NBER WORKING PAPER SERIES

EXCHANGE RATE ECONOMICS: 1986

Rudiger Dornbusch

Working Paper No. 2071

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November 1986

NBER Working Paper #2071
November 1986

Exchange Rate Economics: 1986

ABSTRACT

In the past fifteen years key exchange rates have moved in larger and more persistent ways than advocates of flexible rates in the late 1960s would have left anyone free to imagine. Certainly there was no expectation of constancy for nominal exchange rates. But real exchange rate movements of 30 or forty percent were definitely not suggested as a realistic possibility. Moreover where these large movements did occur they did not obviously appear to be connected with fundamentals, and hence seemed difficult to explain in terms of the exchange rate theories at hand. The persistence of rate movements was as surprising as the rapid unwinding of apparent misalignments when they did ultimately occur.

The past fifteen years provide a natural dividing line between the Keynesian and monetary approaches of the 1960s, and the more recent analysis that takes into account exchange rate expectations and portfolio issues, which took off in the early 1970s as well as the brand-new approaches that concentrate on (partial equilibrium) microeconomics. To review these ideas the paper starts with a brief look at the U.S. experience with flexible exchange rates. From there it proceeds to the Mundell-Fleming model as a comprehensive framework of analysis. The following sections deal with persistent effects of policy disturbances, links between exchange rates and prices, the political economy of exchange rate movements and the question of policies toward excess capital mobility.

Rudiger Dornbusch
Department of Economics
MIT
Cambridge, MA 02139

REVISED
September 1986

EXCHANGE RATE ECONOMICS: 1986*

Rudiger Dornbusch
Massachusetts Institute of Technology
and
National Bureau of Economic Research

In the past fifteen years key exchange rates have moved in larger and more persistent ways than advocates of flexible rates in the late 1960s would have left anyone free to imagine. Certainly there was no expectation of constancy for nominal exchange rates. But real exchange rate movements of 30 or forty percent were certainly not suggested as a realistic possibility. Moreover where these large movements did occur they did not obviously appear to be connected with fundamentals, and hence seemed difficult to explain in terms of the exchange rate theories at hand. The persistence of rate movements was as surprising as the rapid unwinding of apparent misalignments when they did ultimately occur. Research on exchange rate economics has grown tired searching for risk premia determinants or for new macroeconomic models. With a shift of interest toward the microeconomic effects of exchange rate movements research is now turning in a fresh direction. It is therefore a good time to take stock of what is known of exchange rate economics, what has been learnt since the early 1970s and where more research needs to be done.

The past fifteen years provide a natural dividing line between the Keynesian and monetary approaches of the 1960s, and the more recent analysis that takes into account exchange rate expectations and portfolio issues, which took off in the early 1970s as well as the brand-new approaches that concentrate on (partial equilibrium) microeconomics. To review these ideas the paper starts with a brief look at the U.S. experience with flexible exchange rates. From there we proceed to use the Mundell-Fleming model as a

comprehensive framework of analysis. The following section draws attention to persistent effects of policy disturbances. The next three topics deal with the link between exchange rates and prices, the political economy of exchange rate movements and the question of policies toward excess capital mobility.

I. The U.S. Experience With Floating Rates

The most striking result of the flexible rate experience is the recognition that the "law of one price" is a poor description of the facts. Figure 1 shows the real exchange rate of the U.S. dollar over the past ten years. In the transition from fixed rates to floating in the early 1970s (not shown) the dollar depreciated by nearly 40 percent. An index of competitiveness in manufacturing (using the IMF series shown in Figure 1) stood at 155 in 1968-70 and fell to 112 by 1973-75 which is also about the average for the period 1975-86. Over the next ten years the dollar depreciated sharply until 1980. Then appreciation ensued, raising the dollar well above the level of the 1970s. Since 1985 the dollar has been on a slide, taking it back by late 1986 to the average of the 1970s.

Table 1 shows some recent facts for the international sector of the U.S. economy to highlight the large-scale shifts that have taken place. Net exports have moved to a large deficit, import penetration has increased dramatically in just a few years and the net investment position now shows the U.S. as a net debtor. There is some question about the quality of the

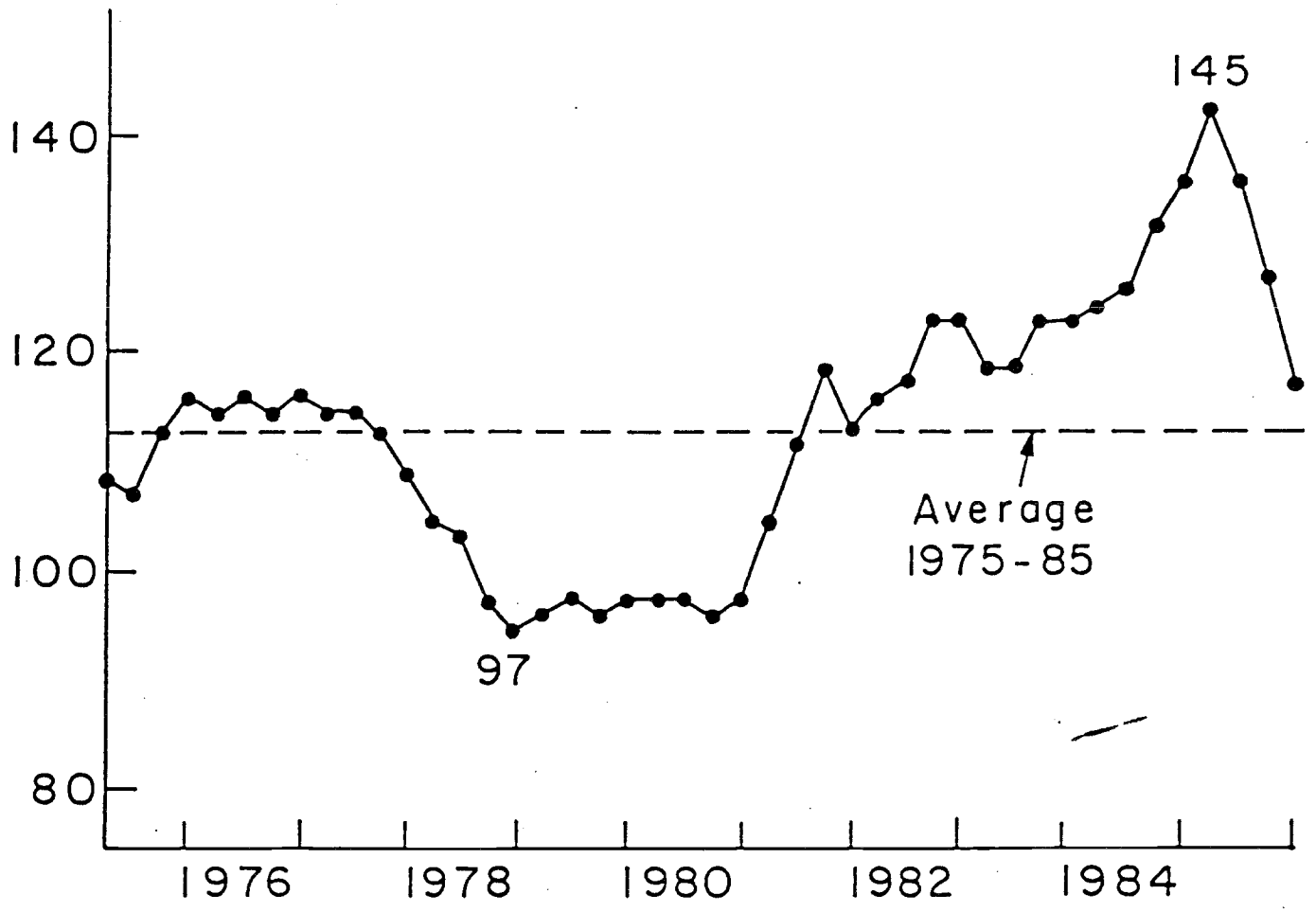

Figure 1 The U. S. Real Exchange Rate (Index 1980= 100)

net investment position data, especially in that it reckons direct investment at historical cost, but the fact that the position has deteriorated is not in question.

