treatment of goods markets from Meade, its treatment of saving and wealth from Metzler,[3] and its treatment of the money and bond markets from Markowitz and Tobin.[4]

A marriage between Meade's approach and the modern version of the monetary approach would be an unhappy union. The partners would not be compatible. One of them, indeed, wants nothing to do with the other. In a paper published

shortly after his death, Johnson defined the monetary approach in these terms:[5]

> The central propositions of the monetary approach are, first, that the balance of payments is a monetary phenomenon and requires analysis with the tools of monetary theory and not barter or 'real' trade theory; second, that money is a stock, whereas real theory traditionally deals with flows, so that an adequate balance-of-payments theory must integrate stocks and flows; and third, that the money stock can be changed in two alternative ways, through domestic credit creation or destruction and through international reserve flows, the policy choice being important for balance-of-payments analysis.

Models fashioned in accordance with these tenets sometimes go so far as to deny altogether the relevance of price and expenditure effects — the ingredients of 'real' trade theory — which figure so importantly in Meade's treatise. They focus single-mindedly on the requirements of monetary equilibrium in the never-never land of the stationary state. Furthermore, they are constructed to affirm the neutrality of money. The economy is dichotomized completely.

Models of this type serve to remind us that the exchange rate is the relative price of money — the price at which one money can be sold for

another. But they are designed to invite the dubious inference that the exchange rate is determined *in and by* the money market. The theory of the balance of payments is made to explain endogenous adjustments in the supply of money when the exchange rate is pegged. The theory of exchange-rate determination is made to explain endogenous adjustments in the 'price' of money when it is flexible.

It is not the main aim of this paper, however, to quarrel with the purposes and models of our competitors but rather to stress some of what we have in common — to show how recent work on the balance of payments and exchange-rate determination embodies an accretion of significant changes in the way we think about external and internal balance and especially to emphasize the ways in which our habits of thought differ from those that we learned from Meade.

Meade's own book was a synthesis, in that it combined for the first time income or expenditure effects with price or elasticities effects to describe the evolution of the balance of payments under the influence of exogenous disturbances and domestic policies. In the preface to his book, Meade acknowledges a debt to Keynes and to Machlup, Metzler, and Nurkse, who were among the first to apply Keynesian methods to balance-of-payments analysis, but he acknowledges another debt

to Robinson and others for the work on price effects. Meade is sometimes criticized, in fact, for giving too much attention to elasticities effects and too little to expenditure effects — for neglecting what we would now call the changes in absorption needed to validate a change in the exchange rate. True, he failed to allow for the possibility of endogenous changes in absorption, whether they be those invoked by Alexander, by Laursen and Metzler, or by Dornbusch.[6] But Meade did not neglect the policy problem posed by the absorption approach. What he did, in effect, was to assign monetary and fiscal policies to the regulation of aggregate demand — to the task of maintaining internal balance — while assigning the exchange rate to the regulation of the current account in the balance of payments. Meade was one of the first to warn that devaluation cannot improve the balance of payments of a fully employed economy if the government will not countenance a reduction in absorption and labor will not countenance a reduction in its real wage. Meade's use of the elasticities approach was not in the partial-equilibrium tradition of those who were the first to use it. Contrarily, it evokes Edgeworth's warning about the apparent simplicity of offer-curve analysis in the pure theory of international trade. Offer curves, said Edgeworth, are like the hands of a clock; there is much machinery

concealed behind them. Much machinery is also behind Meade's supply-and-demand analysis of the foreign-exchange market.

We have said that Meade's book concentrates on the current account in the balance of payments, and that is one of the principal shortcomings that has been corrected by recent work on international monetary theory. Meade did not neglect capital movements in his description of balance-of-payments adjustment, and his model includes a well-defined money market. When capital movements appear in his examples, however, they serve mainly to supplement movements of goods. In Chapter XV of *The Balance of Payments*, for example, Meade compares adjustment under a gold standard with adjustment under a flexible exchange rate. One could delete every reference to the capital account without changing any of Meade's major conclusions. And though the stock of money appears in his model, it does not constrain economic behavior. In most of his work, the central bank is assumed to regulate the domestic interest rate so as to maintain full employment; open-market operations offset changes in the supply of money arising from flows of reserves and offset changes in the demand for money arising from changes in income.[7]

Most importantly from our standpoint, Meade did not connect capital movements with behavior

in the bond markets. Demands for claims on foreigners are *added on* to his model; they are not *extracted* from the model as excess demands for securities. There are, in fact, no bond markets in Meade's model and thus no way to connect flow demands for bonds with current saving or stock demands for bonds with levels of wealth.

One must remember, of course, that Meade's book appeared in 1951, when private capital movements were relatively unimportant. The return to currency convertibility did not take place until 1958, and large-scale capital movements did not become important for balance-of-payments policy until the early 1960's, apart perhaps from leads and lags in trade-related payments. Swings in the capital account induced by international differences in interest rates and changes in exchange-rate expectations did not come to dominate swings in the current account until the late 1960's. (It should be emphasized, moreover, that the breakdown of the Bretton Woods system in 1971 was due to the massive deterioration of the U.S. current-account balance, not to the advent of capital flows. As a matter of fact, the deterioration began earlier but was masked for a time by a capital inflow into the United States resulting from the Eurodollar borrowings of U.S. banks. The crisis of 1971 was precipitated when the capital account turned around, revealing the effects

of the deterioration in the current account and then amplifying those effects as the size and implications of the deterioration became fully apparent.) More attention was paid to capital movements in early papers by Robert Mundell.[8] But these appeared about ten years after Meade's book and were influenced by Mundell's concern with the special situation of his native Canada, which had important capital-account connections with the United States even in the early 1950's. (It cannot be an accident that Canadians, including Viner, Johnson, Mundell, McKinnon, and Caves, have been outstanding contributors to international economics.)

But Mundell and other writers on capital mobility adopted an approach similar to Meade's, in that they added capital-account equations to their models without too much regard for internal consistency, and they were concerned almost exclusively with capital flows rather than with stocks of claims or liabilities. This emphasis on flows, real and financial, was typical of macroeconomic theory until a few years ago, and the new attention that we devote to stocks in international models is the result of the shift in emphasis that began to occur a bit earlier in general macroeconomic theory on account of changes in the world about us and in policy concerns. Not so long ago, macroeconomic theory was concerned with the problems

of short-run stabilization in a Keynesian context, where output and employment are determined by expenditure. Today, it is concerned with the longer-term problems of growth and of short-run stabilization in a neoclassical context, where constraints on capacity loom large and the need to combat inflation rivals the need to combat unemployment.

The older balance-of-payments models neglected *two* types of relationships between stocks and flows. First, they neglected accounting relationships. Saving adds to the stock of wealth; investment adds to the stock of capital; international financial flows add to stocks of claims and liabilities; and under pegged exchange rates, flows of reserves add to and subtract from stocks of money. Second, balance-of-payments models neglected behavioral relationships. Holding all other things constant, the larger is the stock of wealth, the smaller will be the level of saving; the larger is the stock of capital, the smaller will be the level of investment; and in the international context, the larger is a country's stock of claims on the outside world, the smaller will be the incentive to add to that stock (the smaller will be the capital outflow).

