MONETARY AND FISCAL POLICY, THE EXCHANGE RATE, AND FOREIGN WEALTH

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A dissertation submitted April 1990
at the University of Glasgow,
Department of Political Economy,
for the degree of
Doctor of Philosophy

CONTENTS

Acknowledgements

This thesis has been written over a period of nearly four years. The Department of Political Economy of the University of Glasgow has offered a fertile ground for conducting my research. I am particularly indebted to Professor D. Vines for (patiently) reading the thesis in its entirety, for his constant encouragement and for his many comments.

I am also very grateful to A. Muscatelli for his active encouragement of my research activity.

During the last two years of my research I have been teaching in the Department of Economics, Catholic University of Milan. I wish to thank, among others, Professors L.Boggio and C.Beretta for their constant support.

Finally, I wish to acknowledge the financial contributions from Fondazione Einaudi and CNR.

Summary

The theory of macroeconomic policy is now in a difficult position. After the demise of the old keynesian orthodoxy, dissatisfaction has grown with monetarist ideas, too. This thesis aims to contribute to the search for a new framework for macroeconomic policy. Throughout the thesis great emphasis is put on two key ideas. The first is that both monetary and fiscal policy should be used in a well designed policy package. Such a policy package should consist of "simple" rules, on the grounds that simple rules, more easy to understand and monitor in the eyes of the private sector, would enhance the credibility of the government's pre-commitment. The second idea is that foreign wealth accumulation, operating through cumulating current account imbalances, plays a key role in the determination of the open economy macroeconomic equilibrium and its stability. Therefore open economy models should include wealth effects and the current account. Furthermore, policy evaluation should take into account, among other things, the implications of alternative rules on foreign wealth. We shall consider

policy design both in a "small" individual country and in the broader context of policy coordination.

The thesis is organized as follows. In chapter 1 we provide a general introduction to the issues to be discussed in the rest of the thesis. Chapter 2 reviews the literature on flexible exchange rate determination under "monetarist" policies. Chapter 3 presents a more general model of exchange rate determination under a "monetarist" regime, focussing on the instability risk inherent to such policy rule. In chapter 4 we discuss new ideas for the conduct of macroeconomic policy in an open economy and evaluate the performance of alternative simple policy rules. Chapter 5 reviews the debate on international policy coordination, and chapter 6 evaluates some proposals for policy coordination which involve simple rules. In chapter 7 we summarize our main results and outline future research.

PART I

SIMPLE RULES FOR THE OPEN ECONOMY

CHAPTER 1.

THE DESIGN OF SIMPLE RULES FOR THE OPEN ECONOMY

1. Introduction

It is often argued that macroeconomics currently is in a state of flux. Several schools of macroeconomists have fought in the intellectual arena to provide a suitable policy framework. But the alternative policy packages which have been advocated, either orthodox Keynesians, monetarists or new classicals, seem to have been unable to tackle both the unprecedented levels of unemployment that several among the main industrial economies are facing and the trade imbalances which endanger the stability of the international monetary system.

More recently, new attempts have been made to design alternative macroeconomic policies aiming to improve the performance of the advanced economies. This thesis may be considered part of such efforts. The design of macroeconomic stabilization policies requires a general framework involving the definition of objectives, instruments and of the methodology to be followed in the policy design. This chapter provides a preliminary discussion of the subject, setting the necessary framework for the analysis of alternative stabilization policies, to be carried out in the next chapters.

2.Macroeconomic policy in historical perspective

The philosophy of macroeconomic policy making has undergone thorough revisions during the post-war era. Up until the collapse of the Bretton Woods regime policy was guided by what has been labeled elsewhere[1] as "orthodox Keynesianism". This policy framework had the following features. It was thought that in an "uncontrolled" system prolonged periods of underemployment of resources would occur. It was also believed that nominal wage "stickiness" would prevail when productive resources were underutilized. Therefore policy was mainly concerned with stabilizing output at full employment by means of fiscal and monetary instruments. The existence for each country of an external objective was also recognized, as under an exchange rate regime of "adjustable pegs" countries were in principle allowed to revise nominal parities

1See Vines, Macjeickowski and Meade (1983) and Vines, Blake, Weale and Meade (1989) when facing fundamental disequilibrium of the balance of payments.

After the end of the Bretton Woods era and the appearance of severe inflation problems in the major industrial countries during the '70s, "monetarism" took over "orthodox Keynesianism". Monetarists held a rather optimistic view about the self-stabilizing properties of a market economy. It was believed that wage and price flexibility would ensure a sufficiently high level of output and employment without need for any kind of Keynesian "fine tuning". Furthermore, the recognition of forward-looking behaviour in the private sector, combined with the faith in market clearing, led to the famous "policy ineffectiveness" proposition[2]. As a consequence monetarists argued that macroeconomic policy should be re-oriented. At the international level exchange rate flexibility would introduce a free market mechanism which would enable each country to obtain its own desired rate of inflation. On the domestic side, monetarists argued that policy should not be concerned with output stabilization, but should rather focus on the domestic inflation rate by setting an intermediate money supply target. The enphasis on

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2Sargent and Wallace (1975)

rules originated from a profound distrust for the government's capability of successfully managing the economy and from the belief that incumbent governments would exploit fine tuning for their own purposes at the expenses of general welfare. After the rational expectations revolution this argument has been replaced by a more sophisticated point, made by Kydland and Prescott (1977), concerning the dynamic inconsistency[3] of optimal policies.

But over the last few years consensus on monetarism seems to have faded, too. Basically, dissatisfaction with the monetarist philosophy of policymaking is centered around four points, concerning the self-stabilizing properties of a market economy, the implications of forward-looking behaviour in the formation of expectations, the efficiency of monetary targets and the insulating properties of a flexible exchange rate. We shall briefly state the reasons of dissatisfaction with each of these propositions in turn.

3we shall deal with this subject in sections 3.2 and 3.3 of the present chapter.

Wage-price flexibility

Monetarists held the optimistic view[4] that antiinflationary policies would not generate high unemployment to the extent that announced policies were credible. Actual history has turned out to be quite different. A key feature of a modern market economy is the existence of a whole range of implicit and explicit contracts[5]. As a result the macroeconomy exhibits a considerable degree of inertia and the adjustment of prices and quantities which is necessary in response to shocks can only occur gradually, leaving room for prolonged disequilibrium periods. Furthermore, evidence of hysteresis effects has been found[6] in the labour market. This casts serious doubts on the supposed irrelevance of policy for the long run position of the economy, as "full employment" equilibrium cannot be conceived as independent from the past evolution of the economic system and, among other things, from the history of the policy stance.

Rational expectations

It is now widely accepted that rational agents will form their expectations about future economic events

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4Friedman (1968)
5Okun (1981)
6Layard and Nickell (1985)

making use of all available information. But gathering information may prove to be costly and access to the relevant information might simply be not possible. As a matter of fact forward markets have not spread to some key markets, like the investment goods[7]. This fact of life is probably another justification for the considerable degree of inertia that modern advanced economies exhibit. On the other hand, the so called "efficient markets", where prices are flexible and information is quickly available, have witnessed high volatility and speculative "bubbles": prices have often moved in sharp contrast with the predictions of economic theory. This leads to the conclusion that accepting the rational expectations hypothesis is a far cry from inferring continuous equilibrium in the "real" economy as postulated in the "policy ineffectiveness" proposition. The simple recognition of the existence of contracts provides a rationale for the persistence of disequilibrium in the labour market even under the assumption of rational expectations[8].

7See McKinnon (1988)
8See Taylor (1979)

Money supply targets

At the beginning of the 80s governments in a number of industrial economies have adhered to the monetarist prescription of setting monetary targets. But the experience of targeting the money supply has been rather disappointing. Basically this happened because, in contrast with former evidence, the demand for money function has turned out to be unstable. Furthermore, the task of monetary control has been complicated by the growing financial integration of open economies. Antiinflationary policies which relied on attempts to control monetary aggregates often ended up in excessive interest rates hikes and exchange rate appreciations, imparting unduly contractionary stimula to the "real" sector.

Flexible exchange rates

The widespread belief that exchange rate flexibility would insulate national economies has been contradicted, too. Fifteen years of unmanaged float have witnessed wild gyrations in exchange rates, persistent trade imbalances and the resurgence of protectionism. Recently, calls for increased international policy coordination and for a reform of the international monetary system have gained ground[9]. Given the difficulties monetarist policies have run into, it should not come as a surprise that a great deal of research has recently been devoted to the definition of new ways of designing macroeconomic policies.

3.The search for a new policy framework

The search for alternative policy strategies has focussed on the following aspects.

-establishing the theoretical framework necessary to advocate new policy rules.

-defining an appropriate methodology for policy design. This should not be considered a merely technical aspect. The debate on the time inconsistency of optimal policies has clearly shown how the design of policy is crucially affected by the way the economy is conceived to work.

-setting policy targets and instruments

9We shall devote more attention to the subject in part two of this thesis

In this section we discuss these issues in turn.

3.1.The resurgence of more interventionist policies

Recent years have witnessed the resurgence of a more "activist" philosophy of policymaking. The case for interventionist policy rules has been reformulated, allowing for forward-looking behaviour in the private sector. In a seminal article, Buiter, (1981), contrasted fixed rules, of the type advocated by Friedman, versus contingent rules, involving a higher degree of discretion. The terminological distinction between the two can be drawn as follows.

- **Open loop rules**, or fixed rules, require all present and future values of the policy instrument to be known when the planning period starts.
- **Closed loop rules**, or contingent rules, specify the value that policy variables will take in the future as a function of the information that will be available at the time when these values will actually have to be assigned.

A key difference between contingent and fixed rules is that the latter require the initial determination of instrument values regardless of future states of the world, whereas the former only require the functional form of the policy feedback to be defined in advance, the actual future values of the policy instruments depending on the occurring disturbance. Closed loop policies allow for a flexible response to precedently unforeseen disturbances and so doing exploit new information which would not be considered under open loop policy rules.