Table 1 U.S. External Balance Problems

	1980	1981	1982	1983	1984	1985
Real Exchange Rate* (Index 1980-82=100)	90	101	110	113	118	121
Net Exports (NIA, Percent of GNP)	1.2	1.1	0.8	-0.2	-1.7	-2.0
Import Penetration (%)						
Capital Goods	14.6	17.0	19.7	24.6	29.6	29.2
Consumer Goods	6.9	7.4	7.7	8.7	10.7	10.8
Service Trade ($ Bill.)						
Investment Income	30.4	34.1	29.5	25.4	19.1	24.7
Other Net	4.0	6.9	7.3	4.8	0.8	-1.2
Net Investment Position ($ Bill.)	106	141	147	106	28	-60

*The real exchange rate index is reported in Morgan Guaranty World Financial Markets and refers to competitiveness in manufacturing.

The recognition that real exchange rate changes have taken place on a massive scale, and that they have major and potentially persistent macroeconomic effects, points to several important directions for research:

- Why do exchange rate move so much and so persistenly?
- Does the fact that real exchange rates remain misaligned so persistently imply that they must therefore ultimately overshoot to remedy the accumulated consequences of over- or undervaluation?

- Does a review of available theories and evidence suggest that exchange exchange rate movements are based on irrational speculation rather than fundamentals?

- What are linkages between movements in the exchange rate and changes in relative prices?

- Do the large and persistent movements lead to the inevitable conclusion that exchange rate management offers a chance for better macroeconomic performance? If so, what is the externality, and thus what is the appropriate policy instrument, exchange rate oriented monetary policy or a reduced scope for capital movements?

We are certainly not at a point to answer these questions in a satisfactory manner. But it is worthwhile seeing where the literature has gone and what suggestions are available. We start by asking whether the standard models of exchange rate determination can give a satisfactory account of rate movements in the past decade.

1. Why Do Exchange Rates Move?

There are two standard models of exchange rate determination. One focuses on an expectations-augmented, open economy IS-LM model in the tradition of Meade, Fleming, and Mundell. The other highlights the role of portfolio diversification and relative asset supplies. In choosing between these models an important question is to decide how relevant portfolio diversification effects are as part of an explanation for exchange rate movements. In other words, are monetary and fiscal policy most of the story or do relative supplies of debts and other claims also play an important role?

The Extended Mundell-Fleming Model:

The textbook model today is an open economy IS-LM model with perfect capital mobility, sluggish price adjustment, rapid asset market or interest rate adjustment, and rational expectations in asset markets.

A streamlined version is written in log-linear form and takes output as given. Complications stemming from output adjustments can easily be introduced but do not actually change the basic dynamics. In the same way we do not explicitly focus on wage-price interaction.[1]

$$m-p = hi \qquad (1)$$

$$i = i* + \dot{e} \qquad (2)$$

$$\dot{p} = a[b(e-p) + g + c(i-p)] \qquad (3)$$

Here m and p are the nominal money stock and prices, i and e are the nominal interest rate and the exchange rate respectively, and g is a variable representing fiscal policy. All variables other than interest rates are in logs.

[1]See Dornbusch (1976; 1980). Some of the extensions are considered in Dornbusch (1986).

Equation (1) represents monetary equilibrium or the LM schedule. Equation (2) states that with an adjustment for anticipated depreciation, assets are perfect substitutes. Perfect foresight is imposed by equating actual and anticipated depreciation. Equation (3) specifies that price adjustment is linked to the excess demand for goods which in turn depends on the real exchange rate, fiscal policy and the real interest rate.

This model exhibits the familiar overshooting property: A one time monetary expansion leads to an immediate depreciation of the exchange rate. The exchange rate overshoots its new long run level--which is proportional to the increase in money. In the transition period, following the initial overshooting the exchange rate appreciates while prices are rising. The process continues until the initial real equilibrium is re-established.

Wilson (1979) has shown that this model also lends itself to the investigation of currently anticipated disturbances or of transitory disturbances. This exercise highlights the flexibility of asset prices which move ahead of the realisation of disturbances. Exchange rates move immediately, driven entirely by anticipations, and bring about alterations of prices and interest rates before any monetary or fiscal changes are actually implemented.

The strong feature of the model is the contrast between instantly flexible assets prices which are set in a forward looking manner, and the sluggish adjustment of prices. The linkage of the domestic asset market to foreign rates of interest produces exchange rate dynamics which yield the

required rate of return on home assets. Any "news" will make the exchange rate jump instantly to that level such where the expected capital gains or losses precisely offset the nominal interest differential. In this sense the structure is extraordinarily rigid, just as was the original Mundell-Fleming model.

Of course, there is room for some flexibility: output adjustment can be brought into the model, import prices can appear in the real money balances' deflator or a J-curve can be introduced to allow a more gradual response of demand to the real exchange rate. But these are niceties that do not add much to the basic flavor of the results.

Fiscal Policy

A major insight comes from a different application: fiscal policy. A fiscal expansion in this model brings about currency appreciation. Fiscal expansion creates an excess demand for goods, leading to an expansion in output or prices and hence, with a given nominal money stock, to upward pressure on the interest rate. Incipient capital inflows bring about an exchange rate appreciation and full crowding out. This is, of course, exactly the property captured by the Mundell-Fleming model. Fiscal policy works in the way they described even when price adjustments and expectations are introduced.

An interesting extension is to consider a transitory fiscal expansion. This corresponds, for example, to the U.S. experience of the 1980s. Suppose that fiscal policy follows an adjustment process such as:

$$\dot{g} = -\nu(g - \bar{g}) \qquad (4)$$

where $\bar{g}$ is the long run level of government spending. According to (4) a fiscal expansion is being phased out over time at the rate β.

Now suppose that at time T_o a fiscal expansion to level g_o takes place and that from there on fiscal policy will follow the rule of (4). It is possible to solve for the path of the real exchange rate to establish the following results: There will be an immediate real appreciation. Then, under the impact of excess demand, prices will keep rising so that further real appreciation occurs. Over time the exchange rate overvaluation builds up even as the fiscal policy is being wound down. A recession develops which now forces deflation and hence gradually a return to the initial level of the real exchange rate.