The need to include accounting and behavioral relationships between stocks and flows is, of course, a major tenet of the monetary approach to the

balance of payments. In the simplest of monetary models, for example, where money is the only asset, hoarding (saving) adds to money holdings (wealth), while the level of those holdings affects the rate of hoarding.[9] But stock-flow relationships appeared for the first time in modern balance-of-payments analysis in a different context — in the attempt to show why some of us had failed to establish statistically the sensitivity of capital flows to differences in interest rates. They came to be included in general open-economy models when wealth and portfolio-balance constraints were invoked to modify Mundell's well-known conclusions regarding the optimum policy mix and the assignment problem.[10] The earliest portfolio models were quite simple — too simple to deal with many of the issues that attract concern today. They focused on wealth holders' choices between domestic money and a single bond and did not always specify the currency in which the bond was denominated. But progress in this field has been rapid, and the models used today are richer in their structure and thus in their implications. Inspired by concern about the implications of asset-market integration and capital mobility for national autonomy, especially in making monetary policy, model builders have begun to include foreign and domestic bonds, thereby to define asset-market integration in terms of the degree of substitut-

ability between pairs of securities.[11] Inspired by concern about the amplitude of exchange-rate fluctuations after rates began to float, model builders have begun to include home-currency and foreign-currency bonds, thereby to explain exchange-rate behavior in terms of shifts between the two types of assets.[12]

The portfolio or asset-market approach to balance-of-payments and exchange-rate theory has three features that distinguish it from older approaches. First, capital movements are treated as episodes in the process of portfolio optimization. They are responses to changes in expectations about rates of return and risk and to changes in stocks of wealth, the variables that determine wealth holders' choices among the menu of available assets. Second, trade flows are treated as reflections of excess demands and supplies in markets for domestic and foreign goods and are thus made to depend on relative prices but also on levels of absorption, and the latter are made to depend on stocks of wealth (or, in the simplest of monetary models, on stocks of money). Accordingly, asset-market models allow us to trace a number of connections between the behavior of the trade balance and the exchange rate. They feature the familiar elasticities effects. They feature in addition effects on absorption at home and abroad arising from the influence of exchange-rate changes on levels of

wealth and saving. When wealth holdings include assets denominated in various currencies, changes in exchange rates cause capital gains and losses, leading to changes in wealth, saving and absorption. Third, there is a sharp distinction drawn between the short-run (impact) effects of a disturbance or change in policy and the long-run (steady-state) effects, and the two sets of effects are linked by dynamic processes imbedded in stock-flow relationships. (Unfortunately, some authors concentrate exclusively on short-run effects, to the neglect of dynamic processes and long-run effects, while others look only at long-run effects. Much work on the monetary approach to the balance of payments is in this latter category, and the strong conclusions sometimes drawn from the long-run comparative-static properties of monetary models are presented without the appropriate warnings — that they hold only in the never-never land of the steady state and are valid, even then, only when the model from which they are drawn is stable dynamically.)

Corresponding to this strong distinction between short and long runs, there is the sharp distinction drawn between forces that determine an exchange rate in the very short run and those that determine the level to which it must tend in the very long run. In the short run, asset-market processes dominate in the determination

of a floating exchange rate; goods-market processes are relevant mainly for the influence they have on asset-holders expectations about the future course of the exchange rate. With the passage of time, however, the exchange rate must come to conform to the requirements of long-run equilibrium in the goods markets. In certain simple models, for example, it must come to conform to the requirements of purchasing-power parity. There is one difficulty with this sharp distinction between short and long runs. It is valid abstractly but not in real, historical time. The distinction is drawn in order to sort out the effects of a single disturbance or change in policy occuring at a point in time. The world around us, however, is bombarded by disturbances. They do not queue up, like aircraft waiting to land, waiting until the one before has worked its way through the economy. As a practical matter, then, the exchange rate is determined continuously by asset-market processes, given the goods-market processes that have gone before (and those that are expected to follow). By implication, statements made about long-run tendencies have logical, analytical value but not much predictive value.

# II

The model we have built illustrates a number of the statements we have made. It describes a small country whose citizens (households) hold domestic money issued by the country's central bank, a domestic-currency bond issued by its government, and a foreign-currency bond issued in the outside world. The two domestic assets are held at home, not traded, and the interest rate on the domestic bond is determined endogenously. The foreign bond is held at home and abroad and is freely traded, and the citizens of the small country are able to buy or sell unlimited quantities of that bond at a fixed (exogenous) foreign interest rate. The small country produces and consumes two commodities, an export good and a nontraded good, and it consumes in addition an import good that it can purchase in unlimited quantities at a fixed (exogenous) foreign-currency price. The model differs from some others, however, in that the small country is not small in all international markets. It is, we said, a price taker in the markets for the foreign bond and the foreign (import) good. But it is not a price taker in the market for its ex-

port good; it faces a downward-sloping foreign demand curve, and its terms of trade are not exogenous.

How do we represent the new view that exchange rates are determined in the short run by behavior in the asset markets, not jointly by behavior in the asset and goods markets? We are not free to assume as some others do, that the money and bond markets clear much faster than the goods markets. All markets in the model clear all of the time; there are no disequilibria, even momentarily. Furthermore, the demands for foreign and domestic assets cannot be governed by wealth holders' expectations about exchange-rate changes, which is fast becoming the most popular approach to the problem,[13] because we will assume that expectations are stationary. Wealth holders do not act with perfect certainty; if they did, they would not hold simultaneously the domestic currency, the domestic bond, and the foreign bond. But they do not forecast changes in exchange rates. We have therefore to adopt a series of assumptions to segregate asset markets from goods markets, at least in the short run, and two of those assumptions need to be mentioned here:

1. Although asset and goods markets clear continuously, the *ways* in which they clear are different. In goods markets, prices adjust so that the world demand for each good — domestic plus for-

eign demand — equals the current output of the good. However, the small country's aggregate demand for goods does not necessarily equal its own aggregate output; there can be saving or dissaving and changes in wealth. Furthermore, the country's rate of saving and, therefore, its aggregate demand for goods adjust gradually in changes in the country's wealth. By implication, time must pass before households can eliminate discrepancies between the stocks of wealth they hold and those they want to hold. In asset markets, by contrast, households can alter immediately their holdings of money and bonds, subject only to the accounting requirement that money and bond holdings add up to wealth. There are thus no observable discrepancies between actual and optimal portfolios. This assumption is extreme but may be more realistic than the assumption that portfolio adjustments take place only gradually — an assumption under which wealth holders might be seen to hold unwanted stocks of bonds or money. (To put this first assumption in different terms, goods markets are structured to distribute flows of commodities from those who produce them to those who consume them, whereas bond and money markets are structured to distribute stocks of assets from those who would reduce their holdings to those who would enlarge them.)

2. In the vast majority of macroeconomic mod-

dels, the demand for money is made to depend on interest rates and income. In this one, it is made to depend instead on interest rates and wealth. The demands for money, the domestic bond, and the foreign bond are alike in form, apart from the signs of their partial derivatives with respect to interest rates. As a result, the money and bond markets are not affected instantaneously or directly by changes in goods prices or aggregate demand, and the exchange rate, being the price that clears the money market, is determined in and by the money and bond markets, along with the domestic interest rate.

There is thus an asymmetry in this model. Goods markets are affected immediately by disturbances and policy changes that impinge directly on asset markets, but asset markets are not affected immediately by disturbances and policy changes that impinge directly on goods markets. Demands and supplies in goods markets respond immediately to changes in goods prices, domestic and foreign, and therefore to exchange-rate changes caused by asset-market disturbances and policies. Furthermore, the level of aggregate demand (absorption) depends in part on the exchange rate. A depreciation or devaluation of the domestic currency raises the home-currency price of the foreign-currency bond, adding to household wealth measured in home currency, and an increase in

wealth reduces the incentive to save, augmenting consumption and aggregate demand. But changes in goods prices and aggregate demand caused by goods-market disturbances and policies can influence the interest rate and exchange rate only with the passage of time. By altering incomes and saving, they lead gradually to changes in wealth and therefore to changes in demands for bonds and money.

We do not present here all of the equations and assumptions used in our model. Those that are most important for our purposes are shown in Table 1 and can be read as follows:

1. The outputs of the export and nontraded goods, $Q_1$ and $Q_N$, respectively, are functions of their prices in domestic currency, $p_1$ and $p_N$. Gross domestic product, Y, is the sum of the home-currency values of the outputs. (Outputs are assumed to depend only on labor inputs and diminishing returns prevail. Thus, a simple Keynesian case can be obtained by assuming that labor supply is perfectly elastic at a fixed money wage rate. In this case, each output is an increasing function of its own price and independent of the other price. A simple classical case can be obtained by assuming that labor supply is perfectly inelastic and that the money wage rate is perfectly flexible. In this case, each output is an increasing function

of its own price and a decreasing function of the other price.)