Buiter showed that the optimal closed loop rule always dominates the optimal open loop rule. Particularly relevant for the aims of this thesis is his criticism of the new classical proposition that only unanticipated policy shocks may affect the economy, i.e. only fooling the private sector by making them believe that the inflation rate will be below its actual level the government may raise output and employment through a monetary expansion. Buiter demonstrated that, as long as private and public opportunity sets differ, known contingent policy rules will affect real outcomes. A classical example[10] of monetary feedback rules having real effects relies simply on the existence of multi-period wage contracts which are non-contingent, i.e. make use of initial information only, combined with a contingent monetary rule which at any period in time is a known function of

10Fischer, (1977), and Phelps and Taylor, (1977) the information publicly available. The point is very simple but quite important: to the extent that shocks hit the economy and the necessary wage-price adjustment is delayed by the existence of contracts, room is left for contingent policy rules which may reduce the welfare loss that would otherwise be generated. This conclusion applies despite the fact that the functional form of the rule is known in advance: policy is effective as long as private contracts are not made contingent on future information.

This would seem to leave room for a resurgence of the use of optimal control techniques which seemed so promising at the beginning of the 70s[11].

3.2. Optimal policies and the time inconsistency critique

The definition of the optimal policy involves two conceptual tasks.

The first is the representation of an appropriate mathematical framework, where the three sets of endogenous (state), exogenous (forcing) and policy (control) variables are specified[12], along with the stochastic properties of the economic system and the

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11See Currie (1985)
12For a general review of the subject see Blackburn (1987)

set of dynamic equations which link the above variables. The standard, linear controlled system may be represented as follows[13]:

$dx(t) = Ax(t) + Bw(t);$

where x(t) is the n,1 vector of state variables, w is the m,1 vector of control variables, d represents the time derivative. all variables are defined as deviations from equilibrium, so that the forcing variables do not explicitly appear. Matrices A and B are time invariant. The second step in the optimal control exercise is the definition of a performance measure:

$$J = \int_0^{\infty} \exp(-rt)[x(t)Qx(t) + w(t)Rw(t)]dt$$

where r is a discount factor, Q is a symmetric positive semidefinite matrix of order n,n and R is a positive definite time invariant matrix of order m,m. J shows that the controller penalizes deviations of state and control variables from their long run values.

The optimal control problem involves choosing the sequence of w(i) which minimizes J given the dynamic system, the initial state of the system and some appropriate terminal condition. The resulting outcome satisfies Bellman's principle of optimality, which

13For simplicity we refer to the deterministic case states that at any point in time the optimal policy is merely the prosecution of the original plan computed at the beginning of the control exercise[14]. This initial plan is described as time consistent because no incentive exists for the controller to revise it. Such time consistency holds when the control technique is applied to a non-intelligent system, but not when the controlled variables themselves react to the initial optimal plan, as it is the case in rational expectations models. In this class of models at least some state variables are non-predetermined and instantaneously respond to shocks and to policy announcements. As a result a difference can arise between the optimal policy sequence w(t+1), w(t+2),....w(t+i) computed at time t and the optimal policy sequence w(t+1), w(t+2),....w(t+i) computed at time t+1. To understand why this happens one must bear in mind that at year one the controller takes into account that policy actions planned for the years ahead affect the current state of the economy because some state variables immediately respond to expectations about the future. But at year two bygones are bygones, and the optimal policy in year two will be based on the

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14Bellman (1957)

influence of present and future policy actions on the current state of the economy, ignoring their influence on year one. And it is precisely at this stage that an incentive exists for the controller to revise his policy. Consider an example described by M. Miller (1985). Suppose that in an open economy the Government announced at year one a future interest rate rise in order to fight inflation. Rational agents that believed such an announcement would discount this and increase demand for domestic currency. The resulting exchange rate appreciation would deflate the domestic economy before the monetary contraction actually takes place. But in year two the optimal policy would not contemplate the same monetary contraction as that previously announced, since the past anticipation of an interest rate rise would have already deflated the economy. The initial policy plan is therefore time inconsistent because the government has an incentive to fool the private sector, making them believe a future course of action and then revising it. But if rational agents anticipate this incentive they may act in ways which are different from the one implied in the optimal control exercise. As a result attempts to optimize might be counterproductive.

This point was forcefully raised by Kydland and Prescott (1977). They argued that, as optimal plans in models were agents adopt a forward-looking behaviour are time inconsistent, rational agents would recognize the existence of an incentive for the government to "renege" on announced policies and would therefore base their expectations on the anticipation of future re-optimizations. A possible equilibrium of the resulting game would be an optimal government plan accounting for the private sector expectation that the government will reoptimize taking the behaviour of the private sector as given. The following example, drawn from Barro (1985), might further clarify the issue. First, assume that anticipated monetary policy only affects the price level. Second, monetary "surprises" may alter real output. Third, the government welfare function positively values an output expansion above the "natural" rate[15]. Fourth, inflation is a social evil. At any point in time an incentive exists for the policy-maker to generate unexpected inflation and raise output. But forward-looking agents anticipate this incentive and expect an inflation rate which is higher than "announced". Hence the government must

15this might be due to existing distortions which make the "natural" level of output too low "accomodate" a higher inflation rate just to keep output at the natural rate. In this context, Barro and Gordon (1983) describe an equilibrium solution where, although the policy maker has the power to operate inflation surprises, he lacks the incentive for doing so because the expected inflation rises to just that level at which the marginal cost of a surprise inflation is equal to its marginal benefit in terms of higher output. As it may seem intuitively obvious, the outcome where the policy is time consistent is heavily inferior to the one which would prevail if the optimal time inconsistent policy were implemented. The solution advocated by Kydland and Prescott was that Governments should constrain themselves to follow a non optimizing arbitrarily fixed rule which might turn out to be preferable to a time consistent policy.

> "economic theory [should] be used to evaluate policy rules and that one with good operating characteristics be selected.... it is preferable that selected rules be simple and easily understood, so that it is obvious when a policymaker deviates from the policy. There should be institutional arrangements which make it a difficult and time-consuming

process to change the policy rules in all but emergency situations"[16]

Referring to the former example a fixed rule would spare the economy the higher expected inflation rate which is necessary to render the marginal cost of an inflation surprise equal to the benefit accruing from the corresponding output expansion.

An important strand of the literature following the work of Kydland and Prescott has stressed the importance of the government precommitment to carry through the plan implied by the initial optimization and has suggested that the loss of reputation following a policy surprise might impair the successful implementation of future policy plans and therefore would deter governments from reneging on announced policies[17]. In this context it might be superfluous that governments are forced by law to abide rules, provided that departures from the announced policy may be easily recognized by the private sector.

A further development, which is of key importance for the research to be carried out in this thesis, has been the search for simple contingent rules which, by not

16Kydland and Prescott (1977), quoted in Christodoulakis et al. (1989)

17See Barro and Gordon (1983) and, for a more general treatment, Levine (1988) involving the degree of complexity typical of optimal policies, are easily understood by the private sector. This is discussed in the next two subsections, in which we also discuss the connections between the time inconsistency problem and the use of simple rules.

3.3. The design of simple macropolicy rules

In general a fully optimal rule is a rule contingent on all state variables. Intuitively it should be clear that this is the most efficient way of steering the controlled economy as the fully optimal rule controls "everything". But a rule which is exceedingly complex and difficult to understand and to monitor might raise serious problems of credibility. If policy precommitment is to be made credible in the eyes of the private sector, then it is crucial that policy assessment may be carried out easily. Simple feedback rules may well serve this purpose. Another reason for advocating the choice of simple rules concerns robustness[18]. An obvious reason why fully optimal policies outperform simple rules is that the former exploit the details of the dynamic system to be controlled. But to the extent that these aspects are model specific, highly uncertain and subject to

18see Currie and Levine (1985)

frequent changes over time, the gains from full optimization may prove illusory. Optimal policies may perform badly in the face of even minor alterations of the dynamic structure of the economy. By contrast well designed simple rules may turn out to be more robust in presence of such changes[19].

A third source of skepticism with fully optimal policies concerns the way the loss function J is defined. Very often[20] the range of variables included in the objective function is not related to plausible consideration about social welfare; instead its choice is made with the aim of obtaining "acceptable" results[21]. Methods have been suggested for "tuning" the penalty matrices so that dynamic instability is prevented[22] or the optimal solution trajectories are kept reasonably close to the target path[23]. But under no circumstances could policies designed following such methods be regarded as the outcome of a genuine optimization process. Ad-hocery is certainly an inherent feature to the design of simple rules when the functional form and the strength of control parameters

19This has been clearly shown by Christodoulakis and Levine (1987)
20See Vines et al. (1989)
21See Vines et al. (1989)
22See Doyle and Stein (1981)
23See Rustem et al. (1979)

are selected, but very often full optimization removes it only to re-introduce arbitrariness in the design of the objective function.

It has been argued elsewhere that simple rules should be selected according to the following lines[24]:

-the dynamic structure of the rules should be simple

-each instrument should respond to a limited set of variables. Of preeminent interest for the present work is that class of simple rules (assignment rules) which assign each instrument to a specific set of target variables. Within this set of assignment rules we shall be concerned with decoupled control rules[25] which entail the assignment of each instrument to a specific target variable.

The simple rules we shall be dealing with throughout the thesis will take the following general form:

$dw = h_1 IdT + h_2 IT;$

where w and T are respectively the vectors of control and target variables, h_1 and h_2 are the vectors of control parameters and I is the identity matrix. We shall therefore consider decoupled rules involving proportional and integral control[26].

24See Currie, Holtham and Hughes Hallett (1988)
25This definition is drawn from Vines et al. (1983)
26in the sense of Phillips (1957)

3.4. Time inconsistency and simple rules

The problem of time inconsistency potentially applies to simple rules as well as to full optimal control. Consider again the M. Miller example of an interest rate rise to fight inflation through currency appreciation. Suppose that a simple proportional rule were operated which required merely an interest rate x% above the world interest rate for every 1% that inflation was above target. An inflation shock would lead to an immediate raising of interest rates. It would also immediately lead to a currency appreciation whose extent partly depended on the knowledge that interest rates would remain high all through the future period during which inflation was brought down. This knowledge that, according to the rule, interest rates would be high in the future would therefore bring inflation down immediately through the currency appreciation. But when the future arrived there would be an incentive for the government to revise the rule so as to lower x. Such a redesigned rule would enable a partial relaxation of the high interest rate policy and would be desirable because the past anticipation of the high interest rate policy would have already deflated the economy.