If a future transitory fiscal expansion is anticipated or is gradually phased in, the adjustment process is somewhat more complicated. The adjustment path is shown in Figure 2. Upon the news of the fiscal program there will be an initial nominal and real appreciation shown as a jump from A to B. Then the overvaluation exerts a deflationary pressure. As prices decline and real balances rise the nominal interest rate falls. To

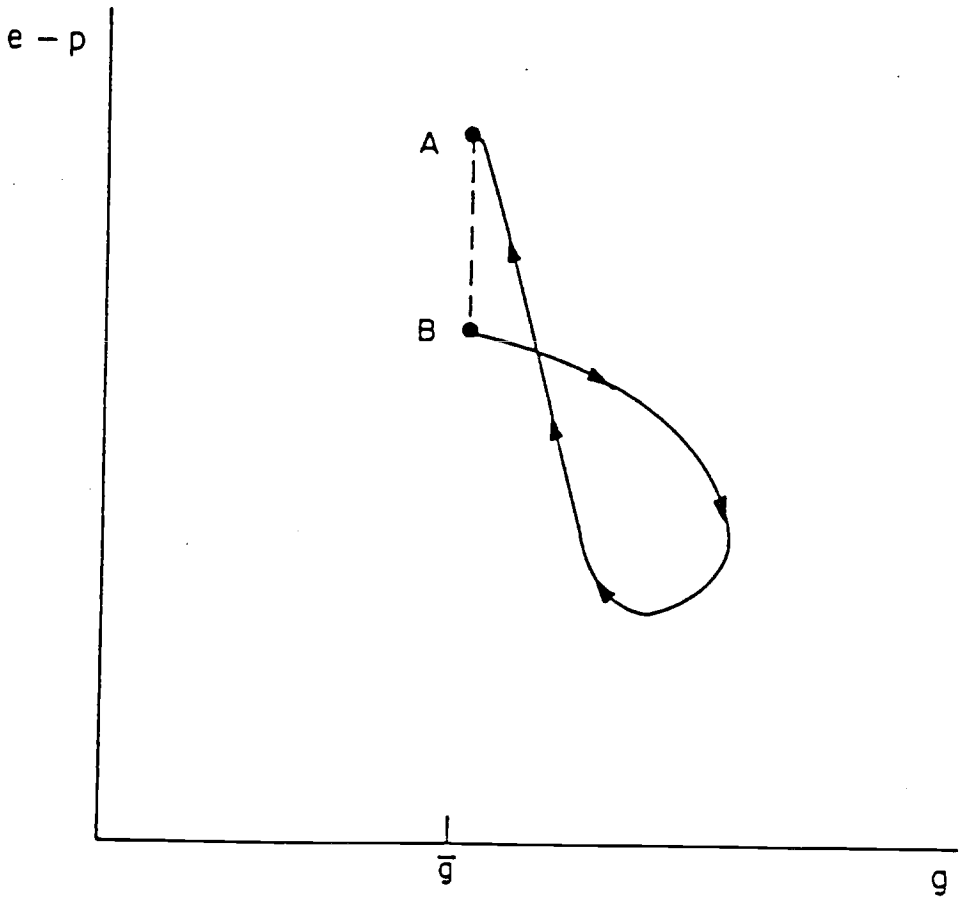

Figure 2 The Real Exchange Rate Effect of a Transitory Fiscal Expansion

match the lower interest rate the exchange rate will be appreciating. That process continues until the fiscal expansion actually gets underway, and leads to excess demand and inflation. Only when real balances and hence interest rates have been pushed up beyond their initial level, does the corrective depreciation start. The depreciation then continues, along with the phasing out of the fiscal expansion, until the initial equilibrium is restored.

Fiscal policy thus appears in addition to monetary policy as an important driving force for the exchange rate. Sustained shifts in government spending or taxes will bring persistent movements of the real exchange rate. Feldstein (1986) and Hutchinson and Throop (1985) have documented that shifts in the full employment budget, along with real interest rates, can in fact explain the large shifts in real exchange rates that have occurred. Interestingly the empirical tests hold up not only for the very recent experience in the United States. They work equally well when applied to multilateral exchange rates for the entire floating rate period.

Fiscal policy, including the expectations of correction associated with Gramm-Rudman, provides one interpretation of the dollar movements in the 1980s. The alternative is to argue the case or at least partial irrationality as has been done by Frenkel (1985), Frankel and Froot (1986) and Krugman (1986).

II. Persistence Effects

Three features of the extended Muundell-Fleming model account for its strong and unambiguous predictions. First, the absence of any effects, dynamic or otherwise, associated with the current account. Second, that home and foreign assets are perfect substitutes. Third, that there are only two classes of assets, money and bonds, and no real assets. We consider now what alternative models might look like and what they imply for exchange rate economics.

Current Account Effects

A period of fiscal expansion leading to appreciation will also involve cumulative current account imbalances. The case of the United States stands out, as now more than 2 percent of GNP is borrowed from the rest of the world in financing the persistent deficit, adding in each year to come to a seemingly ever growing external indebtedness (See Figure 3). Sometime in 1985 the U.S. passed from net creditor to net debtor status.

The accumulated net external indebtedness will, of course, show up in the current account in the form of reduced income from net foreign assets. The reduction in net external assets means that following a period of deficits the current account cannot be balanced simply by returning to the initial real exchange rate. Now there will be a deficit stemming from the increased debt service. Therefore, to restore current account balance, an overdepreciation is required.

The current account can be represented in the following manner. Let d be the net external assets and i* the rate of return on net foreign assets. The term $\dot{d}$ denotes the current account surplus or accumulation of net foreign assets:

$$\dot{d} = f(e-p,g) + i^*d \qquad (5)$$

The real exchange rate that yields current account balance will therefore depend on the rate of return on assets and on the cumulated history of fiscal policy and other shocks to the current account. A transitory fiscal binge requires a subsequent permanent real depreciation to yield the improvement in the non-interest current account that is necessary to service the debt.

Such a permanent response to transitory deficits is clearly not part of the standard model. The question is whether it represents a realistic, quantitatively important effect. This is the case addressed in trade theory under the heading of the "transfer problem". It depends in large part on the impact on demand for domestic goods of an international redistribution of wealth and spending, and on the production response to changes in relative prices.

The discussion of the transfer problem is not complete without a consideration of how the budget will be balanced. The fiscal expansion gives rise to a budget deficit which is financed by issuing debt. The debt in turn

will have to be serviced at some point by increased taxes. The question then is whether the taxation yields an equal current account improvement at constant relative prices. If so then there is no need for terms of trade adjustments. At the going levels of output disposable income and absorption by domestic residents decline but part of reduced spending falls on domestic goods rather than imports. To achieve the transfer at full employment ordinarily requires a real depreciation. The real depreciation will shift demand toward domestic goods.

This discussion of fiscal policy effects on real exchange rates clearly provides scope for an application of the Barro-Ricardo equivalence ideas to the open economy. A particularly complete rendition is offered in Frenkel and Razin (1986).