2. Household wealth is held as money, $L^h$, in domestic bonds denominated in home currency, $B^h$, and in foreign bonds denominated in foreign currency, $F^h$. Both bonds are bills, so that capital gains and losses arise in the model only because the home-currency value of a foreign bond depends on the exchange rate, $\pi$. Wealth has also to be written as the sum of the history of saving, S, and the history of capital gains and losses on foreign bonds, this being the principal dynamic relationship in the model. Saving is made to depend on foreign and home interest rates, $\bar{r}_0$ and $r_1$, respectively, on disposable income, $Y^d$, and on wealth, and is homogeneous of degree one in disposable income and wealth. (If it did not depend on interest rates, absorption would not be interest-sensitive, as there is no investment in the model.) Disposable income is gross domestic product *plus* the sum of interest incomes earned on bond holdings *less* lump-sum taxes, $T^h$, paid by households. Nominal consumption, C, is disposable income *less* saving and is spent on the physical quantities $C_0$, $C_1$, and $C_N$ of the import good, the export good, and the nontraded good, respectively.

3. The domestic demands for the two domestic goods, $C_1$ and $C_N$, are functions of the home-currency prices of the three goods in the model

and of total nominal consumption. These demands are assumed to be homogeneous of degree zero in prices and nominal consumption and to be unit elastic with respect to consumption. All goods are deemed to be gross substitutes. (We do not write down the domestic demand for the import good, as we will have no need for it, and it can in any case be obtained as a residual from the statement at (2) concerning consumption.) The foreign demand for the export good, $C_1^f$, is written as a function of the foreign-currency prices of the goods consumed abroad and of total foreign consumption. It is assumed to have analogous properties. The foreign-currency prices $\bar{p}_0^f$ and $\bar{p}_N^f$ are exogenous; so is total foreign consumption, $\bar{C}^f$.

4. The households' demands for money, domestic bonds, and foreign bonds are, of course, constrained by wealth. They are written in nominal terms, as functions of interest rates and nominal wealth and are homogeneous of degree one in wealth. The two bonds are deemed to be partial substitutes.

5. Domestic money is issued by the central bank. Thus, the stock of money, L, is equal to the sum of the central bank's holdings of domestic bonds, $\bar{B}^c$, and foreign-currency reserves, R. The central bank adjusts its holdings of domestic bonds by open-market operations. It adjusts its holdings of reserves to execute its exchange-rate policy. Un-

der a floating rate, it abstains from intervention in the foreign-exchange market and has no need for reserves. It is thus convenient (but not necessary) to suppose that the stock of reserves is zero. Under a pegged rate, it intervenes to guarantee that the rate remains at the desired level, $\bar{\pi}$, and its holdings of reserves vary accordingly.

6. The government buys domestic goods; its demands, $\bar{G}_I$ and $\bar{G}_N$, are policy determined in nominal terms. Thus, the budget deficit, D, is the difference between the government's spending on goods, interest payments to households, and transfer to foreigners, $T^f$, on the one hand, and tax receipts from households, on the other. The new variable B is the stock of government debt (the supply of domestic bonds) and is determined by the history of budget deficits. If the budget deficit were endogenous, as it is in most macroeconomic models, there could be no clear-cut distinction between goods-market and asset-market disturbances; anything impinging directly or indirectly on any term in the budget equation would affect the deficit and supply of bonds. For this and other reasons, it is useful to suppose that the budget deficit is policy determined. The government selects a deficit of predetermined size and duration, and it implements its choice, $\bar{D}$, by adjusting lump-sum taxes continuously.[14] (By implication, the stock of debt is policy determined and is denoted

hereafter by $\bar{B}$.) It is also convenient, albeit less plausible, to suppose that the government adjusts its transfers to foreigners, $T^f$, to offset exactly and continuously the interest income households earn from foreigners. (By implication, the current account in the balance of payments is equal always to the trade balance.) Taking these new assumptions together, we have rewritten the budget equation to solve for $T^h$ (and will use the solution in a moment to rewrite the equation for disposable income).

7. As the supply of the import good is perfectly elastic at the fixed foreign-currency price $\bar{p}_0^f$, and the supply of foreign bonds is perfectly elastic at the fixed foreign interest rate $\bar{r}_0$, we have only to write down and solve simultaneously the four market-clearing equations in the table — those for the domestic goods, the domestic bond, and domestic money. These, moreover, can be rewritten as follows:

$$C_1\left(\pi\bar{p}_0^f, p_1, p_N, Y^d - S\right) + C_1^f\left(\bar{p}_0^f, \frac{p1}{\pi}, \bar{p}_N^f, \bar{C}^f\right) + \\ + \left(\bar{G}_1/p_1\right) - f_1(p_1, p_N) = 0,$$

$$C_N\left(\pi\bar{p}_0^f, p_1, p_N, Y^d - S\right) + \left(\bar{G}_N/p_N\right) - f_N(p_1, p_N) = 0,$$

$$B\left(\bar{r}_0, r_1, W^h\right) + \bar{B}^c - \bar{B} = 0,$$

$$L\left(\bar{r}_0, r_1, W^h\right) - \left(\bar{B}^c + \pi R\right) = 0,$$

TABLE 1

THE ALGEBRAIC MODEL

1. *The Supply Side*

$$Q_1 = f_1(p_1, p_N),\ f_{11} > 0,\ f_{1N} \leq 0,$$

$$Q_N = f_N(p_1, p_N),\ f_{N1} \leq 0,\ f_{NN} > 0,$$

$$Y = p_1Q_1 + p_NQ_N.$$

2. *Wealth and Saving*

$$W^h = L^h + B^h + \pi F^h = \int S\ dt + \int F(\frac{d\pi}{dt})dt,$$

$$S = S(\bar{r}_0, r_1, Y^d, W^h),\ S_0,\ S_1 > 0,\ 0 < S_Y < 1,\ S_W < 0,$$

$$Y^d = Y + \bar{r}_0(\pi F^h) + r_1(B^h) - T^h = C + S,$$

$$C = \pi\bar{p}_0^f C_0 + p_1C_1 + p_NC_N.$$

3. *Demands for Goods*

$$C_1 = C_1(\pi\bar{p}_0^f, p_1, p_N, C),\ C_{10},\ C_{1N} > 0,\ C_{11} < 0,\ C_{1C} > 0,$$

$$C_N = C_N(\pi\bar{p}_0^f, p_1, p_N, C),\ C_{N0},\ C_{N1} > 0,\ C_{NN} < 0,\ C_{NC} > 0,$$

$$C_1^f = C_1^f(\bar{p}_0^f, \frac{p1}{\pi}, \bar{p}_N^f, \bar{C}^f),\ C_{10}^f,\ C_{1N}^f > 0,\ C_{11}^f < 0,\ C_{1C}^f > 0.$$

TABLE 1 (continued)

4. *Demands for Assets*

$$L^h = L(\bar{r}_0, r_1, W^h),\ L_0,\ L_1<0,\ L_W>0,$$

$$B^h = B(\bar{r}_0, r_1, W^h),\ B_0<0,\ B_1>0,\ B_W>0,$$

$$\pi F^h = F(\bar{r}_0, r_1, W^h),\ F_0>0,\ F_1<0,\ F_W>0.$$

5. *The Central Bank, Money, and Exchange-Rate Policy*

$$L = \bar{B}^c + \pi R,\ R = 0 \text{ or } \pi = \bar{\pi}.$$

6. *The Government, Fiscal Policy, and Supply of Domestic Bonds*

$$D = \bar{G}_1 + \bar{G}_N + r_1(B - \bar{B}^c) + T^f - T^h,$$

$$B = \int D dt,$$

$$T^f = \bar{r}(\pi F^h),$$

$$T^h = \bar{G}_1 + \bar{G}_N + r_1(\bar{B} - \bar{B}^c) + \bar{r}_0(\pi F^h) - \bar{D}.$$