This example shows that simple rules, as well as optimal policies, run into the time inconsistency problem when the private sector adopts a forward-looking behaviour. In this thesis we do not tackle this problem. We simply assume that reneging would involve a loss of reputation whose cost, in terms of a lesser chance to implement policies requiring such reputation, would be sufficiently high to prevent the government from redesigning its policy. In this context the adoption of simple rules is precisely meant to help the private sector to understand government's behaviour and so more accurately build it into their expectations[27]. Throughout the thesis we shall therefore assume that the government sticks to announced policies and that the private sector fully trusts the government.

3.5. Targets and instruments of macroeconomic policy

The next issue to be discussed concerns the choice of targets and instruments of macroeconomic policy.

The adoption of targets

We have already stated that the experience of setting monetary targets has been disappointing. Basically, this failure is to be ascribed to the frequent shifts in the velocity of circulation which occurred over the

27This was discussed in Vines et al. (1989), chapter2 last few years. The adoption of new policy targets obviously reflects the underlying philosophy of policymaking. Whatever the merits of a money supply target per se, monetarist policies relied on the presumption that governments should only be concerned with inflation control, neglecting output fluctuations. If policy were to retain this principle and the only required change was to allow for the apparent inefficiency of monetary targets as a result of velocity shifts, then the natural substitute would be a price level target (or an inflation rate target[28]). Barro (1985) has advocated the choice of a price level target, precisely on the grounds that it would enable the policymaker to offset shocks originating in the money market. As an alternative he considered the adoption of a nominal exchange rate rule[29]. Obviously the adoption of such rule would raise the issue of international leadership in the definition of the global inflation target. Others have suggested[30] that policy aim at stabilizing nominal GDP. In contrast with

28Needless to say, the two targets are closely interrelated, as setting a price level target implies integral control of inflation.
29McKinnon (1988) has advocated the return to a fixed exchange rate regime. We give a detailed account of his proposal in chapter 5.
30Hall (1980), Vines et al. (1983), Taylor (1984)

the former proposals, this rule prescribes a policy feedback on both the price level and on real output. It relies on the presumption that wage-price stickiness leaves room for policy effects on output stabilization. Vines et al. (1989) put forward two reasons for adopting a nominal income target. The first is that it would still discourage inflationary wage claims in the labour market as trade unions would anticipate that an inflation rate above target would be matched by a loss of output and employment, even although it would do this less rigorously than a strict price level target. The second is that, should prices rise for some unforeseen event, the money GDP target would set a ceiling to the corresponding output loss, whereas under a price rule the recession would need to be intensified as long as the price level were above target. A widespread criticism of this proposal is that it implies that the policymaker puts equal weight on output and price fluctuations. Fischer (1988) argues that such a trade-off would be unlikely to be accepted if put explicitly. In principle, there is nothing that should prevent the policymaker from stating a target which exactly reflects his preferences in terms of output and inflation. A boundless range of targets would then be available, but to the extent that some cost was attached to output fluctuations such targets would still be in the spirit of a nominal income target, whose basic feature is the explicit recognition of the influence of policy on output fluctuations. In some recent attempts to evaluate the performance of simple policy rules nominal income targets have been adopted[31]. We shall make the same choice in this thesis, namely in chapters 4 and 6.

But controlling nominal income only might not be enough to ensure that policy does not lead to adverse results in the long run. Vines et al. (1989) have advocated the adoption of a national wealth target along with nominal income. They suggest that policy should aim at targeting the distribution of national resources between investment and consumption. The first reason for doing so obviously is that ensuring sufficient investment would help achieving sustained productivity growth in the longer run. The second reason is that a wealth target would prevent stabilization policies that curb current inflation at the cost of lower growth in the future. An obvious example of how such outcome might occur is a policy combining a lax fiscal stance

31Vines et al. (1989),

with relatively high real interest rates. As a result domestic output and inflation would be kept on target but the policy mix would raise consumption relative to investment, with adverse results in the longer run. In an open economy such policy would generate another undesirable consequence: higher interest rates would appreciate the exchange rate and penalize the trade sector. The "wrong" policy mix would cause a current account deficit. In the long run the inevitable exchange rate depreciation would require a contraction of domestic consumption to offset the inflationary consequences of the devaluation, and free resources for the improvement of the foreign balance. Furthermore, the permanent accumulation of foreign debt would cause a permanent future subtraction to national disposable income, as foreign debt would have to be serviced. Indeed much of the recent debate on policy stabilization has focussed on the importance of pursuing policies that are consistent with external balance. The well known target zones proposal is built with the aim of avoiding unsustainable trade imbalances[32]. In this thesis we shall evaluate policy proposals which include a wealth target. But since the

32We shall review this proposal in chapter 5 scope of this work is restricted to the analysis of stabilization policies in a context which rules out capital accumulation, we shall only consider a foreign wealth target, defined as the net stock of financial claims on foreign residents held by the domestic private sector[33].

Adopting a foreign wealth target is a fundamental departure from the monetarist orthodoxy. Followers of the monetary approach to the balance of payments[34], suggest that governments should focus on the internal objective, neglecting the evolution of the current account, whose balance is merely regarded as the result of saving-consumption decisions of the private sector. Typically, monetarists assert that, as long as the budget is balanced, governments should not be concerned with external disequilibria simply because the private sector will not run a permanent deficit. But this approach seems open to criticism for several reasons. We have already pointed at the danger that policies who neglect the external constraint might produce illusory gains in the short run control of the domestic target

33This definition is drawn from the seminal works of Branson (1978) and Kouri (1976)
34The approach was explicitly put forward by Frenkel and Johnson (1974), but still retains great influence, see Genberg and Svoboda (1988) and the review in Boughton (1989)

at the expenses of the long run performance of the economy. But we see two more reasons for setting a foreign wealth target.

First of all, external deficits increase the consumption of current generations at the expenses of the future ones (Cooper, 1985). Therefore governments might be concerned with ensuring that such a transfer is consistent with the collective preferences of the public (Boughton, 1988). Secondly, the danger of withdrawal on short notice might turn external debt into a serious threat to national independence (Dornbusch and Park,1988).

We agree with the view that setting a foreign wealth target, in a direct or indirect way[35], must be a key element of a policy package. Throughout the thesis we shall be greatly concerned with the current account implications of policy. This is one of the main distinctive elements of the research.

Instruments selection

Traditionally, Keynesian policies relied on both monetary and fiscal instruments. The monetarist "counterrevolution" stressed the role of the monetary

35As an example of an indirect way of setting a foreign wealth target consider the target zones proposal, where the choice of an exchange rate target implies the definition of the country's net external position.

instrument. Controlling monetary aggregates has proven extremely difficult, but the manipulation of interest rates has been quite effective. The monetary feedback policies we shall analyze in this thesis will therefore involve control of a short term <u>real</u> interest rate. Rules of this kind have recently found growing acceptance[36]. It is well known since Poole's (1970) seminal article that pegging the interest rate insulates the economy from the adverse effects of demand for money instability. The traditional monetarist objection to an interest rate peg is that such policy would leave the economy without a "nominal anchor". This argument does not apply here, as a)we consider an interest rate feedback rule and b) this operates on the real rate. It is a familiar danger that pegging the interest rate instead of monetary aggregates might cause instability because, when inflation rises the real rate falls. But here we operate a rule on the real interest rate, so that a rise in inflation causes a rise of the nominal rate and this is part of a feedback policy designed so that real rates would be <u>raised</u> when inflation increased.

36See Currie and Levine (1985), Edison Miller and Williamson (1987) Vines et al. (1989), Currie and Wren-Lewis (1988)

Controlling a real interest rate obviously faces the difficulty of measuring the actual inflation rate but, as Edison Miller and Williamson (1987) suggest, this is by no means more difficult than measuring and interpreting monetary aggregates.

The existence of a second target, besides the domestic objective, raises the issue of selecting an additional instrument, if policy goals are to be met. Fiscal policy would seem the most obvious candidate. After a period of widespread acceptance of the monetarist prescription that governments should simply opt for a balanced budget, recent years have witnessed a resurrection of policy "packages" which involve active use of the fiscal instrument for the purpose of macroeconomic stabilization[37]. New classical theorists[38] would appeal to the Ricardian equivalence theorem to assert that fiscal policy cannot affect the saving/consumption decisions of rational forward-looking agents. But the work of Blanchard (1985) has shown that such ineffectiveness proposition only holds under the assumption of infinitely-lived agents. When this restrictive hypothesis is removed it is shown that

37See Meade (1983), Williamson (1987), Boughton (1989), Vines et al. (1989)
38See Barro (1974)

even rational, forward-looking consumption decisions made in the context of a life-cycle hypothesis are affected by the current fiscal policy stance.

The fiscal instrument will be part of some of the policy proposals to be assessed in this thesis. Shifts of the fiscal stance can be operated on either side of the budget accounts, that is, by manipulating either expenditures or revenues. Vines et al. (1983) have argued in favour of tax rate rules, as such instrument are likely to be more flexible and less costly to alter than public expenditures. In chapter 4 we shall refer to the tax rate as the fiscal instrument, whereas in chapter 6 we shall refer to the more general concept of a fiscal stance index[39].

3.6 Summary

This chapter has pointed out how new progress has been made in the search for a policy framework alternative to the monetarist orthodoxy. Such a new framework is built on the following basic hypotheses.

39The reason we do so in chapter 6 is that since we wish to provide a further evaluation of the target zones proposal, we want to keep our model as close as possible to the original version of Edison, Miller and Williamson (1987)

-sluggish price adjustment leaves substantial room for disequilibrium and therefore for macroeconomic stabilization policies

-such policies are designed to provide a stable environment. Hence they are publicly announced and policy makers recognize that rational forward-looking agents will behave according to their perceptions of government's policies. Therefore credibility and sustainability are essential prerequisites of policy packages. In this context simple feedback rules might turn out to be more appealing than full optimization.