Portfolio Effects:

A separate persistence effect can arise via the impact of a fiscal and current account imbalances on the relative supply of assets. Suppose that, contrary to (2), assets are not perfect substitutes so that there is a risk premium:[2]

[2]The formula for the risk premium here omits wealth terms. It also focusses on debt rather than all nominal outside assets. For a more complete treatment see Dornbusch (1982).

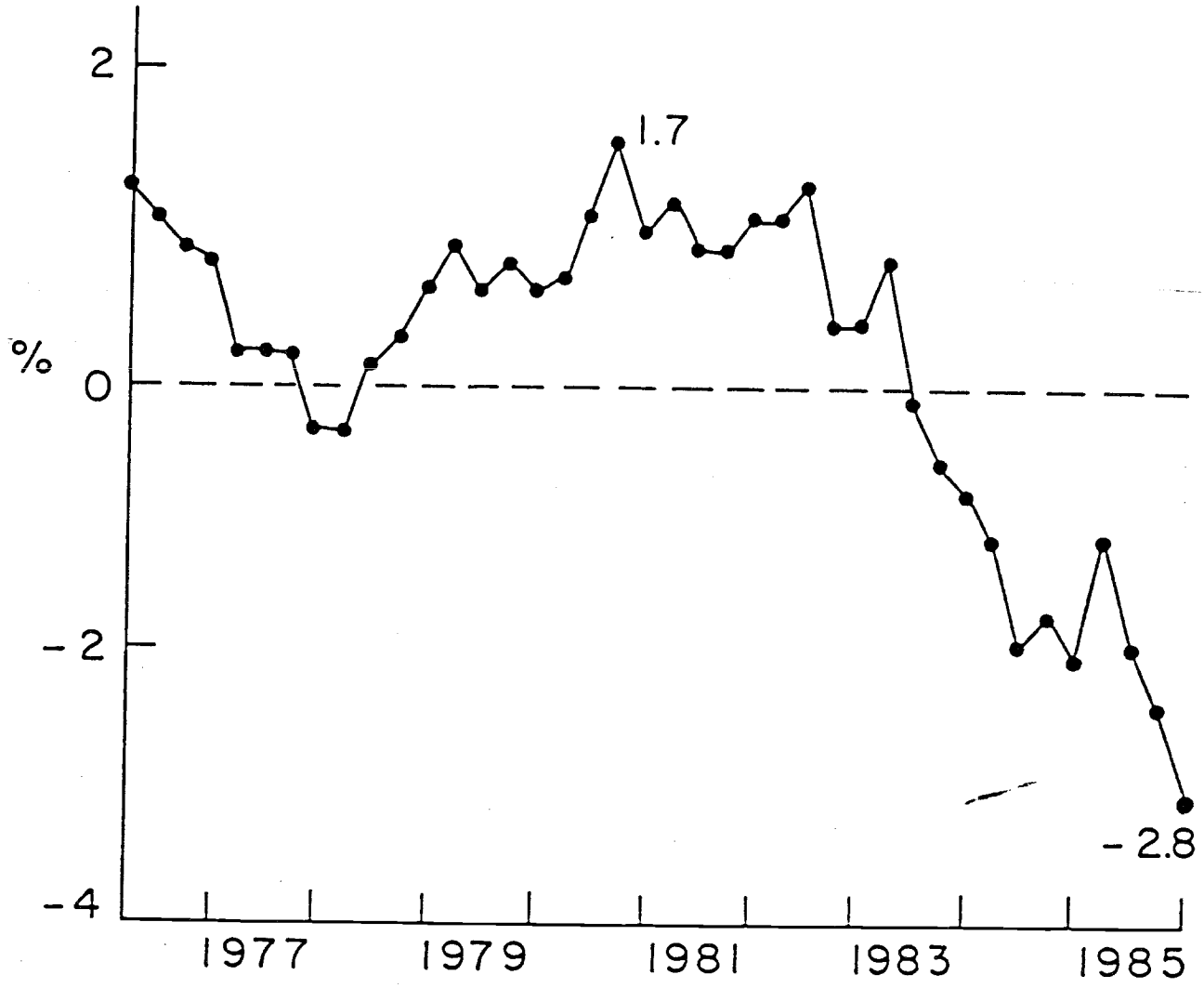

Figure 3 U. S. Net Exports (NIA, % of GNP)

$$i = i^* + \dot{e} + z(b-b^*-e) \qquad (2a)$$

where b and b* are the supplies of domestic and foreign debt in national currencies.[3]

If current account imbalances are financed by an increase in the relative supply of domestic debt, then the cumulative imbalance would require an increase in the relative yield on domestic securities or a change in the relative valuation via exchange rate changes. A depreciation would be a means of correcting on increase in the relative supply of domestic securities by reducing their value in foreign currency, thus restoring portfolio balance at an unchanged yield differential. Other things equal we would therefore expect a period of debt accumulation to have a permanent

[3]In a model with a risk premium there is a serious difficulty in linking goods and assets markets. There is certainly no excuse for using the interest rate on bonds in home currency as "the" domestic interest rate used as a determinant of domestic spending. The ad hoc model becomes a liability.The correct treatment, drawing on an optimisation model would use the marginal cost of capital which is based on the marginal financing pattern which in turn is derived by solving the firm's and household's complete intertemporal optimisation problem.

effect on exchange rates, so as to bring interest differentials in line with the changed relative supply of assets.

The responsiveness of exchange rates to relative asset supplies has been addressed in a number of important papers by Frankel.[4] He concludes that relative asset supplies in fact do not provide a satisfactory account of relative yields, at least in the context of a capital asset pricing model. The impact of relative asset supplies is practically negligible. That is an uncomfortable conclusion for a whole strand of research which places major emphasis on the imperfect substitutability of assets as a major feature of open economy macroeconomics.

Work by Sachs and Wyplosz (1984), Dornbusch and Fischer (1980) and Giovannini (1982) raises the following problem: if as a result of debt accumulation, via the transfer problem or via risk premia, an ultimate depreciation is required, why should we expect an initial appreciation? Is it not likely that for certain parameters and paths of subsequent budget correction there should be an immediate path of sustained real depreciation. It turns out that all the parameters in the model--trade elasticities, wealth elasticities, risk premium responses, etc.--matter for this question. Even in very highly simplified models no firm conclusions emerge about the path of the exchange rate.

[4]See especially Frankel (1985,1986) and Frankel and Froot (1986).

Real Assets:

The standard model remains oversimplified even when long-term issues of current account balancing and a risk premium are taken into account. The simplification lies in the omission of real capital from portfolios, and in disregarding the effect over time of investment on the capital stock and thus the supply side of the economy.

Concurrently with the imbalance in the current account and the resulting shift in net foreign assets, capital accumulation takes place. Portfolio adjustments in response to the changing relative asset supplies bring about changes in the value of real assets and in relative yields. The flow of investment and the changes in the value of real capital potentially dominate the effects of current account imbalances. A good week on the stock market produces a change in wealth that is several times the magnitude of an entire year's deficit in the current account. While it is true that the current account is important because persistent imbalances cumulate, exactly the same argument must be made for investment.