7. *The Market-Clearing Equations*

$$C_1 + C_1^f + (\bar{G}_1/p_1) - Q_1 = 0,$$

$$C_N + (\bar{G}_N/p_N) - Q_N = 0,$$

$$B^h + \bar{B}^c - \bar{B} = 0,$$

$$L^h - L = 0.$$

and the solution for $T^h$ in Table 1, taken together with the definitions of Y and $Y^d$, implies that

$$Y^d = p_1 f_1 (p_1, p_N) + p_N f_N (p_1, p_N) + \bar{D} - (\bar{G}_1 + \bar{G}_N).$$

Recalling further that the level of wealth is the sum of the history of saving (a state variable) and the history of capital gains on foreign bonds (a function of the exchange rate), it follows that the asset markets can be solved for the short-run (impact) changes in $r_1$ and $\pi$ (or R) and that the goods markets can be solved for the short-run changes in $p_1$ and $p_N$, given the changes in $r_1$ and $\pi$. Thus, an open-market purchase by the central bank, an increase in $\bar{B}^c$, has immediate effects on all four market-clearing variables, and so do other asset-market disturbances. By affecting $r_1$ and $\pi$, they affect demands for goods and, therefore, the prices $p_1$ and $p_N$. (Their impact *via* $r_1$ works through the effect on saving; their impact *via* $\pi$ is more complicated, since a change in $\pi$ affects directly the home-currency price of the import good, altering relative prices, but also affects indirectly the level of saving because it affects the level of wealth.) An increase in $\bar{p}_0^f$ or $\bar{C}^f$, by contrast, has instantaneous effects on the two goods-market variables $p_1$ and $p_N$ but not on the asset-market variables.

It is not difficult to prove that this model is stable. The relationship between saving and

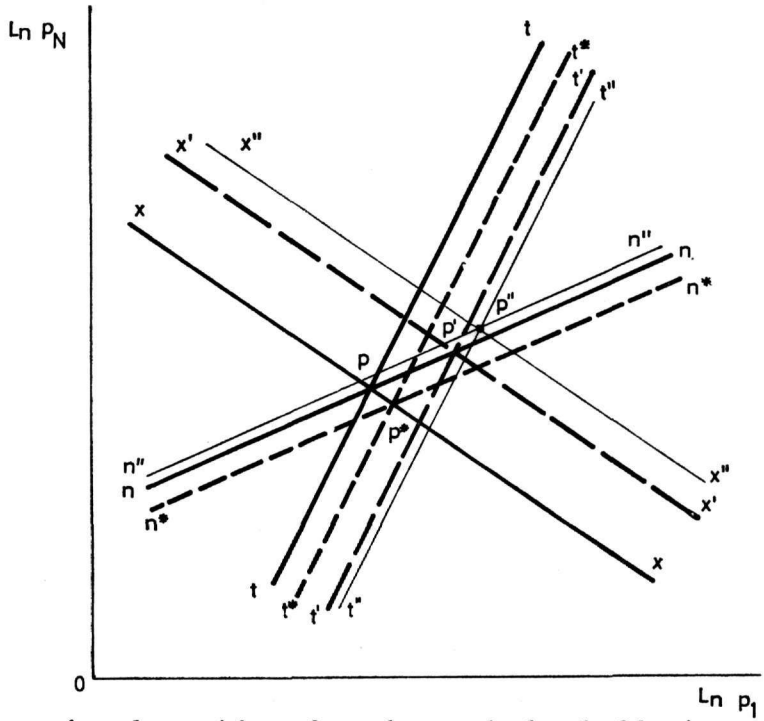
wealth, taken in conjunction with other relationships, drives saving to zero eventually, and the model settles into a stationary state. It can therefore be solved for the long-run effects of changes in exogenous and policy variables. But we do not propose to write out the solutions, neither for the short run nor for the long run. We shall instead illustrate the behavior of the model diagrammatically. We consider the consequences of an increase in $\bar{C}^f$, the level of demand abroad.

# III

Because an increase in foreign demand is a goods-market disturbance and cannot affect the exchange rate immediately, its impact effects are the same when $\pi$ is pegged as when $\pi$ is flexible. Its long-run effects are different, however, under the two exchange-rate regimes, as asset markets are affected eventually.

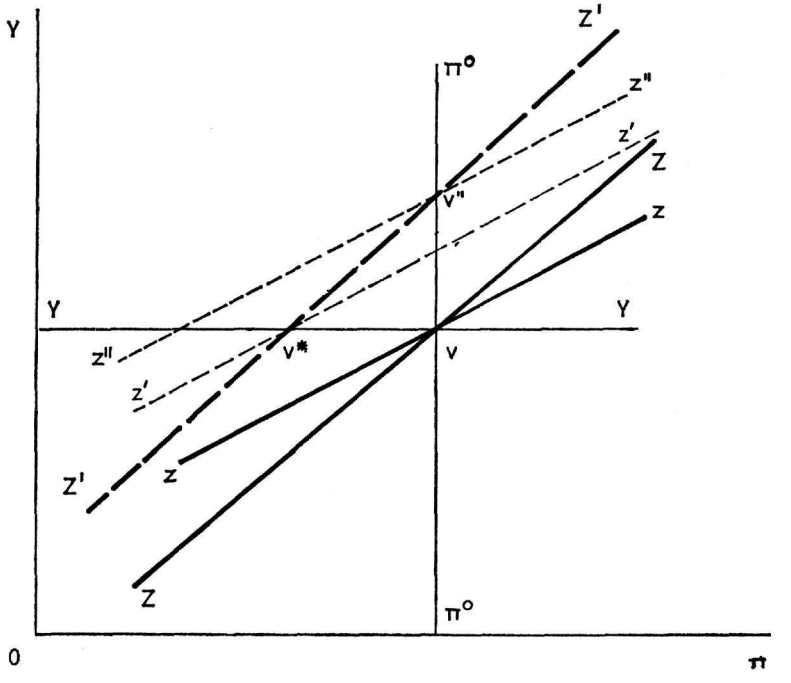
The impact effects of an increase in $\bar{C}^f$ can be described with the aid of Figure 1. The curve nn in that figure is the locus of sets of domestic prices that clear the market for the nontraded good. Its slope is unambiguously positive; when all goods are gross substitutes, an increase in $p_1$ raises the demand for the nontraded good, and an increase in $p_N$ is needed to clear the market for that good. The position of nn depends on the home-currency price of the import good, on saving and taxes (which join with income to determine domestic consumption), and on the size and composition of government spending.[15] The curve tt is the locus of sets of points that clear the market for the export good. Its slope is positive too, and its position depends on the same set of variables that deter-

FIGURE 1




mine the position of nn plus on the level of foreign demand for the export good. (The slopes and positions of nn and tt are obtained by solving the market-clearing equations for the two domestic goods, given in the text above.) Because of the way in which nn and tt are defined, excess demand for the nontraded good raises nn, and excess supply lowers it. Similarly, excess demand for

FIGURE 2




the export good shifts tt to the right, and excess supply shifts it to the left.

An autonomous increase in foreign demand does not affect the position of nn; at the initial set of market-clearing prices, it does not cause excess demand or supply in the market for the nontraded good. It does displace tt, however, moving it to t′t′, because it raises the demand for the export good. Goods-market equilibrium is dis-

placed immediately from p to p′, raising both domestic prices, and there is as a result an increase of gross domestic product and an equal increase of disposable income. The effect on Y is shown in the diagram by the shift in the curve xx to x′x′. Points on xx are sets of prices at which Y is constant at its original level. Points on x′x′ are sets of prices at which Y is constant at its new, higher level.