-policy targets should include both inflation and output; we opt for nominal income. Furthermore, the adoption of national wealth targets would prevent policies which yield short run gains at the expenses of the longer term performance of the economy.

3.7.Outline of the rest of the thesis

The thesis is laid out as follows.

Chapter 2 is a basic literature review of models of floating exchange rates. It enables us to build up the key pieces of our model. It points to the importance of wealth effects for exchange rate determination, as it has been pointed out by Branson (1979) and by Dornbusch and Fischer (1980). But it also shows that scarce attention has been paid to the problem of exchange rate determination in models where goods prices are sticky, exchange rate expectations are forward looking, and wealth effects occur.

Chapter 3 presents a more general model of this kind and highlights the danger of instability inherent to such models under a monetarist regime. Several criticisms have been raised of monetarist policies[40]; in this chapter we stress another reason of dissatisfaction, as we show that under such policies dynamic instability might occur. Furthermore, we show that the danger of instability arises because the process of wealth accumulation, operating through the current account, is deliberately not controlled under a monetarist regime. Indeed the enphasis on the adoption of foreign wealth targets is a key issue throughout the following chapters.

Chapter 4 is a central contribution of the thesis to which chapters 2 and 3 lead. We abandon the monetarist orthodoxy and move on to evaluate the relative performance of 4 alternative policy assignments in an open economy which involve simple feedback rules. This is done by means of both algebraic

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40See Vines et al. (1983), chapter 2

analysis and numerical simulations of a small theoretical model. The rules we consider can be described as follows.

Rule 1, a "monetarist" rule, assignes a real interest rate feedback to a nominal income target. Rule 2, which originates from the "Group of Cambridge", working with Meade, and from Boughton (1989), adds fiscal control of a foreign wealth target to the monetary control of the internal objective. Rule 3 simply reverses the Meade assignment, as it sets fiscal control of domestic nominal income and monetary control of the foreign wealth target. Finally, rule 4 applies in a small country context the kind of assignment advocated in the Target Zones proposal by Williamson: the government is supposed to dispense with monetary policy altogether and to assign fiscal policy to the domestic target. We will obviously comment later on the original results of our analysis. One general point we wish to stress from the outset is the importance of fiscal policy in a well designed policy package, especially if it is assigned to a wealth target.

In part two of the thesis chapters 5 and 6 apply our ideas to issues of policy coordination. Chapter 5 is merely a literature survey which mainly concentrates on those issues in the policy coordination debate that are relevant for an application of simple rules.

Chapter 6 is the substantive contribution. In a two-country setting we consider a disinflation experiment and we assess the relative performance of three alternative proposals, which assign the same instrument to the control of global, or average, inflation, but differ in their strategies of reduction of intercountry inflation differentials and of foreign wealth control. The first rule is the well known Williamson's Target Zones proposal. The second is a standard "monetarist" rule. The third is a two-country version of the Meade assignment. The analysis crucially differs from the one carried out in chapter 4 as it accounts for the international ripercussions of individual policy actions. Furthermore, it gives a detailed account of the influence of global disinflation policy on intercountry inflation differentials, which occurs through the international transfer of wealth determined by the fluctuation of world interest rates.

CHAPTER 2
MONETARIST MACROECONOMIC POLICIES AND EXCHANGE RATE DETERMINATION: A CRITICAL SURVEY.

1. Introduction

In this chapter we carry out a critical assessment of the main contributions to the theory of exchange rate determination under fixed "open loop" policy rules that could be labeled as "Monetarist" policies. We use this term to mean that the money supply, the level of public expenditure and their rates of change are regarded as exogenous.

2. The basic monetary model

The monetary approach to the determination of a flexible exchange rate regards the exchange rate as an asset price[1], namely the price at which level agents are prepared to hold the outstanding stock of domestic money. Proponents of the monetary approach[2] rely upon the so called "small country assumption": neither changes in domestic real output can affect relative prices in the international goods market, where homogeneous goods are sold, nor can variations in the domestic saving rate induce changes in the world real interest rate. In the financial markets assets

1See Mussa (1977)
2Mussa (1977), Bilson (1978), Frenkel (1976)

denominated in different currencies are considered perfect substitutes; therefore the domestic interest rate, i, is tied to the world interest rate, i^f,

1) $i - i^f = Ede$;

where Ede is the expected variation of the exchange rate. Interest rate differentials must be matched by the expected cost of holding domestic rather than foreign currency. Eq.1) has been referred to as uncovered interest parity condition[3] .

In the goods market perfect competition and international arbitrage are necessary to assume the equivalence between national and foreign price levels expressed in the same currency.

2) $ep^f = p$

where p and p^f are respectively the domestic and foreign price levels. Both variables can be re-expressed in terms of the domestic and foreign money supplies and real money demands.

3) $m/p = (y^{k_1})\exp(-k_2 i)$;

4) $(m/p)^f = (y^{f k_1})\exp(-k_2 i^f)$;

3Eq.1) implicitly assumes that agents are neutral towards the exchange rate and the default risk associated with foreign investment. Later this will be discussed in more detail.

y and y^f, domestic and foreign real outputs, are assumed to be fixed at the natural rate. Continuous clearing in the goods markets is due to perfect price flexibility. Substituting 1), 3), 4), into 2) we get :

5) $e = (m/m^f)(y^f/y)^{k_1}\exp(-k_2 Ede)$;

The current exchange rate depends on the relative money supplies, the relative outputs, and expectations about future levels of the exchange rate. Under the rational expectations hypothesis expected variations of the exchange rate correspond to actual changes. Therefore from 5), imposing for simplicity that

$p^f = y^f = m^f = 1$

and taking logs, yields[4]:

6) $e_t = (m-p)_t \,/\, (1+k_2\,) - y_t(k_1 \,/\, 1+k_2\,) + e_{t+1}(k_2/$
$/\, 1+k_2\,)$

In a more general form

7) $e_{t+j} = (m-p)_{t+j}/(1+k_2) - y_{t+j}(k_1/1+k_2) +$
$+\, e_{t+j+1}(k_2/1+k_2)$

Repeatedly substituting 7 into 6) and ruling out the possibility of unstable paths[5] we obtain:

8) $e_{t+j}= (1+k_2)^{-1}\Sigma(m-p)_{t+j}(k_1/1+k_2)^{j}-$

4This formulation is due to Hoffmann and Schlagenhauf (1983)
5On the rationale for imposing the transversality condition see Sargent and Wallace (1973)

$$-(k_1/1+k_2)\Sigma y_{t+j}(k_1/1+k_2)^j$$

The exchange rate is expressed as a function of current and expected future values of the exogenous variables, y and m.

3. Criticisms

Not surprisingly, the monetary model has been criticized on different grounds and this has led to further developments. First of all the Dornbusch model[6] accounts for the sluggish adjustment of the price level to demand shocks. Secondly, another strand of the literature has re-established the "missing link" between the exchange rate and the current account. According to the proponents of the monetary model the current account does not matter at all for exchange rate determination. The monetarist school[7] merely regards the current/capital account flows as the difference between current levels of production and consumption, where agents are supposed to make consumption/savings decisions on the grounds of the permanent income theory. For this approach to hold at the micro-level, agents neutrality towards the risk associated with future income must be assumed as well

6Dornbusch (1976) For an extension including the role of unanticipated disturbances see Wilson (1979)
7This is clearly stated in Frenkel and Johnson(1976)

as unlimited access to credit. Also, at the macro level, it is needed that temporary surpluses of domestic output on consumption can be always sold without any effect on relative prices. Furthermore it is necessary that current account deficits of whatever size are financed by foreign agents at a constant real interest rate. Some authors have turned to an alternative specification of the consumption function[8], linking current consumption with current income and the stock of financial wealth. Since foreign assets held by domestic residents obviously are a component of financial wealth, it turns out that the equilibrium exchange rate cannot be determined unless the current account flow equals zero. Another reason for considering the exchange rate as jointly determined with the equilibrium level of the domestic holdings of foreign assets is that assets denominated in different currencies are not, in general, perfect substitutes, unless agents are neutral towards the risk associated with the determination of the future foreign exchange rate. Portfolio models of exchange rate determination[9]

8Kouri (1976) Dornbusch and Fischer (1980) Engel and Flood (1985)

9Branson (1979 and 1984), Eaton and Turnovsky (1983) Driskill (1981) focus on this aspect. They assume that interest rate differentials do not arise only to match expected exchange rate changes, but also as a compensation for the risk of holding foreign assets. Once again the exchange rate cannot be set independently from the current account: changes in the stock of foreign assets will cause portfolio adjustment and instantaneous exchange rate movements.

In the next sections we shall give a more detailed account of these developments of the monetary model.

4. Sticky prices, wealth effects and imperfect capital mobility: a review of the literature.

At this stage we shall discuss in some detail the main theoretical contributions that embed the criticisms of the basic monetary approach we have outlined in the previous section. The first model to be discussed here is the Dornbusch, (1976) extension of the traditional Fleming-Mundell model. Secondly, we shall analyze the Dornbusch and Fischer (1980) model, relating wealth accumulation to domestic expenditure and the exchange rate. Finally, Branson's, (1984), portfolio model of exchange rate determination will be taken into account.

4.1.The Dornbusch model

Dornbusch assumes that, although in the long run changes of the money supply are fully neutral, sluggish price adjustment leaves room for short term disequilibrium. Henceforth the observed exchange rate volatility and the deviations from purchasing power parity are linked to short term price stickiness in the aftermath of monetary shocks.

8)$m-p = k_1y - k_2i$;

9)$i-i^f = Ede$;

10)$Ede = de$

Eq. 8), 9), 10) describe[10] the equilibrium conditions in the financial sector of the economy. Eq. 8) is a standard demand for money function, excluding financial wealth. It follows from eq.9) that Dornbusch assumes perfect capital mobility: deviations of the domestic interest rate from the international one can arise only as a compensation for expected exchange rate changes. It is also clear from equation 10) that expectations are assumed to be rational: the expected exchange rate

10Dynamics are specified here in continuous time. Needless to say the model is loglinear.

variation corresponds to its actual rate of change.