Work by Gavin (1986) shows that the inclusion of the stock market in the standard model offers important additional channels for exchange rate dynamics. Unfortunately the inclusion of the stock market removes at the same time the simplicity of the standard model. Now virtually anything is possible. And that result is arrived at by looking only at the portfolio implications of a money-debt-capital model and the ensuing yield and wealth

effects, without even taking into account the accumulation of physical capital. Among the sources of ambiguity are two different effects: an expansion in demand will bring about both an increase in output and an increase in interest rates. The net effect on the valuation of the stock market is therefore uncertain. Thus wealth may rise or fall, and this is important in judging the induced effects on money demand and spending. The second important consideration is the relative substitutability of money and debt, and debt and capital. This is relevant for the extent of yield changes and hence for the direction and magnitude of exchange rate changes.

The money-debt-capital model is also important in highlighting that current accounts are not necessarily financed by sales of domestic bonds or foreign bonds. There need not be any link between cumulative current account imbalances and yield differentials between home and foreign nominal bonds. There would be a significant distinction, for example, between fiscal deficits and investment deficits. The difference is also relevant from the point of view of the transfer problem. Deficits that arise as a result of increased investment have different implications from deficits that have their source in fiscal imbalances.

Hysteresis Effects:

A final channel for persistence effects is introduced by an industrial organization approach to the consequences of extended rate misalignments. When an industry is exposed to foreign competition and entry

by a persistent overvaluation it may close down and perhaps even reopen in the low wage country. Firms already producing in the low wage country may make the necessary investment to enter the market where home firms are handicapped by overvalued labor. A period of overvaluation or undervaluation thus changes the industrial landscape in a relatively permanent fashion. These considerations are at the center of a new literature that seeks to interpret the U.S. experience following the five year overvaluation.[5] The upshot of the literature is, of course, that overvaluation leads ultimately to the need for overdepreciation to remedy the accumulation of adverse trade effects.

Overvaluation, for example due to monetary contraction or fiscal expansion brings in foreign firms and displaces domestic firms. When the overvaluation is ultimately undone the foreign firms are still there and the domestic firms may exist no longer. Worse yet, they now may even be producing abroad. A period of sustained undervaluation is required to bring forth the required investment. The possibility of entry and the choice of labor market from which to supply a particular market, thus opens an important dynamic theory of adjustment to the exchange rate. Expectations about the persistence of changes in relative labor costs become important for the determination of relative prices. Now pricing between firms not only

[5]See especially Baldwin (1986), Krugman (1986) and Baldwin and Krugman (1986).

involves current strategic interaction, which we consider below, but also the impact of pricing strategies on entry, location and investment.

There is some offset to these considerations from the side of factor prices. To the extent that an industry has a captive factor supply we would expect that wages come down with the exchange rate, thus maintaining a firm in existence. Conversely, in expanding countries wages might rise and thus offset some of the gain in profitability arsing from depreciation.

III. Exchange Rates and Pricing

The monetary approach to the balance of payments used purchasing power parity (PPP) as an essential ingredient in explanations of exchange rate determination. Today PPP is certainly no longer a cornerstone for modelling. Attention has shifted to modelling changes in equilibrium relative prices. The simple Keynesian model assumes that wages and prices in the national currencies are given, so that exchange rate movements change relative prices one-for-one. A newer approach recognizes the sluggishness of wages, but builds on that a theory of equilibrium price determination along industrial organization lines.[6]

[6]See Dornbusch(1985), Krugman (1986), Feinberg(1986), Mann(1986) and Flood(1986).

Relative Prices:

An interesting setting for exchange rate-wage-price relationships is a world of imperfect competition. Here firms are price setters. They may or or may not interact strategically, but they certainly face the problem of how their pricing decision should react to a change in the exchange rate. Consider the simple case of an oligopoly.[7]

The typical setting would be the following. We look at the home market where n home firms and n* foreign firms compete. The profits of the typical home and foreign firms, with constant unit labor costs in their respective currencies given by w and w*, are:

$$J = (p_i - w) D_i(p_i, p_j) \qquad (6)$$

$$J^* = (p_j - ew^*) D_j(p_i, p_j) \qquad (7)$$

These profits are maximized subject to the strategic assumptions about the determinants of the demand facing each firm and the responses of other firms in the market. It is clear that there is no general solution to the problem. The impact of an exchange rate change on equilibrium prices will depend on a number of factors. Specifically these include:

[7]This analysis draws on Dixit (1986) and Seade (1983).

.whether goods are perfect substitutes or differentiated products

.the market organisation--oligopoly, imperfect competition, etc.

.the relative number of domestic and foreign firms

.the functional form of the market demand curve

Even though there is no presumption about the effects of exchange rates on the changes in equilibrium prices, it is immediately clear that there is an important link between open economy macroeconomics and industrial organisation. There is no presumption that an exchange rate movement affects all markets equally. Some markets may involve a homogeneous good and, for example, a duopoly. Other markets may involve differentiated products and Chamberlinian competition. Yet other markets may be close to perfect competition. But whichever is the case, once the exchange rate changes, given wages, there will be an adjustment in the equilibrium price. Of course this pricing issue, depending on market organisation, may be repeated at different levels from import to retail. The same pricing issue arises on the export side..

For the case of differentiated products an appreciation tends to bring about a rise in the relative price of domestic goods. Imported variants decline in price both absolutely and relatively. For homogeneous products the industry price declines, with the decline being larger the less monoplized the market and the larger the relative number of foreign firms.

An interesting, and perhaps surprising, result appears here:currency appreciation, in certain cases, may lead to a more than proportionate decline in market price. This result occurs because the favorable cost shock for foreign firms makes expansion overly profitable and overcomes the tendency to preserve profits by restricting output. But these results are very specific to market structure and functional form. In public finance, as Seade (1983) has shown, a similar result occurs: a tax on an oligopolistic industry may raise profits.

To show how specific the results are to the details of the market, consider a simple duopoly market with a domestic and a foreign firm. Let the inverse market demand function be:

$$P=P(Q) \; ; \quad P'(Q)<0, \qquad Q\equiv q+q^* \tag{8}$$

where Q denotes total quantity demanded and q and q* are the supplies by the home and foreign firm. Let the elasticity of the slope of the inverse demand function be denoted by c:

$$c = -(P''/P')Q \tag{9}$$

which may be zero, as in the linear case, positive or negative.

Suppose that each of the two firms assumes that the other maintains a given level of output. The equilibrium then is the Cournot-Nash solution for industry output and price. The elasticities of output, and of the industry price in response to an exchange rate change, are:

$$(9) \qquad \hat{Q} = [(ew^*/P)(P/P'Q)/(3 - c)]\hat{e} \; ; \qquad \hat{P} = [(ew^*/P)/(3-c)]\hat{e}$$

where a hat denotes a percentage change.

Consider now three cases. First, with a linear market demand function the term c=0. Accordingly, the pass-through of depreciation to the prices is one third of marginal cost-price ratio for the foreign country. Because we are in a situation of oligopoly the marginal cost-price ratio is less than unity. The elasticity of industry price with respect to the exchange rate is thus definitely a fraction and perhaps much less than a half.