The goods-market effects of the increase in demand can also be described with the aid of Figure 2, in which we treat the level of gross domestic product as a function of the exchange rate. The curve zz is the relationship that has to prevail instantaneously. The curve ZZ is the one that has to prevail in the steady state. It is easy to prove that zz is upward sloping; one has only to show what an increase in $\pi$ will do to the curves nn and tt in Figure 2. Because it raises the home-currency price of the import good, it raises demands both for the nontraded good, shifting nn upward, and for the export good, shifting tt rightward. It has thus to raise $p_I$ and $p_N$, which means that it must increase gross domestic product. It follows, of course, that the position of zz depends on the same sets of exogenous variables that determine the positions of nn and tt. It likewise follows that an increase in foreign demand will displace zz to some such level as z′z′. It is equally

easy to prove that ZZ is upward sloping, using steady-state counterparts of the curves nn and tt, and that the increase in demand under study here will displace ZZ to some such level as Z′Z′. Furthermore, it can be shown that ZZ is steeper than zz (because there is no "leakage" into saving as we move along ZZ) and that Z′Z′ will intersect z′z′ at the point v* (for reasons that will be made clear momentarily.)

As the exchange rate is not altered instantaneously by any goods-market disturbance, an increase in foreign demand has as its impact effect the movement from v to v′ in Figure 2. Gross domestic product rises. Under a pegged exchange rate, moreover, the steady-state effect of the increase in demand is given by the movement to v″. Gross domestic product rises further and remains thereafter at the level given by the point v″. By inference, z′z′ must move up to z″z″ as the economy travels to the steady state, while nn and t′t′ in Figure 1 would move upward and rightward, respectively, to n″n″ and t″t″. They will thus intersect at the point p″, on the curve x″x″, which reflects the higher level of steady-state income. Under a flexible exchange rate, by contrast, there can be no permanent change in income, and the exchange rate must appreciate ($\pi$ must decline) until the economy comes to rest at v*. Gross domestic product returns to what it was ini-

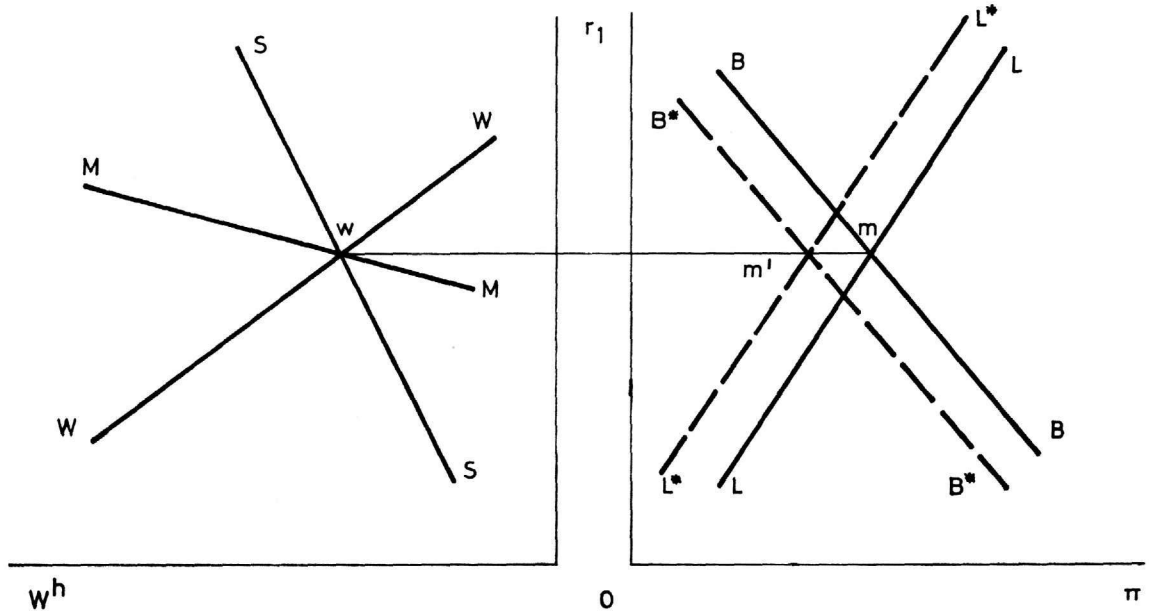
tially. By inference, nn and t't' in Figure 1 must move downward and leftward, respectively, to n*n* and t*t* until they intersect at the point p* lying on the original curve xx.[16]

What causes this difference between steady-state goods-market outcomes? It is, of course, the consequence of differences between asset-market outcomes when $\pi$ is pegged and when it is flexible. We turn now to those outcomes beginning with the case in which $\pi$ is flexible.

In Figure 3A, we draw three new curves. The curve SS is the locus of values of the domestic interest rate and wealth, $r_1$ and $W^h$, at which there is no saving, given the level of disposable income. The curve WW is the locus of values of those two variables that clear the market for the domestic bond, given the supply of bonds, and the curve MM is the locus of values that clear the money market, given the money supply.

The curve SS is upward sloping because an increase in wealth generates dissaving unless it is offset by an increase in the interest rate. It follows that an increase in disposable income will shift SS downward, as it would raise saving at a constant interest rate. The curve WW is downward sloping because an increase in wealth raises the demand for the domestic bond and calls for a decrease in the domestic interest rate to clear the bond market. It follows that an interval of bud-

FIGURE 3




(A) Wealth and Interest Rate

(B) Exchange Rate and Interest Rate

get deficits, raising the supply of bonds, will shift WW upward, since it would produce excess supply in the bond market at a constant interest rate. Finally, the curve MM is upward sloping because an increase in wealth raises the demand for money and calls for an increase in the interest rate to clear the money market. It follows that an increase in the money supply, resulting from an increase in central-bank holdings of bonds or reserves, will shift MM downward, since it would produce excess supply in the money market at a constant interest rate. It is at once apparent from these definitions that asset markets can be in equilibrium in the steady state only when the three curves intersect, as they do at the point w in Figure 3A, but instantaneous equilibrium can occur in asset markets at any intersection of WW and MM.

Under a flexible exchange rate, the positions of WW and MM are predetermined at each point in time. The location of WW depends on the supply of bonds, which can change only gradually. The position of MM depends on the supply of money, which depends on the central bank's holdings of bonds, because there are no changes in reserves when $\pi$ is flexible. Thus, an intersection of these two curves determines instantaneously the interest rate $r_1$ and stock of wealth $W^h$. The level of wealth is not fixed, even momentarily. It

is determined endogenously by the exchange rate, which sets the home-currency value of foreign-currency bonds held in domestic portfolios.

This last point is made explicitly in Figure 3B, where we translate the market-clearing equations for bonds and money into the curves BB and LL. The slopes of these curves can be inferred from the slopes of WW and MM. They reflect the fact that a depreciation of the domestic currency (an increase in $\pi$) raises wealth by raising home-currency holdings of foreign-currency bonds, and an increase in wealth adds to the demands for bonds and money. By implication, BB shifts up and down together with WW, while LL shifts up and down together with MM. Furthermore, *both* curves shift gradually through time under the influence of saving. An interval of positive saving will drive them to the left, because the domestic currency must be made to appreciate in order to hold wealth constant and thereby to clear the bond and money markets at a constant interest rate. Any intersection of BB and LL determines momentarily the interest rate, exchange rate, and (inferentially) the stock of wealth, given the supplies of bonds and money, holdings of foreign-currency bonds, and the inheritance of past saving. With the passage of time, however, BB and LL will move together — to the left with saving and the right with dissaving — until their posi-