11) $dp = \epsilon(D - y^*)$

12) $D = \alpha[\beta(e-p) - \sigma i - \delta s]$

Eq. 11) describes price dynamics as a function of the gap between aggregate demand, D, and output, y^*, which is assumed to be fixed at its "natural" rate. In eq.12 aggregate demand is positively affected by terms of trade, $(e-p)$, the nominal interest rate and real taxation, s[11],. Substituting eq. 8, 10, 12, in 9, 11 we obtain the system in state space form:

$$X_1 = AX_2 + BX_3$$

where $X_1' = [dp, de]$, $X_2' = [p, e]$,

$X_3 = [y^*, s, m-p, i^f]$

$$A = \begin{bmatrix} -\epsilon\alpha(\beta+\sigma/k_2) & \epsilon\alpha\beta \\ 1/k_2 & 0 \end{bmatrix}$$

$$B = \begin{bmatrix} \epsilon(1 + \alpha\sigma k_1/k_2) & -\epsilon\alpha\delta & \epsilon\alpha\sigma & 0 \\ k_1/k_2 & 0 & 1/k_2 & -1 \end{bmatrix}$$

The equilibrium values of dynamic endogenous variables, p and e, are:

$p_{\infty} = -k_1 y^* + k_2 i^f + m$

11In the original Dornbusch model fiscal policy was not explicitly taken into account. Nonetheless we make this assumption here as it has commonly been done in the literature originating from Dornbusch seminal work. See Branson and Buiter (1981)

$e_\infty = [(\alpha\beta)^{-1} - k_1]y^* + [k_2 + \sigma/\beta]i^f + (\delta/\beta)s + m$ The money supply has no long run effect on real variables, in equilibrium purchasing power parity holds after a monetary shock: dm = dp = de. Fiscal policy permanently alters aggregate demand and requires an offsetting variation of the terms of trade. A fiscal expansion, e.g. a reduction of the tax rate, causes an exchange rate appreciation to be matched by a revaluation of the terms of trade. The absence of any long term link between p and s depends on the assumptions of perfect capital mobility and no wealth effects in demand for money. In the next chapter we shall present a more general model where fiscal policy does affect the price level. Changes in the natural rate of output require the adjustment of both p and e. The price variation is determined at the level which ensures equilibrium in the money market, being m and $i=i^f$ fixed, determined respectively by the government and the international financial markets. The exchange rate adjustment must be such that, given the price fall, the relative prices depreciation brings aggregate demand at the level which corresponds to the new equilibrium rate of output. A rise of the world interest rate lowers demand for money and causes a price increase. In order to keep aggregate demand in equilibrium e must depreciate. Furthermore, the negative impact of i^f on D must be offset by a terms of trade devaluation, ensured by a further exchange rate rise.

Let's turn now to the analysis of price and exchange rate dynamics. As it is well known, rational expectations models can be stable and uniquely determined only if the number of unstable roots of the characteristic equation of the dynamic matrix is matched by the number of non pre-determined variables, which are allowed to make discrete jumps in response to shocks[12]. Therefore the Dornbusch model can be stable if its characteristic equation has two roots of different sign, a result which is actually ensured by the structure of the transition matrix, A. The two roots of the Characteristic equation (A−θI) = 0 are:

$$\theta_s = -\epsilon\alpha(\beta+\sigma/k_2)/2 - (1/2)\{\epsilon\alpha[\beta+\sigma/k_2]^2+4\epsilon\alpha\beta/k_2\}^{1/2}$$

$$\theta_u = -\epsilon\alpha(\beta+\sigma/k_2)/2 + (1/2)\{\epsilon\alpha[\beta+\sigma/k_2]^2+4\epsilon\alpha\beta/k_2\}^{1/2}$$

12Blanchard Kahn, (1980)

Exchange rate and price dynamics can then be described as follows[13]:

$p_t = p_\infty + C\theta_s k_2 \exp(\theta_s t);$

$e_t = e_\infty + C\exp(\theta_s t);$

where p_∞ and e_∞ stand for the equilibrium price level and exchange rate. C is a constant which can be defined as a function of p_0-p_∞.

$C = (p_0-p_\infty)/k_2\theta_s$

Once C is determined, it is trivial to compute the intial exchange rate overshooting (undershooting):

$e(0)-e_\infty = (p_0-p_\infty)/k_2\theta_s$

After a money supply increase $p_0<p_\infty$ and $e(0)>e_\infty$, since $\theta_s<0$. Henceforth the actual amplitude of the initial exchange rate jump depends on the size of the exogenous shock, of the stable root and of the interest rate semielasticity in the money market. θ_s is

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13The general solution for this class of dynamic systems is:

$p_t-p_\infty = AU_u\exp(\theta_u t) + CU_s\exp(\theta_s t);$

$e_t-e_\infty = A\exp(\theta_u t) + C\exp(\theta_s t);$

where $[U_u, 1]$ and $[U_s, 1]$ are the eigenvector associated to the unstable and to the stable root, respectively θ_u and θ_s. C and A are arbitrary constants. Imposing the transversality condition we set A = 0 and choose to analyze the only stable dynamic path.

real, henceforth the dynamic path must be monotonic[14]. The gap between the current and the equilibrium exchange rate is negatively related, at any point in time, to the gap between the current and the equilibrium price level. It is quite apparent that changes of the tax rate are instantaneously offset by exchange rate jumps and do not involve any dynamics at all. But less restrictive assumptions about the degree of capital mobility and the inclusion of financial wealth as an argument of demand for money would yield quite different results[15].

We give the following interpretation of the overshooting result. In the aftermath of unanticipated shocks, i.e. an increase of the money supply, the exchange rate immediately jumps, but the sluggish price adjustment prevents e from setting at its new long run equilibrium value. In fact the monetary shock causes disequilibrium in the money market and a fall of the domestic interest rate. From eq.9 it is clear that this fall is sustainable only if the expected exchange rate change is negative. This requires that the instantaneous exchange rate jump overshoots the long

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14For a formal proof of this assertion see Gandolfo (1971)
15See Branson and Buiter (1981)

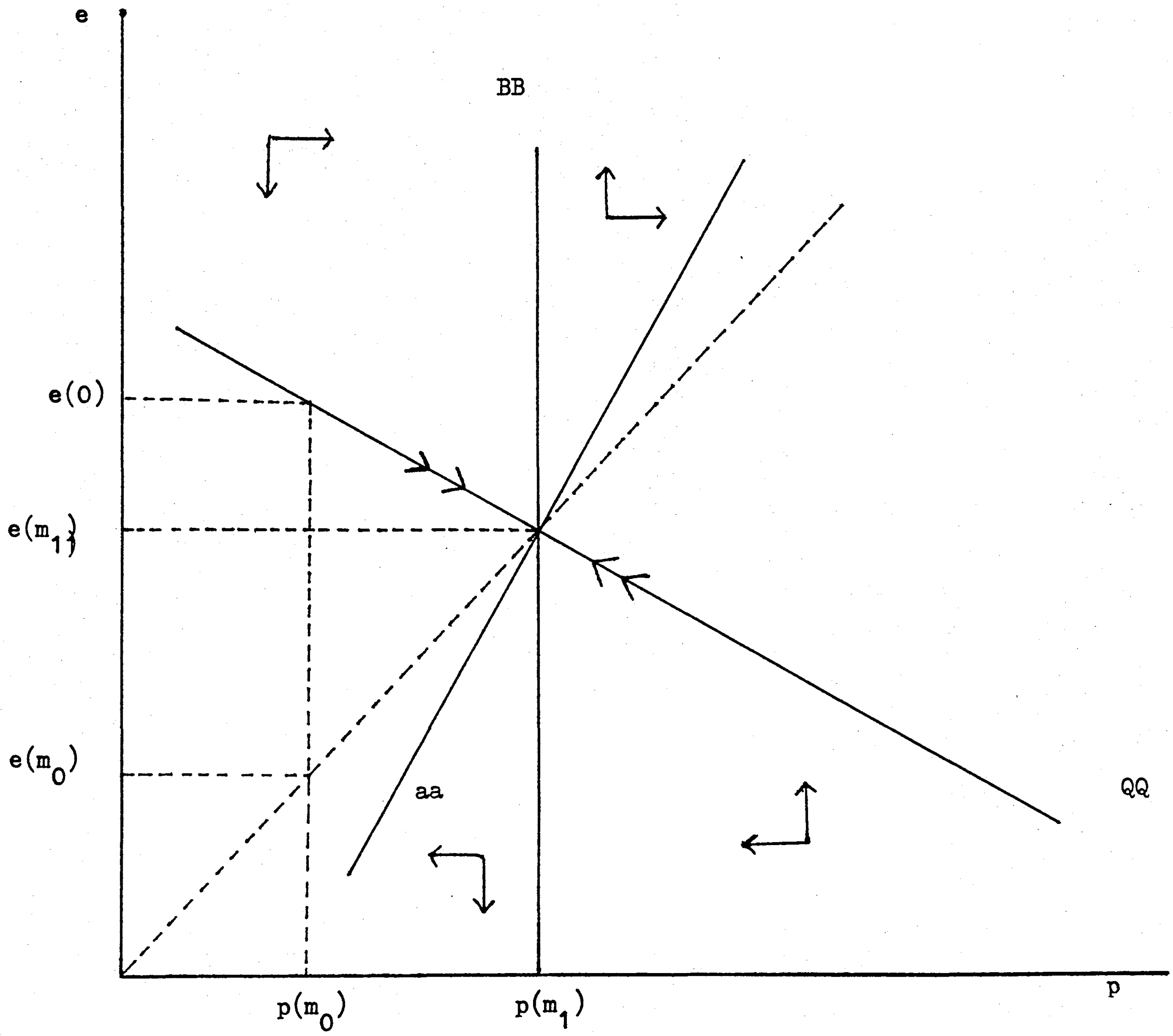
run depreciation (de = dm). After the initial exchange rate overshooting the terms of trade devaluation and the fall of the interest rate gradually drive the price level upwards. This raises demand for money and brings the interest rate up to its previous level. Correspondingly, the exchange rate appreciates steadily. When purchasing power parity is restored the system is back to equilibrium. These concepts can be illustrated graphically (graph 1). Just before the monetary shock occurs the system is in equilibrium at point a. When m shifts from m_o to m_1 the new equilibrium position is set at point b, lying along the 45 degrees line because in equilibrium:

$de/dm = dp/dm$.