Next we look at a constant semi-elasticity demand curve, $Q=Ae^{xp(-}aP)$. For this case the elasticity c=1, and the price elasticity is already increased to a half of the marginal cost-price ratio. Going further to a constant elasticity demand curve $Q=AP^{-a}$ yields a value of c= 1+1/a. Let a=1 so that spending on the good is constant. In that case the elasticity of price is equal to the marginal cost-price ratio.

The examples show that the impact of exchange rate movements on prices is far from straightforward. Market structure, conjectural variations and functional form all come into play. Even though this application of industrial organization ideas to the effects of exchange rate movements does not emerge with firm results, it is quite apparent that it offers a major avenue for theoretical research and for applied studies. Exchange rate changes affect differentially home and foreign firms, to an extent which varies between industries. Focusing on the adjustment to major exchange rate movements may therefore help identify market structures and thus enrich industrial organization research.

Commodity Prices:

One of the more interesting price effects of real exchange rate movements between major industrial countries occurs in the area of commodities. It is readily established that a real dollar exchange rate depreciation (in terms of value added deflators for manufactured goods) will lead to a rise in the dollar price of commodities, and a rise in their real price to U.S. users. Conversely, abroad the real price declines as does the absolute price in foreign currencies.

This result can be seen by looking at the commodity market equilibrium condition where J is the excess demand for any particular commodity, say cotton:

$$J(p/P, p^*/P^*, ..) = 0 \qquad (10)$$

where p and p* are the national currency commodity prices and P and P* are the deflators. Excess demand is a declining function of the real prices in the two regions. In Figure 4 the market equilibrium schedule is shown as downward sloping. Points above and to the right correspond to an excess supply. Let $R=P/eP^*$ be the real exchange in terms of manufacturing deflators rate, and which is shown as the ray OR through the origin. Using the law of one price for commodities, $p=ep^*$, and the definition of the real exchange rate in (10) we obtain:

$$J(p/P, Rp/P, ..) = 0 \qquad (11)$$

or

$$p/P = h(R, ...), \quad h' < 0 \qquad (11a)$$

A real appreciation of the dollar corresponds to a rise in R rotating downward the OR ray. The model predicts a decline in real commodity prices in the U.S. as a result of dollar appreciation. Equation (11a) shows that a real appreciation of the dollar will lead to a decline in the real price of commodities to U.S. users, and a real price increase abroad. Given the U.S.

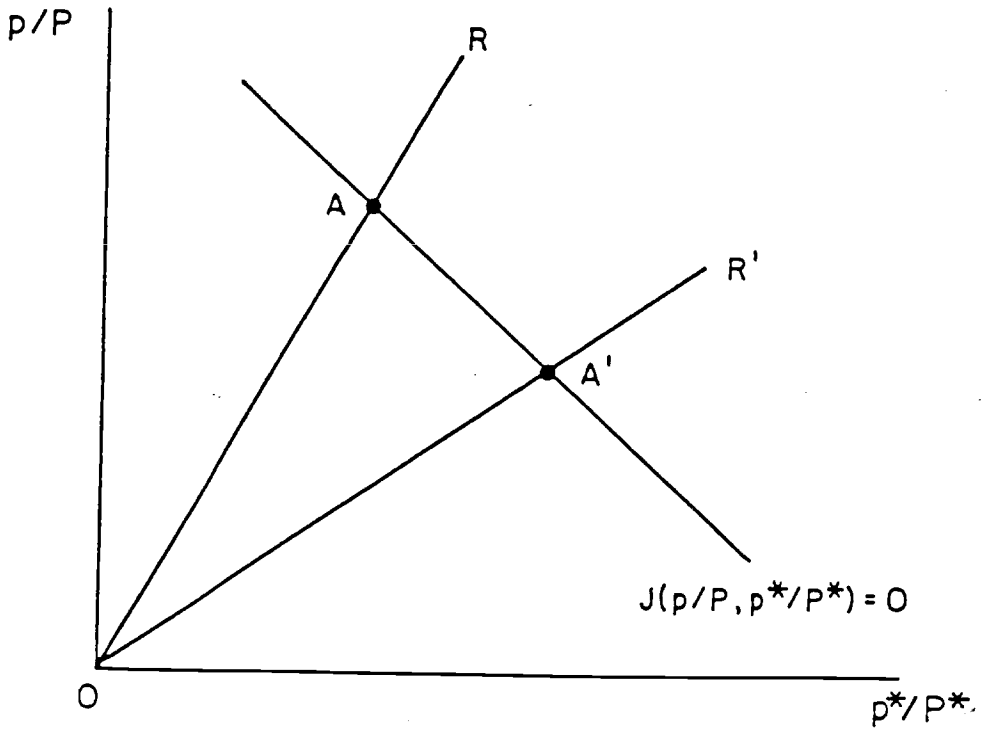

Figure 4 Real Exchange Rate Movements and the Real Prices of Commodities

deflator,P, the nominal commodity price quoted in dollars will decline. In this perspective the large dollar appreciation of 1980-85 helps explain the sharp decline of dollar commodity prices in world trade. In fact though the dollar appreciation and world cyclical movements are not enough to explain fully the decline in these prices.

Exchange Rates and Inflation:

The impact of exchange rates on inflation is well-established for any Banana Republic and, indeed, for any industrial country. The experience of the 1980s makes it clear that it even applies to the United States. There are several channels through which exchange rates affect inflation. The least controversial effect of exchange rates on inflation concerns the prices of homogeneous commodities traded in world markets.

Changes in commodity prices influence directly the rate of inflation for food and hence influence wages. They also affect industrial materials costs in manufacturing. But exchange rates influence inflation also via several other channels. Their influence is important because they are rapid and quite pervasive.

One channel working in addition to commodity prices involves the prices of traded goods and the prices of those goods directly competing with traded goods. The industrial organization analysis considered above applies to determine the magnitude and speed of response for prices. The less monopolistic a market, and the lower entry costs, the more pervasive the price effects.

There are also inflation effects via wages. These can arise because wages respond to the competitive pressure of an appreciation or depreciation in affected industries. They also come about as wages respond to changes in the cost of living.

Adding together these various channels yields a pervasive pattern of cost and price effects that are directly or indirectly associated with exchange rate movements. It is interesting to note that in the U.S. the magnitude of these effects is still under discussion. Estimates of the impact of a 10 percent dollar appreciation on the price level range between one and two percentage points. The reason it is so difficult to establish the size of the impact is apparent. There have been only three recent episodes involving a major change in inflation. Each coincided with an oil price change, a large change in unemployment, and a major change in the dollar. As a result it is nearly impossible to extract a precise estimate for the size of each of these three elements in the inflation process.[8]

IV. The Political Economy of Overvaluation

The literature on political business cycles has drawn attention to the systematic pursuit of macroeconomic goals on a timetable dictated by political elections. The exchange rate fits very well into that scheme. It

[8]See Dornbusch and Fischer (1984), Sachs (1985) and Woo (1984) on the exchange rate effects on U.S. inflation.

does so via its effects on output and inflation, but also as a highly visible indicator of confidence in policy.