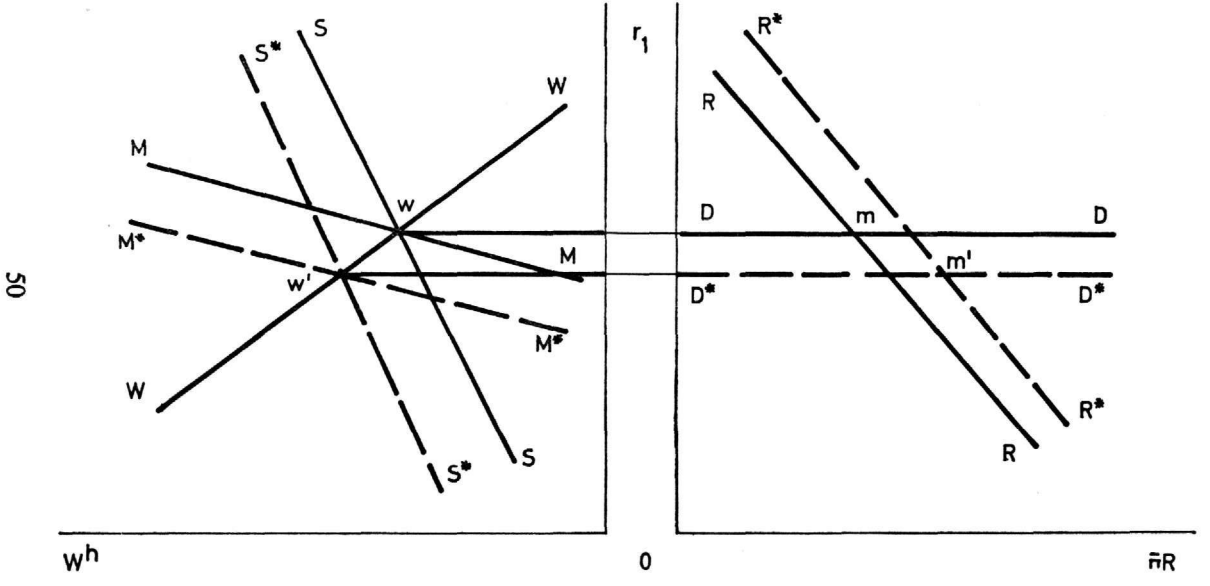
tions conform to the requirements of long-run equilibrium. In the steady state itself, the intersection of WW and MM will determine the permanent levels of $r_1$ and $W^h$, and the fact that they must also intersect SS, as they do at w in Figure 3A, will determine disposable income. The latter will determine gross domestic product and, therefore, the position of YY in Figure 2, above. The intersection of YY with ZZ (the initial point v in Figure 2) will determine the exchange rate which is, as we said, a goods-market variable in the long run. Finally, the values of $\pi$ and $r_1$ given in Figures 2 and 3A will determine the location of the point m in Figure 3B, which is to say that they determine the positions of BB and LL from which we can in turn infer the size of the stock of inherited saving.

It is now easy to explain why there can be no permanent change in gross domestic product when there is an increase in foreign demand and $\pi$ is flexible. Because the supply of domestic bonds is fixed by fiscal policy (the budget deficit is zero) and the supply of money is fixed by monetary policy (reserves cannot change), the positions of WW and MM cannot change. For this reason, however, the position of SS cannot change, and the economy has to remain at the point w in Figure 3A. There can be no permanent change in $r_1$, $W^h$, or $Y^d$. When disposable income is constant, moreover,

and there are no changes in government spending, gross domestic product must be constant too. The curve YY stays put in Figure 2, and the economy must come to rest at the point v*, where YY intersects Z'Z'. The domestic currency must appreciate. Turning finally to Figure 3B, the change in the exchange rate is denoted by the movement from m to m', so that LL must move to L*L* and BB must move to B*B*. By implication, there has been positive saving during the transition to the new steady state.[17]

We turn now to the case in which $\pi$ is pegged. It can be described with the aid of Figure 4. Beginning with Figure 4A, the curves SS, WW, and MM are drawn as they were before, as functions of wealth and the interest rate, but the curves now behave differently. (1) When the exchange rate is pegged, there can be no instantaneous change in wealth. Home-currency holdings of foreign-currency bonds can be altered only by buying or selling them (by imports or exports of foreign bonds financed by transfers of reserves, as well as by the current-account balance). Accordingly, changes in $W^h$ can take place only gradually, under the influence of saving or dissaving. (2) The curve MM can shift endogenously and can do so instantaneously, because the money supply depends in part on the size of the central bank's holdings of reserves.

FIGURE 4




(A) Wealth and Interest Rate

(B) Reserves and Interest Rate.

These two differences have, in turn, two implications. Because wealth can change only gradually, momentary asset-market equilibrium is determined uniquely by the size of the existing stock of wealth and the position of the curve WW. The money-market curve MM must move automatically and instantaneously to intersect the bond-market curve at the appropriate point. Thus, the stock of wealth and the supply of bonds determine the interest rate, and the demand for money determines the stock of reserves. Furthermore, steady-state equilibrium is determined uniquely by the positions of WW and SS, as at the point w in Figure 4A, and MM moves to meet them. The supply of bonds and the requirement that saving the zero (at the steady-state level of income determined in the goods markets) determine the level of wealth and the interest rate. The corresponding demand for money determines the steady-state stock of reserves.

These points are made explicitly in Figure 4B, where the curves DD and RR are drawn as functions of the interest rate and stock of reserves. The curve DD is horizontal because reserves do not appear in the market-clearing equation for the domestic bond. Nevertheless, it shifts up and down with WW and will also move down gradually under the influence of positive saving. The curve RR is downward sloping because an increase in

the stock of reserves adds to the supply of money and calls for a reduction in the interest rate to clear the money market. It shifts up and down with MM (unless the shift in MM is due to a change in the stock of reserves) and will move up gradually under the influence of positive saving. Momentary equilibrium is given in Figure 4A by the level of wealth and the position of the WW curve. These define the position of the DD curve in Figure 4B, and the intersection of DD with RR gives us the stock of reserves. That stock, in turn, defines the position of the MM curve in Figure 4A. Thus, a change in the positions of WW and DD, should they occur, cause an immediate change in the interest rate, given the stock of wealth. In Figure 4A the result is represented by a shift in MM; in Figure 4B, it is represented by a movement along RR. On the way to the new steady-state equilibrium, however, there may be saving, and there will then be movements in both DD and RR. The change in the stock of reserves defined by those movements will determine the size of the shift in MM that is needed to obtain an intersection of SS, WW, and MM at a single, long-run equilibrium point, such as w in Figure 4A.

It is now possible to show why an increase in foreign demand can cause a permanent increase in gross domestic product when $\pi$ is pegged.

Starting with Figure 2, recall that there was a temporary increase in Y but no immediate change in the interest rate or wealth. When $\pi$ was flexible, the increase was not permanent. There could be no shift in WW or MM, and thus the curve SS could not shift. Gross domestic product had to return to what it was initially, and this was accomplished by a fall in the exchange rate. But when $\pi$ is pegged, the requirements of equilibrium in the goods markets can only be met by a permanent increase in gross domestic product, implying a shift of SS to S*S*. This is consistent with the requirements of asset-market equilibrium under a pegged exchange rate, for the steady-state position of MM is determined endogenously by the stock of reserves, and it can shift to M*M* in Figure 4A. Steady-state equilibrium is displaced from w to w′. Wealth rises permanently in response to the interval of positive saving caused by the initial increase in income, and the interest rate declines from what it was to start. Turning to Figure 4B, the gradual increase in wealth causes the bond-market curve to move gradually from DD to D*D*, apace with the change in the interest rate, and causes the money-market curve to move gradually from RR to R*R*. Equilibrium is displaced from m to m′, raising the stock of reserves.