The AA and BB loci represent the combinations of e and p that ensure equilibrium in the goods and money markets, for a given set of values of the exogenous variables. In this case the position of AA and BB depends on the new level of the money supply,

$p_o = p(m_o)$ is fixed, e(0) jumps on to the saddlepath associated with the new equilibrium point. Since then the combinations of e and p that feature the system's dynamics lie along the QQ line: the exchange rate initially overshoots its long run depreciation and then

GRAPH 1



constantly appreciates, the price level gradually increases.

4.2. Wealth effects, exchange rate overshooting and current account dynamics in the Dornbusch and Fischer model

The model

Dornbusch and Fischer abandon the hypothesis of sluggish price adjustment and investigate the connections among the current account, the international redistribution of wealth and the variation of relative prices[16]. We discuss their results by suitably modifying the Dornbusch model.

8b) $m-p = k_1 y^* - k_2 i + k_3(W-p)$;

13) $W = (1-w_1)m + w_1(e + F)$

9) $i-i^f = Ede$;

10) $Ede = de$

11b) $D = y^*$

12b) $D = \alpha[X^* + \beta(e-p) - \sigma i - \delta s + \tau(e+F-p)]$

14) $dF = -\tau(W-p)$

The stock of financial wealth, W, held by domestic residents is introduced in the demand for money function, eq.8b. Wealth is assumed to be held in the

16The original model of Dornbusch and Fischer is set out in implicit form. To simplify the exposition we log-linearize it, at the cost of making some restrictive assumptions. Variables are expressed as deviations from equilibrium.

form of foreign assets, F, and real money balances, eq.13. Following Driskill (1980) and Eaton and Turnovsky (1983) we have linearized W around equilibrium, w_1 being the initial share of foreign wealth on W[17].
Continuous equilibrium between demand, D, and supply, y^*, is ensured by perfect price flexibility, eq.11b. Real wealth and a shift term representing shocks to foreign demand for domestic goods are included in aggregate demand. Quite surprisingly, Dornbusch and Fischer do not consider the influence of the interest rate on domestic demand. We have chosen to follow a more general specification of aggregate demand, as in 11b. In this model savings are assumed to be a negative function of real financial wealth. Since no capital accumulation occurs, net savings can only take the form of foreign assets accumulation. Eq.14) is a typical partial adjustment dynamic equation, where agents gradually accumulate/decumulate assets according to the gap between current and "desired" levels of wealth.

17We have chosen to approximate wealth around equilibrium by a Cobb-Douglas function: $W = H[M^{1-\alpha}(eF)^{\alpha}]_0$, where H is an arbitrary constant. Taking logs and reminding that if W is to be a good approximation to actual wealth we must set $\alpha/(1-\alpha) = (eF/M)_0$ one may easily show that $\alpha = (eF/W)_0$

Dornbusch and Fischer define eq.14) as the current account flow. To define 14 as the current account it is necessary to make one strongly restrictive assumption. To derive a proper description of the current account one should first define consumption according to the life-cycle theory:

$c = by^{*} + \tau(W-p)$

The stock of fixed capital is constant, therefore savings, defined as s, only occur through foreign wealth accumulation, which is determined by the difference between ouput and consumption and by the service of foreign investment.

14a) $dF = s = y^{*} - c = (1-b)y^{*} - \tau(w-p) + i^{f}F$

The only way to reconcile 14a) with 14) is to drop the terms describing the influence on savings of output and foreign interest payments. Dornbusch and Fischer apparently do this and we shall follow them here, as this chapter only aims to review well known results, but we shall replace parameter Ω, apparently selected ad hoc, with the propensity to spend out of wealth, τ. Obviously, a correct specification of the current account would have led to alternative conclusions concerning both comparative statics and the stability condition. In fact eq.14 implies that long run changes of foreign assets must leave domestic real wealth constant, whereas this would not necessarily apply under 14a. Furthermore, the inclusion of foreign interest payments would highlight the potential instability inherent to this class of models. This issue has been raised by Branson in a study to be reviewed in the next section. In chapter three we shall further discuss the subject in a more general model which accounts for wealth effects, imperfect capital mobility, flexible output and sluggish inflation.

In order to obtain the Dornbusch and Fischer's model in state-space form we shall proceed as follows. First of all we express the endogenous non dynamic variables, p and i, in terms of endogenous dynamic and exogenous variables, substituting eq.12b, 13 into 8b and 11b.

15) $\pi_1 p = \pi_2 e + \pi_3 F + \pi_4 m - \delta s + X^* - y^*/\alpha;$

16) $i = \{-\pi_5 m + \pi_6 e + \pi_7 F + [k_1 - (1-k_3)/\alpha\pi_1]y^* + (1-k_3)[X^* - \delta s]\}/\pi_1 k_2;$

where

$\pi_1 = [\beta + \tau + \sigma(1-k_3)/k_2];$

$\pi_2 = [\beta + \tau - \sigma k_3 w_1/k_2];$

$\pi_3 = [\tau - \sigma k_3 w_1/k_2];$

$\pi_4 = [\tau + \sigma(1-k_3)(1-w_1)/k_2];$

$\pi_5 = \{1 - (1-w_1)k_3 - (1-k_3)\pi_4/\pi_1\}= \{w_1 k_3 + (1-$
$- k_3)[\beta+\sigma(1-k_3)w_1/k_2;$

$\pi_6 = \{ k_3 w_1 + (1-k_3)\pi_2/\pi_1\};$

$\pi_7 = \{ k_3 w_1 + (1-k_3)\pi_3/\pi_1\};$

π_1 describes the feedback effects of price variations in aggregate demand. A price rise appreciates the real exchange rate, and lowers domestic demand because real wealth falls. But the reduction of wealth weakens demand for money, so that the interest rate falls and domestic demand is stimulated. On the other hand lower real money balances require a higher interest rate, which has a negative impact on demand. $\sigma(1-k_3)/k_2$ shows the influence of the price level on the interest rate, via its effect on real wealth and real money balances; under the plausible assumption that $k_3<1$ it is obviously negative. π_3 describes the influence of financial wealth changes. An increase of F stimulates domestic consumption, but on the other hand raises demand for money and the interest rate. π_2

differs from π_3 because the exchange rate influences foreign demand as well as financial wealth[18]. Obviously the price change necessary to offset variations of financial wealth and nominal exchange rate is less than proportional. π_4 shows that the an expansion of the money supply raises wealth and lowers the interest rate: its effect on aggregate demand is unambiguously positive. $\pi_4/\pi_1<1$, because the price level has a broader effect on aggregate demand than the money supply. π_5, π_6, π_7 describe the influence of money, the nominal exchange rate and foreign wealth on the domestic interest rate. They include the direct impact of these variables on i and the one operating through the changes of the price level which are necessary to keep the goods market in equilibrium.

Let us now turn to the analysis of the system in state space form.

Substituting eq.10, 15, 16, into 9 and 14 we get:

$X_4 = CX_5 + DX_6$

where $X_4' = [de, dF]$, $X_5' = [e, F]$, $X_6' = [y^*, m, X^*, s]$

18The sign of $\pi_{2,3}$ cannot be defined a priori because, unlike Dornbusch and Fischer we introduce interest rate effects in aggregate demand.

$$C = \begin{matrix} \pi_6/k_2 & \pi_7/k_2 \\ -\tau\{w_1-\pi_2/\pi_1\} & -\tau\{w_1-\pi_3/\pi_1\} \end{matrix}$$

$$D = \begin{matrix} [k_1-(1-k_3)/\alpha\pi_1]/k_2 & -\pi_5/k_2 & (1-k_3)/\pi_1 k_2 & -(1-k_3)\delta/\pi_1 k_2 & -1 \\ \tau/\alpha\pi_1 & -\tau(1-w_1-\pi_4/\pi_1) & \tau/\pi_1 & -\tau\delta/\pi_1 & 0 \end{matrix}$$

Variations of e,F and m positively affect financial wealth, exerting a negative pressure on desired wealth accumulation, proportional to their shares on W. For the goods market to clear the variation of nominal financial wealth must be offset by a movement of the price level in the opposite direction.

Note that

$w_1-\pi_2/\pi_1 = \{w_1\sigma k_3/k_2 \quad -(1-w_1)(\beta+\tau)\}/\pi_1;$

$w_1-\pi_3/\pi_1 = \{w_1\sigma k_3/k_2 \quad -(1-w_1)\tau\}/\pi_1;$

Unlike Dornbusch and Fischer we are not able to define unambiguously the effect of changes of e and F on W. This because we include the interest rate in aggregate demand and so doing we stress a weakness of the original model. In fact it is difficult to find theoretical or empirical arguments for excluding the interest rate from aggregate demand and we have just shown that this significantly alters the structure of the transition matrix. Nevertheless saddlepath stability obtains anyway, as in Dornbusch and Fischer. The two roots of the characteristic equation $\| C-\theta I \| = 0$ are:

$$\theta_u=0.5[\pi_6/k_2 -\tau(w_1-\pi_3/\pi_1)]+$$
$$+0.5\{[\pi_6/k_2 -\tau(w_1-\pi_3/\pi_1)]^2+4(\tau\beta/k_2)J\}^{-1/2}$$

$$\theta s=0.5[\pi_6/k_2 -\tau(w_1-\pi_3/\pi_1)]-$$
$$-0.5\{[\pi_6/k_2 -\tau(w_1-\pi_3/\pi_1)]^2+4(\tau\beta w_1/k_2\pi_1)\}^{-1/2}$$

At any point in time, the relation between current and equilibrium values of the endogenous dynamic variables is defined as follows.

$$e_t = e_\infty + N\exp(\theta_s t);$$
$$F_t = F_\infty + Nu_s\exp(\theta_s t);$$

where $[1, u_s]$ is the right eigenvector associated with the stable root.