The political business cycle implication of exchange rate movements is strongly enhanced by the relative timing of output and inflation results. A real appreciation quickly raises real wages in terms of tradeables and quickly reduces inflation. The impact on activity is much more gradual. The implication of these timing relationships is that a policy of real appreciation, conducted at the right time, can make an administration look particularly successful at controlling inflation, while at the same time delivering increases in real disposable income.

Diaz Alejandro (1966) was the first to draw attention to the fact that devaluation in the short term may reduce activity, in addition to having inflationary effects. Only in the long term do output and employment expand. The reason is that in the short run a devaluation cuts real wages in terms of tradeables thereby reducing purchasing power and the demand for home goods. These income effects dominate in the short run. The neoclassical substitution effects take time to build up. The short term effects are sufficiently powerful to be highly relevant for political decision making.

The reverse side of this coin is overvaluation. In the short term it involves less inflation and an increase in real income and hence it wins popularity contests. Only over time, as substitution effects become important and output declines due to the loss of competitiveness, do the costs emerge. No wonder that overvaluation is a very popular policy. It

created broad shortterm political support in Chile for Pinochet, in Argentina for the policies of Martinez de Hoz, for the Thatcher government in the U.K., and in the U.S. for Reaganomics.

Whether the policy mix was deliberate or not, there is little doubt that for a while the real appreciation was celebrated as a mark of achievement, rather than being seen as a highly destructive misalignment. Only as the deindustrialization effects became visible, and politically alarming did the policy makers back track and start viewing overvaluation with concern. In the meantime it had bought a strong disinflation.

In the U.S. case the oil price decline of 1986 came just in time to offset the cut in real income and the inflationary impact implied by dollar depreciation. The timing of appreciation and depreciation thus looked like a masterpiece of political economy. The only cloud remains the very serious blow to industry, the effects of which do appear to persist even after an already significant depreciation. Of course, in addition, there is the cost of servicing the accumulated debt.

These episodes of overvaluation raise the interesting issue of why an electorate would favor exchange rate misalignment. Given the welfare costs associated with uneven tax structures over time, and the costs resulting from de- and reindustrialization, one would expect voters to favor steady policies, rather than large fluctuations in the real exchange rate and the standard of living. Yet the evidence runs counter to this observation, overvaluation being one of the best tricks in the bag.

There is an international dimension to the issue of inflation stabilization via overvaluation. Under flexible exchange rates a tightening of monetary policy exerts immediate disinflationary effects via currency appreciation. When used by a large country, such a policy amounts to exporting inflation. Investigation of policy coordination and of the gametheoretic implications of these effects has been an important part of international economics research.[9]

A recent study by Edison and Tryon (1986) makes an important point in this connection. The authors find that in simulations with the Federal Reserve MCM model an asymmetry is apparent. For the U.S.-- the large country-- foreign repercussions and the particulars of foreign policy responses are relatively unimportant in their impact on inflation and growth. For foreign countries, by contrast, the details of U.S. policy have a major impact. This asymmetry should be expected to influence the nature of Europe's policy responses to U.S. actions.

V. Excess Capital Mobility and Policy Responses

[9]See Cooper(1969), Hamada (1985), Buiter and Marston (1985) and Oudiz and Sachs (1984).

In this concluding section we consider policy issues that follow from the the fact that macroeconomic disturbances exert significant excess effects on real exchange rates, trade flows, and on the standard of living. There are broadly two approaches: one is to accept the fact of international capital mobility and use monetary policy coordination to avoid exchange rate effects of disturbances. The other is to interfere with capital flows in order to pursue more freely macroeconomic objectives.

Target Zones and Exchange Rate Oriented Monetary Policy:

A strong case for some form of managed exchange rates is returning in the aftermath of the extreme exchange rate fluctuations. In particular, among those arguing for more fixed exchange rates are Williamson (1983) and McKinnon (1984).

The McKinnon position for a fixed exchange rate has at its center the assumption that international portfolio shifts are behind exchange rate movements. In an initial version of this argument shifts between M_1 in one country and another were the source of disturbance. Monetary authorities, being committed to national monetary targets, would not accommodate these money demand shifts, and exchange rate volatility was seen as the inevitable consequence. More recent versions of the hypothesis recognize that international portfolio shifts are more likely to take the form of shifts in the demand for interest bearing assets denominated in different currencies. But the recommendation remains to fix exchange rates, using exchange rate

oriented monetary policy to hold rates and accommodate money demand shifts. In other words unsterilized intervention is to be used.

This policy recommendation prescribes exactly the wrong kind of intervention. To offset the exchange rate impact of shifts in the demand for bonds the currency denomination of the world bond portfolio should be allowed to change. That means sterilized intervention is the correct answer. In response to exchange rate appreciation the authorities should intervene, leaving money supplies unchanged but increasing the supply of home bonds and reducing the supply of foreign currency bonds. That, of course, is sterilized intervention. The case for sterilized intervention is well-established, and has been a basic principle of asset market management ever since Poole's authoritative analysis of the choice between interest rate and monetary targets. The remaining problem, of course, is to determine whether it is portfolio shifts or shifts in fundamentals that are moving rates.

The case for fixing exchange rates whatever the source of disturbance is advanced by those favoring target zones. Their position is that exchange rates do not necessarily reflect fundamentals but rather irrationality, band wagons, and eccentricity. The large movements in exchange rates interfere with macroeconomic stability, but they can and should be avoided by a firm commitment to exchange rate targets. On the surface it is difficult to see any difficulty with this prescription, but on further inspection two serious difficulties emerge. First, it is certainly not an established fact that exchange rates move irrationally and without

links to fundamentals. Nor, if they do move in this way, is it clear that they do so more than stock prices or longterm bond prices. Why single out one price for fixing if it may mean that the other prices have to move even further away from their fundamental equilibrium levels?

The second objection concerns a lack of instruments. Governments are unlikely to agree on coordinating their fiscal policies. But if real exchange rates are to remain fixed in the face of uncoordinated fiscal policy changes then monetary accommodation is required. In the context of the dollar appreciation of 1980-5, for example, that would have meant a more agressively expansionary monetary policy in the U.S. and hence no disinflation. It is questionable whether the objective of fixed rates is sufficiently important to warrant bad monetary policy.[10]

Policies Toward Excess Capital Mobility:

But there is an alternative, extreme answer to international exchange rate instability which is more attractive. The stickiness of wages relative to exchange rates creates a macroeconomic externality which possibly justifies closing or restricting some markets. Tobin (1982) has made the case for throwing more sand into the international financial system, so as to reduce the overwhelming influence of capital flows over productive activity and trade. The proposal, known as the "Tobin tax", involves a uniform tax on all foreign exchange transactions, to be levied in

[10]For a further discussion see Fischer (1986).

all countries of the world. The consequence of the tax is to make short term hot money roundtrips unprofitable. Under this system capital flows would therefore be more nearly geared to considerations of the long term profitability of investment rather than the overnight speculation which now dominates.