It is frequently asserted that a flexible exchange rate can insulate the domestic economy from an

external disturbance. It is generally agreed that a flexible rate affords more insulation than a pegged rate and is sometimes said to do so instantaneously and completely.[18] In this model, however, insulation is not instantaneous. Gross domestic product rises temporarily on account of an increase in foreign demand. It returns to its initial level only when the economy has settled into a new steady state.[19]

To afford instantaneous insulation, the exchange rate must be free to adjust immediately and sufficiently to forestall any change in the trade balance, which means that two conditions have to be satisfied. First, goods markets must be directly connected to the market in which the exchange rate is determined. Second, a change in the exchange rate must not affect the capital-account balance. The first condition does not hold in our model. The exchange rate is one of the prices that clear the asset market, and the demand for money does not depend on income. There is thus no way for a goods-market disturbance to affect the exchange rate immediately. With the passage of time, of course, the demand for assets are affected; changes in income give rise to saving, which changes wealth and alters demands for assets. But the change in the exchange rate that is brought about gradually cannot confer insulation, even with a lag, because the second condi-

tion is not satisfied. A change in the exchange rate affects the home-currency value of foreign bonds held in domestic portfolios and has therefore to generate capital flows, as wealth holders buy or sell foreign bonds to optimize their holdings. When the capital account is not balanced, moreover the current account cannot be balanced either. Insulation cannot be complete until the steady state is reached and holdings of assets come to be constant. At that point, the capital account goes to zero, and the current account must go to zero too.

Recasting this argument in general terms, models in which insulation is instantaneous are those in which the only flows affected by exchange-rate changes are those pertaining to demands for goods and services.[20] In asset-market models, by contrast, exchange-rate determination is part of the process of portfolio optimization, by which households' demands for stocks of assets are reconciled at each point in time with available supplies of assets. In an asset-market model, the change in the exchange rate required to stabilize the current-account balance can come to be consistent with the one required for asset-market equilibrium only after holdings of foreign-currency assets have been adjusted to compensate for changes in the values of those assets brought about by changes in the exchange rate.

Taking the argument a step further, it is perhaps

misleading to describe as "insulation" the stabilization of gross domestic product that does occur eventually. On the one hand, it occurs in respect of certain domestic disturbances, not only foreign disturbances, but does not occur in respect of a foreign financial disturbance, such as a change in the foreign interest rate, which causes a permanent change in gross domestic product. On the other hand, the stabilization of gross domestic product does not always preclude a permanent change in real activity. In Figure 1, above, relative prices are different at the point p* than they were at the initial point p. There is thus a permanent change in the composition of domestic output, even in the classical variant of this model, and there may be a permanent change in the level of employment in the Keynesian variant of the model. Real changes are ruled out only when the economy is completely specialized (there is no nontraded good) or when the goods-market disturbance is in fact "monetary" (the case of an equiproportional change in $\bar{p}_0^f$, $\bar{p}_N^f$, and $\bar{C}^f$) and only in the classical version of the model.

# IV

Our model can be used to study the effects of many goods-market disturbances, including parametric shifts in demand between traded and nontraded goods or between the two traded goods. It can be used to solve for asset-market disturbances, including an open-market operation by the central bank, an increase in the foreign interest rate, and parametric shifts in demand between pairs of assets. Finally, it can be used to study the effects of a budget deficit or devaluation of a pegged exchange rate which are, in effect, compound disturbances, because they impinge directly on goods and asset markets. We do not describe these results in this paper, but have sought merely to show how to obtain them. In the process, we have tried to stress the implications of the asset-market approach to balance-of-payments and exchange-rate theory—to how recent developments have carried us beyond the contributions of Meade and Mundell and why the asset-market approach is somewhat more general than the monetary approach. The tests of time and further work will, we hope, bear out these claims.

# NOTES

1. G. Haberler, "Review of *The Monetary Approach to the Balance of Payments*," *Journal of Economic Literature*, 14 (December 1976), p. 1328. The reference, of course, is to J. E. Meade, *The Balance of Payments*, Oxford University Press, London, 1951.

2. See, e.g., J. A. Frenkel and H. G. Johnson, eds., *The Monetary Approach to the Balance of Payments*, University of Toronto Press, Toronto, 1975, especially the editors' introductory essay and the papers by Johnson, Mundell, Frenkel, Dornbusch, and Rodriguez; also H. G. Johnson, "The Monetary Approach to the Balance of Payments: A Nontechnical Guide," *Journal of International Economics*, 7 (August 1977), pp. 251-268, R. Dornbusch, "Currency Depreciation, Hoarding, and Relative Prices," *Journal of Political Economy*, 81 (July/August 1973), pp. 893-915, and R. A. Mundell, "The Optimum Balance of Payments Deficit," in E. Claassen and P. Salin, eds., *Stabilization Policies in Interdependent Economies*, North-Holland, Amsterdam, 1972, pp. 69-86. For critical reviews of monetary models, see M. v. N. Whitman, "Global Monetarism and the Monetary Approach to the Balance of Payments," *Brookings Papers in Economic Activity*, 1975 (3), pp. 121-166, and F. H. Hahn, "The Monetary Approach to the Balance of Payments," *Journal of International Economics*, 7 (August 1977), pp. 231-249.

3. L. A. Metzler, "Wealth, Saving and the Rate of Interest," *Journal of Political Economy*, 59 (April 1951), pp. 930-946.

4. H. M. Markowitz, *Portfolio Selection*, John Wiley and Sons, New York, 1959, and J. Tobin, "Liquidity Preference as Behavior Toward Risk," in D. D. Hester and J. Tobin, eds., *Risk Aversion and Portfolio Choice*, John Wiley and Sons, New York, 1967, pp. 1-26.

5. Johnson, "A Nontechnical Guide," p. 251.

6. S. S. Alexander, "Effects of a Devaluation on a Trade Balance," *International Monetary Fund Staff Papers*, 2 (April 1952), pp. 263-278, S. Laursen and L. A. Metzler, "Flexible Exchange Rates

and the Theory of Employment," *Review of Economics and Statistics*, 32 (November 1950), pp. 281-299, and Dornbusch, "Currency Depreciation, Hoarding, and Relative Prices."

7. On money and monetary policy in Meade's model, see S. C. Tsiang, "The Role of Money in Trade Balance Stability," *American Economic Review*, 51 (December 1961), pp. 912-936.

8. R. A. Mundell, "The Appropriate Use of Monetary and Fiscal Policy under Fixed Exchange Rates," and "Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates," reprinted in his *International Economics*, Macmillan, New York, 1968, chs. 16, 18.

9. See, e.g., Dornbusch, "Currency Depreciation, Hoarding, and Relative Prices."

10. The first general model was, we believe, the one in R. I. McKinnon and W. E. Oates, *The Implications of International Economic Integration for Monetary, Fiscal, and Exchange-Rate Policies*, Princeton Studies in International Finance 16, Princeton University, Princeton, 1966. On the development of the approach, see J. Myhrman, "Balance-of-Payments Adjustment and Portfolio Theory: A Survey," in E. Claassen and P. Salin, eds., *Recent Issues in International Monetary Economics*, North-Holland, Amsterdam, 1976, pp. 203-237. On the reformulation of Mundell's conclusions, see M. v. N. Whitman, *Policies for Internal and External Balance*, Special Papers in International Economics 9, Princeton University, Princeton, 1970, pp. 23-30, and the sources cited there; also W. H. Branson and T. D. Willett, "Policy Toward Short-term Capital Movements: Some Implications of the Portfolio Approach," in F. Machlup, *et al.*, eds., *International Mobility and Movement of Capital*, Columbia University Press for the National Bureau of Economic Research, New York, 1972, pp. 287-310.

11. See, e.g., W. H. Branson, "Stocks and Flows in International Monetary Analysis," in A. Ando, *et al.*, eds., *International Aspects of Stabilization Policies*, Federal Reserve Bank of Boston and International Seminar in Public Economics, Boston, 1975, pp. 27-50, where there are domestic equities and foreign bonds, and his "Portfolio Equilibrium and Monetary Policy with Foreign and Nontraded Assets," in Claassen and Salin, eds., *Recent Issues in International Monetary Economics*, pp. 241-250, where there are domestic bonds and equities, as well as foreign bonds.