$u_s = (\theta_s k_2 - \pi_6)/\pi_7$ is negative. This means that:

$C = (F_0-F_\infty)/u_s$ is negatively related to F_0-F_∞. Whenever a change in the exogenous variables occurs that requires a long term rise of foreign assets, the exchange rate must overshoot its equilibrium value. θ_s is real, therefore after the initial exchange rate jump the exchange rate path will be monotonic, with e and F having opposite signs. When unexpected shocks occur, current account surpluses will be associated with exchange rate appreciation and vice versa. This is shown more clearly with the aid of the familiar state-space diagram.

17) $dF=0$: $e = \{-[w_1\pi_1-\pi_3]/[w_1\pi_1-\pi_2]\}F =$
$= \{-[(w_1-1)\tau + w_1\beta + w_1\sigma/k_2]/[(w_1-1)\tau + w_1\beta + w_1\sigma/k_2 - \beta]\}F$

18) $de=0$: $e = -(\pi_7/\pi_6)F =$
$= -\{[k_3w_1(\beta+\tau)+(1-k_3)\tau]/[k_3w_1(\beta+\tau)+(1-k_3)(\beta+\tau)]\}F$

18 represents locus ee in graphs 2,3,4. It is negatively sloped because e and F exert the same kind of influence on demand for money[19], hence if e rises F must fall correspondingly. Points located above the ee locus are associated with a devaluation because they imply that demand for money is above the current level of real money balances and this requires an interest rate rise to equilibrate the money market.

The slope of the FF locus, described by eq.17, depends on the sign of

$[(w_1-1)\tau + w_1\beta + w_1\sigma/k_2]$ and

$[(w_1-1)\tau + w_1\beta + w_1\sigma/k_2 - \beta]$.

19see discussion above

If these two coefficients have the same sign FF is negatively sloped. If

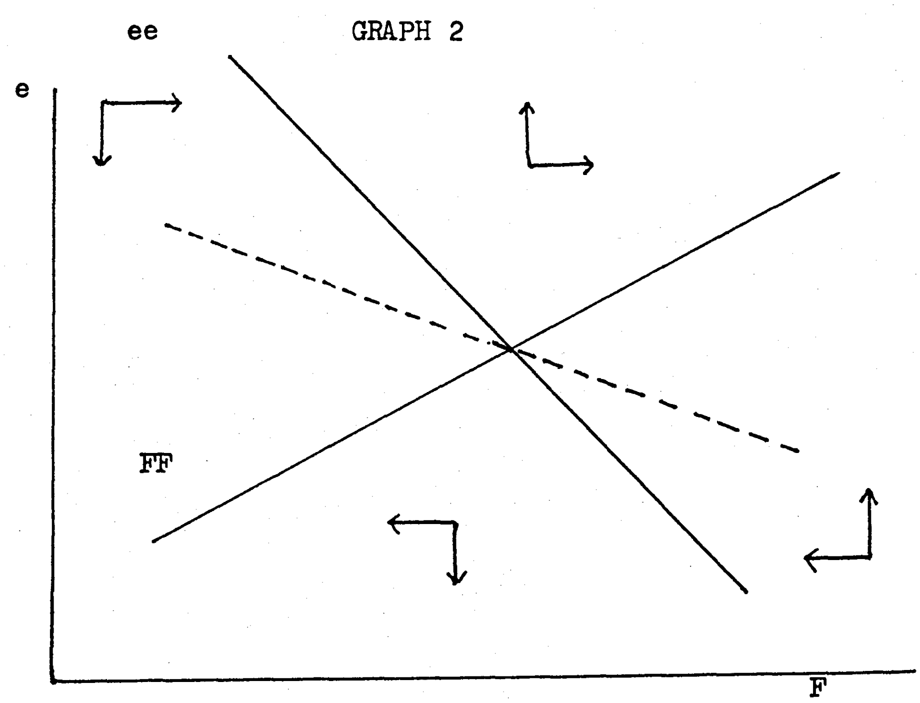
$[(w_1-1)\tau + w_1\beta + w_1\sigma/k_2]>0$ and $[(w_1-1)\tau + w_1\beta + w_1\sigma/k_2 - \beta]<0$

FF is positively sloped[20]. In this case, graph 2, a low level of financial assets, for a given exchange rate, triggers wealth accumulation and vice versa.

On the other hand, assuming that FF is negatively sloped, points below the FF locus are associated with foreign wealth decumulation, graph 3, when:

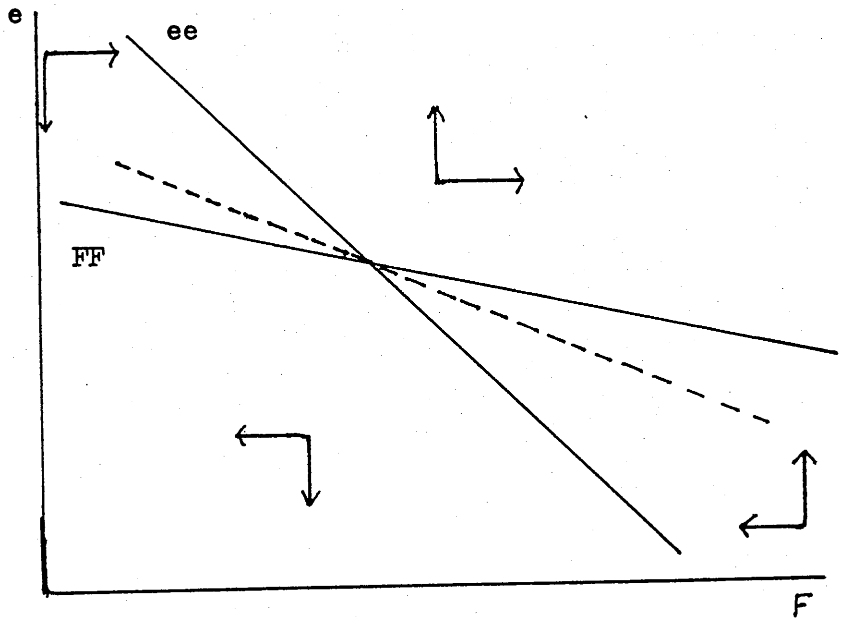
$[(w_1-1)\tau + w_1\beta + w_1\sigma/k_2]<0$

GRAPH 2

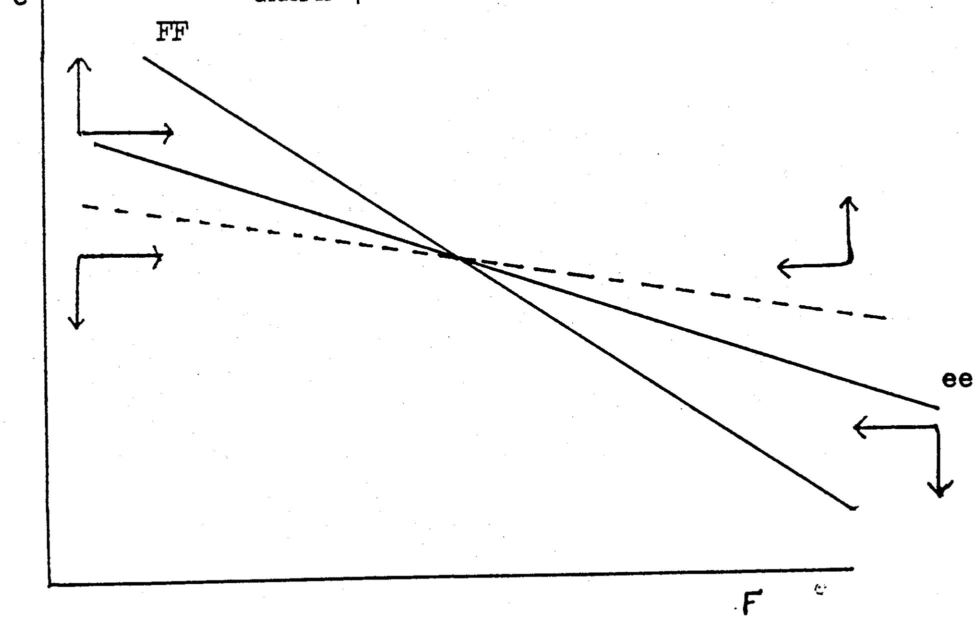


20Dornbusch and Fischer consider this case only.

GRAPH 3



GRAPH 4



Points below the FF are consistent with foreign wealth accumulation, graph 4, when

$[(w_1-1)\tau + w_1\beta + w_1\sigma/k_2]>0$

We are therefore left with three alternatives, but from the analysis of the roots of the characteristic equation we know that the system is saddlepath stable anyway. In each case an initial negative shock to F is associated with instantaneous exchange rate depreciation followed by gradual wealth accumulation and exchange rate appreciation towards the former equilibrium. It is clear from eq.16 that the shock to wealth lowers the interest rate. As in the Dornbusch model the jump of the exchange rate is then necessary to generate the expectation of a future appreciation, which compensates for the low level of the interest rate. But this is not the consequence of insufficient demand[21]: in fact the price level falls and restores equilibrium in the goods market. The lower interest rate is necessary for the money market to be in equilibrium at a higher level of real money balances. Note that only when

$[(w_1-1)\tau + w_1\beta + w_1\sigma/k_2]<0$ (graph 3),

21as in the Dornbusch model.

the devaluation is also necessary to restore wealth equilibrium. In this case the shock to F triggers a price fall which is so strong that real wealth actually rises. As a consequence agents decumulate financial assets. The devaluation is then necessary to stimulate demand and raise the price level, so that wealth eventually falls in real terms.