It might be argued that it is too late for stopping the flow of international capital flows, that throwing sand in the wheels is no longer sufficient. But why stop there and not use rocks? An operational way of doing this is to use a managed rate for current account transactions so as to achieve stability of inflation and of real activity and at the same time employing a separate or dual exchange rate for capital account transactions. If capital markets are irrational and primarily speculative it might be as well to detach them altogether from an influence on real activity. Rather than use scarce macro policy tools to adapt the real sector to the idiosyncracy of financial markets, a separate exchange rate would detach the capital account and deprive it from distorting influences on trade and inflation.[11]

[11]For a discussion of a dual rate system and extensive references to the literature see Dornbusch (1986c).

ACKNOWLEDGEMENT

*This paper was originally presented at a meeting on exchange rates of the Royal Economic Society. I am indebted to Charles Goodhart, Stanley Fischer, Simon Johnson and the conference participants for their helpful comments and suggestions. Financial support was provided by a grant from the National Science Foundation.

REFERENCES

Baldwin, R.(1986) 'Hysteresis in trade' Unpublished manuscript, Massachusetts Institute of Technology, April.

-------and Krugman,P. (1986) 'Persistent trade effects of large exchange rate shocks'. Unpublished manuscript, Massachusetts Institute of Technology, July.

Branson,W. and Henderson,D. (1985) 'The specification and influence of asset markets.' in R.Jones and P. Kenen (eds.) Handbook of International Economics, Vol. 2, North-Holland.

Buiter,W. and R.Marston (eds.) International Economic Policy Coordination, Cambridge University Press.

Cooper,R.(1969) 'Macroeconomic policy adjustment in interdependent economies'. Quarterly Journal of Economics, February.

Cuddington,J.(1983) 'Currency substitution, capital mobility and money demand'. Journal of International Money and Fiance, 2.

Dixit, A. (1986) 'Comparative statics for oligopoly," International Economic Review, February 1986, Vol. 27, 107-122

Diaz-Alejandro,C.(1966) Exchange Rate Devaluation in a Semi-Industrialized Country: The Experience of Argentina 1955-1961. MIT Press

Dornbusch, R. (1976) 'Expectations and exchange rate dynamics'.Journal of Political Economy, December.

--------(1983a) 'Exchange risk and the macroeconomics of exchange rate determination'. in R.Hawkins et al. (eds) The Internationalization of Financial Markets and National Economic Policy. JAI Press.

--------(1983b) "Flexible Exchange Rates and Interdependence" IMF Staff Papers, March, reprinted in Dollars, Debts and Deficits, MIT Press, 1986.

_____(1985) "Purchasing Power Parity" NBER Working Paper No. 1591 forthcoming in The New Palgrave's Dictionary of Economics, Macmillan.

---------(1986a) "Inflation, Exchange Rates and Stabilization" Princeton Essays in International Finance, forthcoming.

--------(1986b) "Exchange Rates and Prices" American Economic Review, forthcoming

_____(1986c) 'Flexible exchange rates and excess capital mobility'. Brookings Papers on Economic Activity, 1.

---------(1986d) 'Special exchange rates for capital account transactions'. The World Bank Economic Review, 1, No.1.

-------and Fischer,S.(1980) 'Exchange rates and the current account" American Economic Review, December.

--------------(1984)"The open economy implications of monetary and fiscal Policy" forthcoming in R.Gordon (ed.) The American Business Cycle, U. of Chicago Press

Edison,H. and Tryon,R.(1986) 'An empirical analysis of policy coordination in the United States, Japan and Europe'. Board of Governors of the Federal Reserve, International Finance Discussion Papers No. 286, July.

Feinberg, Robert M. (1986) 'The interaction of foreign exchange and market power effects on German domestic prices" The Journal of Industrial Economics, forthcoming.

Feldstein,M.(1986) 'The budget deficit and the dollar' NBER Macroeconomics Annual.

Fischer,S.(1986) 'Symposium on exchange rates, trade and capital flows: comments' Brookings Papers on Economic Activity,1.

Flood, Eugene (1986) 'An empirical analysis of the effects of exchange rate changes on goods prices.' Unpublished manuscript, Stanford University.

Frankel,J.(1982) 'In search of the exchange risk premium: a six-currency test assuming mean-variance optimization'. Journal of International Money and Finance,1.

----------(1985a) 'The dazzling dollar' Brookings Papers on Economic Activity,1.

----------(1985b) 'Portfolio crowding-out empirically estimated'. Quarterly Journal of Economics, Supplement.

----------(1986) ' The implications of mean-variance optimization for pour questions in international finance'Journal of International Money and Finance, forthcoming

-------and K.Froot (1986) 'The dollar as an irrational speculative bubble" The Marcus Wallenberg Papers on International Finance, No.1

Frenkel,J. and A.Razin (1986) 'The international transmission and effects of fiscal policy.' American Economic Review, May.

Gavin,M.(1986) 'The stock market and exchange rate dynamics' International Finance Discussion Papers,, Board of Governors of the Federal Reserve, No. 278

Giovannini, Alberto (1985) 'Exchange rates and traded goods prices" Unpublished manuscript, Columbia University

----------(1983) Three Essays on Exchange Rates, Unpublished MIT dissertion.

Hamada,K.(1985) The Political Economy of International Monetary Interdependence, MIT Press.

Hutchinson,M. and A. Throop (1985) 'The U.S. budget deficit and the real value of the dollar'. Federal Reserve Bank of San Francisco, Economic Review, No.4, Fall.

Isard,P. and L.Stekler,M.(1985) 'U.S. international capital flows and the dollar" Brookings Papers on Economic Activity,1.

Krugman,P. (1986) 'Pricing to market when the exchange rate changes." NBER Working Paper Series, No. 1926, May.

---------(1985) 'Is the strong dollar sustainable?" in Federal Reserve Bank of Kansas The U.S. Dollar--Recent Developments.

Mann, C.(1986) 'Prices, profit, margins and exchange rates." Federal Reserve Bulletin, June.

McKinnon,R.(1984) An International Standard for Monetary Stabilization, Institute for International Economics.

Obstfeld,M.(1985) 'Floating exchange rates: experience and prospects.' Brookings Papers on Economic Activity,2.

Oudiz,G. and J.Sachs (1984) 'Macroeconomic policy coordination among the industrial economies'. Brookings Paopers on Economic Activity,1.

Sachs,J.(1985) 'The dollar and the policy mix: 1985" Brookings Papers on Economic Activity, 1.

----and C.Wyplosz(1984) "Real exchange rate effects of fiscal policy". NBER Working Paper No. 1255

Seade,J. (1983) 'Prices, profits and taxes in oligopoly," Working Paper, University of Warwick.

Tobin,J.(1982) 'A proposal for international monetary reform'.in Essays in Economics: Theory and Policy, MIT Press.

Williamson,J.(1983) The Exchange Rate System, Institute for International Economics.

Wilson,C. (1979) 'Exchange rate dynamics and anticipated disturbances' Journal of Political Economy, December.

Woo,W.T. (1984) 'Exchange rates and prices of nonfood, nonfuel products'. Brookings Papers on Economic Activity,2.