12. See L. Girton and D. Henderson, "Central Bank Operations in Foreign and Domestic Assets under Fixed and Flexible Exchange

Rates," in P. Clark, *et al.*, eds., *The Effects of Exchange Rate Adjustments*, U. S. Treasury, Washington, 1977, pp. 151-178, and "Finacial Capital Movements and Central Bank Behavior in a Two-Country, Short-Run Portfolio Balance," *Journal of Monetary Economics*, 2 (January 1976), pp. 33-61; also R. S. Boyer, "Commodity Markets and Bond Markets in a Small Fixed-Exchange-Rate Economy," *Canadian Journal of Economics*, 8 (February 1975), pp. 1-23, and "Devaluation and Portfolio Balance," *American Economic Review*, 67 (March 1977), pp. 54-63. Boyer's model is much like the one we set out below and anticipates some of our conclusions. Some of those conclusions are likewise anticipated by models that contain no bonds but allow wealth holders to choose between home and foreign currencies. See, e.g., C. Chen, "Diversified Currency Holdings and Flexible Exchange Rates," *Quarterly Journal of Economics*, 87 (February 1973), pp. 96-111, and G. Calvo and C. A. Rodriguez, "A Model of Exchange Rate Determination under Currency Substitution and Rational Expectations," *Journal of Political Economy*, 85 (June 1977), pp. 617-625.

13. See, e.g., Kouri, "The Exchange Rate and the Balance of Payments," R. Dornbusch, "Exchange Rate Expectations and Monetary Policy," *Journal of International Economics*, 6 (August 1976), pp. 231-244, and "Expectations and Exchange Rate Dynamics," *Journal of Political Economy*, 84 (December 1976), pp. 1161-1176, and W. Ethier, "Expectations and Asset-Market Theories of the Exchange Rate," Discussion Paper 346, Department of Economics, University of Pennsylvania, Philadelphia, 1976. Asset-holders' expectations also play important roles in models that invoke the purchasing-power-parity and interest-parity conditions to explain exchange-rate behavior; see, e.g., J. A. Frenkel, "A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence," *Scandinavian Journal of Economics*, 78, 1976(2), pp. 220-224.

14. Similar assumptions are employed by Foley and Sidrauski in their work on fiscal policy; see D. K. Foley and M. Sidrauski, *Monetary and Fiscal Policy in a Growing Economy*, Macmillan, New York, 1971.

15. The position of nn does not depend on Y itself, however, since Y is determined by $p_1$ and $p_N$. It does depend indirectly on interest rates and wealth, because they affect the level of saving.

16. The shifts from nn to n*n* and from t't' to t*t* reflect the

effects of the reduction in $\pi$ on the demands for the domestic goods. Because it reduces the home-currency price of the import good, $\pi\bar{p}^f_0$, and raises the foreign-currency price of the export good, $\frac{p_1}{\pi}$, it shifts domestic and foreign demands away from domestic goods.

17. It can in fact be shown that there will be a trade surplus whenever goods-market equilibrium is at a point such as v′ in Figure 2, where the short-run goods-market curve (z′z′ in this instance) lies below the corresponding long-run curve (Z′Z′ in this instance). Whenever there is a trade surplus, however, there has to be positive saving. This can be shown by adding up the market-clearing equations for the two domestic goods and rearranging terms:

$$S + \bar{D} = p_1 C^f_1 - p_0 C_0.$$

Throughout this paper, however, the budget deficit is zero, so that a trade surplus ($p_1 C^f_1 > p_0 C_0$) is associated with saving ($S > 0$) and a trade deficit is associated with dissaving ($S < 0$).

18. See, e.g., E. Tower and T. D. Willett, *The Theory of Optimum Currency Areas and Exchange-Rate Flexibility: A More General Framework*, Special Papers in International Economics 11, Princeton University, Princeton, 1976, pp. 51-57, and R. G. McTeer, "Economic Independence and Insulation through Flexible Exchange Rates," in N. A. Beadles and L. A. Drewy, eds., *Money, the Market, and the State*, University of Georgia Press, Athens, 1968, pp. 102-133.

19. For similar results, see R. Dornbusch, "The Theory of Flexible Exchange Rate Regimes and Macroeconomic Policy," *Scandinavian Journal of Economics*, 78 (1976), pp. 255-275.

20. These properties are characteristic of the models used by Meade and Mundell to study the behavior of a flexible exchange rate (Meade, *The Balance of Payments*, ch. xii, and Mundell, *International Economics*, ch. 17). They are likewise characteristic of models in which capital movements reflect once-for-all-adjustments to stock equilibrium in asset markets, but all assets are denominated in home currency; see, e.g., P. R. Allen and P. B. Kenen, "Portfolio Adjustment in Open Economies: A Comparison of Alternative Specifications," *Weltwirtschaftliches Archiv*, 112, 1976(1), pp. 34-71.

# IN THE SAME SERIES

1. Andreas G. Papandreou, *Planning Resource Allocation for Economic Development*, (1962).
2. Frederic E. Balderston, *The Evolution of Management Sciences*, (1962).
3. Adam A. Pepelasis, *Les Problèmes de la Main d'Oeuvre en Grèce dans le Cadre du Marché Commun*, (1962).
4. George Coutsoumaris, *The Location Pattern of Greek Industry*, (1962).
5. Milton Friedman, *Post War Trends in Monetary Theory and Policy*, (1963).
6. Jan Tinbergen, *The Trend Towards Integration*, (1963).
7. Anna Koutsoyianni-Kokkova, *Production Functions for the Greek Industry*, (1963 - in Greek only).
8. Adam A. Pepelasis, *Labour Shortages in Greek Agriculture, 1963-1973*, (1963).
9. Diomedes Psilos, *The Choice of Financial Assets in Greece*, (1963).
10. Nicos Devletoglou, *Montesquieu and the Wealth of Nations*, (1963).
11. Robert Gordon, *Some Thoughts on the Recent Slow Growth of the American Economy*, (1964).
12. Pan A. Yotopoulos, *The Elasticity of the Labour Supply Curve: A Theory and an Evaluation for Greek Agriculture*, (1964).
13. Richard M. Westebbe, *Saving and Investment in Greece*, (1964).
14. Ralph Turvey, *Description of the Greek Tax System*, (1964 - in Greek only).
15. G. C. Archibald, *Investment and Technical Change in Greek Manufacturing*, (1964).
16. G. C. Archibald, *Industrialisation and Capital Requirements in Greece*, (1964).

17. JOHN HENRY MERRYMAN, *Some Problems of Greek Shoreland Development*, (1965).
18. KENNETH J. ARROW, *Statistical Requirements for Greek Economic Planning*, (1965).
19. A. FATOUROS, *Legal Aspects of the Problem of Attracting and Guaranteeing Foreign Private Investment*, (1965 - in Greek only).
20. GERHARD WEISSER, *Grenzen und Probleme der Planung*, (1965).
21. ROBERT EISNER, *Some Factors in Growth Reconsidered*, (1966).
22. JEROME ROTHENBERG, *An Approach to the Welfare Analysis of Intertemporal Resource Allocation*, (1967).
23. *The General Frame of Regional Development*, (1973-in Greek only).
24. HELMUT REICHARDT, *Optimization Problems in Planning Theory*, (1971).
25. GEORGE D. DEMOPOULOS, *Monetary Policy, Unemployment and Wage Rates: The U.S. Postwar Experience*, (1971).
26. K. P. PRODROMIDIS, *Forecasting Aggregate Consumer Expenditure in Greece: A Long-Run Analysis*, (1973).
27. CARL S. SHOUP, *The Value-Added Tax*, (1973).
28. THEODORE P. LIANOS *and* KYPRIANOS P. PRODROMIDIS, *Aspects of Income Distribution in Greece*, (1974).
29. PANAYOTIS G. KORLIRAS, *The Economics of Disorder*, (1977).
30. LAWRENCE R. KLEIN, *Project LINK*, (1977).
31. GEORGE N. PARASKEVOPOULOS, *An Econometric Analysis of International Tourism*, (1977).
32. DANIEL B. SUITS, ANDREW MASON, and LOUIS CHAN, *Spline Functions Fitted by Standard Regression Methods*, (1977).