Comparative statics

$$
\begin{aligned}
e = m &+ (\delta s - X^*)/\beta + \\
&+ \{-k_1[w_1\beta + (w_1-1)\tau + w_1\sigma/k_2] + w_1/\alpha\}y^*/\beta w_1 + \\
&+ (k_2/\beta)[\sigma/k_2 + \beta + \tau(1 - 1/w_1)]i^f
\end{aligned}
$$

$$
\begin{aligned}
F = &- (\delta s - X^*)/\beta - (k_2/\beta)[\sigma/k_2 + (\beta + \tau)(1- 1/w_1)]i^f \\
&- \{k_1[w_1\beta + (w_1-1)\tau + w_1\sigma/k_2] - w_1/\alpha\}y^*/\beta w_1
\end{aligned}
$$

The model is defined in such a way that in the short run the price level ensures that supply and demand for domestic goods match, the interest rate equilibrates the money market, whereas the exchange rate keeps the international financial markets in equilibrium by settling at the level that generates the expectation of the devaluation/revaluation necessary to compensate for differentials between domestic and foreign interest rates. But in the long run, when $i=i^f$, the price level is assigned the task of ensuring equilibrium in the money markets and the exchange rate balances supply and demand for domestic goods. Foreign assets keep the level of real financial wealth at its desired value. Changes of the money supply are fully neutral: any variation of m is completely offset by p and e in such a way that terms of trade and real wealth are unchanged. Since it is assumed that both the price level and the exchange rate are non pre-determined variables, the adjustment takes place instantaneously. An interest rate rise requires higher real money balances and therefore pushes up the price level. Furthermore, variations of both the interest rate and the price level depress aggregate demand. The adjustment of foreign assets and of the exchange rate must keep wealth constant and balance aggregate demand. One cannot define the sign of changes of F and e. We can only say that if the exchange rate appreciates the stock of foreign assets must increase. On the other hand, if the exchange rate is devalued foreign assets might either rise or fall. If, following Dornbusch and Fischer, we had ruled out interest rate effects from aggregate demand by setting $\sigma=0$, the story would have been partly different. In fact when $\sigma=0$ F certainly increases. The exchange rate change is still undetermined, but less likely to be positive.

Output variations must be matched, on the demand side, by terms of trade adjustment, if W is to stay fixed. Output growth depresses the price level by raising real demand for money; this already corresponds to a terms of trade depreciation. However, equilibrium in the goods market is achieved by an exchange rate variation which ensures that relative prices actually adjust to the necessary level. If the price fall is bigger than the required overall terms of trade depreciation, the exchange rate must appreciate.Indeed, the sign of de/dy* cannot be defined a priori. The introduction of the interest rate in aggregate demand strengthens the price influence on D. By doing so it makes more likely that an output expansion appreciates the exchange rate. Once again the stock of foreign assets must adjust, offsetting the effect of movements of e and p on wealth. The change of F is indetermined, too. However one may rule out the possibility that both e and F increase, because in that case, at a lower level of real money balances, wealth would inevitably rise, but the peculiar structure of eq.14 constraints wealth to be constant.

Foreign demand and fiscal policy shocks are offset by exchange rate variations. An increase of foreign demand appreciates the exchange rate whilst a fiscal contraction requires a devaluation. Variations of domestic holdings of financial assets keep real wealth stable. F increases in the former case and falls in the latter.

A comparison with the Dornbusch "sticky prices" model immediately points out that, as far as comparative statics is concerned, no difference arises about the equilibrium values of the price level, whilst the exchange rate change after an interest rate shock might be of opposite sign. As we shall show in the next chapter, these results are substantially modified when: a)the assumption of perfect capital mobility is relaxed; b)a more proper description of the current account is introduced. However, even under the restrictive and debatable assumptions that Dornbusch and Fischer have made, the model shows that stationary steady state cannot be achieved unless wealth accumulation is nil. Furthermore, their model shows that wealth and exchange rate dynamics are strictly interrelated.

4.3. Portfolio equilibria and exchange rate and current account dynamics: the Branson model.

The model

Branson model of exchange rate determination focusses on the impact of portfolio allocation on the exchange rate. Branson relaxes the restriction that assets denominated in different currencies are perfect substitutes. The assumption of perfect capital mobility implies that agents are neutral towards the risk associated with investment in foreign currency[22]. But this can be considered just a special case in the theory of portfolio allocation. In general agents will perceive investment abroad as riskier than investment in domestic currency because of the default risk and because of uncertainty about the future exchange rate level; this perceived risk has to be compensated for by a differential between the rates of return on domestic and foreign assets. It is quite apparent that steady state equilibrium cannot be achieved unless the current account flow equals zero: a non-zero current account balance would require portfolio reallocation and changes of the differential between rates of return on

22Eaton and Turnovsky(1983)

domestic and foreign assets would be necessary to equilibriate demand and supply for each asset.

19) $M = -\varnothing_1 i - \varnothing_2(i^f + Ede) + W;$

20) $B = \varnothing_3 i - \varnothing_4(i^f + Ede) + W;$

21) $e + F = -\varnothing_6 i + \varnothing_5(i^f + Ede) + W;$

22) $W = w_1 B + w_2(e+F) + (1 - w_1 - w_2)M;$

Equations[23] 19-22 is a stylized representation of the financial sector of the economy. Agents are supposed to hold three assets: money, M, domestic bonds, B, assets denominated in foreign currency,F. Financial wealth, W, is a linear approximation to the sum of these three assets. At any point in time demand for each asset, described on the right hand side of eq.19-21, must equal the corresponding outstanding stock, whose amount is defined on the left hand side term of eq.19-21. Demand for each asset is homogeneous of degree one in wealth. Obviously demand for money is negatively related to the rates of return on both foreign and domestic assets. Note that the former includes the exchange rate expected depreciation[24] as well as the foreign interest rate, the latter to be treated as an

23we have loglinearized the original Branson model
24Branson makes this assumption himself when he analyzes a model where expectations in the financial markets are assumed to berational.

exogenous variable. Demands for B and F are positively related to their own rates of return and are negatively affected by the rate of return on the other interest bearing asset. The model assumes that equilibrium in the financial markets obtains instantaneously. For sake of simplicity we shall assume here that both output and the price level are constant. Therefore, for the model to be complete we only need to define the process of wealth accumulation/decumulation. We assume that the government budget is balanced, therefore wealth dynamics can only occur through the capital account flow[25].

23) $dF= X^{*} + \beta(e-p) + i^{f}F$;

Eq.23 states that in a flexible exchange rate regime the current account balance is exactly matched by capital flows: a current account surplus corresponds to an increase in the country's foreign investment. The current account includes the trade balance, expressed as a function of terms of trade and a shift factor, X^{*}, as well as interest payments on foreign investment.

24) $Ede = de$

25Eq.23 is a loglinear approximation to the current account flow. A formal demonstration of this result is provided in Niehans (1978, pag.36)

The familiar assumption of rational expectations completes the model.

In order to achieve the state-space form of the model we need to obtain a proper description of the exchange rate dynamics determined by portfolio allocation. Given that when two financial markets are in equilibrium the whole financial sector must be in equilibrium as well, we shall choose to analyze eq.19 and 21 and so obtain i and Ede in terms of e,F,B,M,i^f.

From eq.19 and 21 we get:

$$X_7 = (\emptyset_1\emptyset_5+\emptyset_2\emptyset_6)^{-1}E_1E_2X_8$$

where: $X_7' = [i,\ Ede]$; $X_8' = [(e+F),\ M,\ B,\ i^f]$;

$$E_1 = \begin{bmatrix} \emptyset_5 & \emptyset_2 \\ \emptyset_6 & -\emptyset_1 \end{bmatrix}$$

$$E_2 = \begin{bmatrix} -w_2 & (w_1+w_2) & -w_1 & \emptyset_2 \\ 1-w_2 & -(1-w_1-w_2) & -w_1 & -\emptyset_5 \end{bmatrix}$$

This system yields:

$$25)\ Ede = \{[\emptyset_6 w_2+(1-w_2)\emptyset_1]/[\emptyset_1\emptyset_5+\emptyset_2\emptyset_6]\}(e+F)$$
$$\{-[\emptyset_6(w_1+w_2)+(1-w_1-w_2)\emptyset_1]/[\emptyset_1\emptyset_5+\emptyset_2\emptyset_6]\}M$$
$$\{w_1[\emptyset_6-\emptyset_1]/[\emptyset_1\emptyset_5+\emptyset_2\emptyset_6]\}B - i^f;$$

$$26)\ i = \{[\emptyset_5 w_2-(1-w_2)\emptyset_1]/[\emptyset_1\emptyset_5+\emptyset_2\emptyset_6]\}(e+F)$$
$$\{[-\emptyset_5(w_1+w_2)+(1-w_1-w_2)\emptyset_2]/[\emptyset_1\emptyset_5+\emptyset_2\emptyset_6]\}M$$
$$\{w_1[\emptyset_5+\emptyset_2]/[\emptyset_1\emptyset_5+\emptyset_2\emptyset_6]\}B;$$

Changes in the supplies of money and foreign assets affect e and i in two ways: a) the wealth effect, proportional to the equilibrium share of each asset; b) the substitution effect, defined as the variation of the differential between rates of return which is required for portfolio to be in equilibrium after the composition of wealth has changed. This effect is proportional to one minus the initial share of each asset on total wealth. In a one asset portfolio the substitution effect would be nil whilst the coefficient attached to the wealth effect would be one. Let us consider the case of an increse of (e+F). The change of W, w_2(e+F), raises demand for money. For a given stock of money supply, equilibrium requires that both rates of return become higher. In the foreign assets market higher wealth requires higher rates of return on e+F. Turning to the analysis of the substitution effect, note that the variation of demand for foreign assets must be equal to $[1-w_2](e+F)$, $w_2(e+F)$ being already accounted for by the wealth effect. The higher stock of foreign assets will be willingly held if Ede rises. Equilibrium in the money market will require that the change of the differential between rates of return does not affect demand for money. As a result i must fall.

In summary, an increase of foreign assets is positively related to Ede. The impact of e+F on i is ambiguous: the wealth effect will certainly push i up, but the substitution effect will make i move in the opposite direction. The wealth effect of a money supply expansion on demand for foreign assets requires that profitability of foreign assets falls. But this would raise demand for money, whereas the wealth effect requires it to be lower. Inevitably, the interest rate must go up. Henceforth, the wealth effect of a money supply increase is the fall of Ede and the rise of i. The substitution effect of M obviously requires that both rates of return fall, so that agents willingly hold a higher stock of money. Therefore a positive variation of M certainly lowers both Ede and i. A rise of B only causes wealth effects, both in the money and foreign assets market. Higher wealth raises demand for money, henceforth equilibrium can obtain only if returns on the other assets increase. In the foreign assets market lower relative profitability of e+F is needed as a compensation for the rise of W, therefore e must fall and i increase. The overall effect of B on i is unambiguously positive, whilst the impact on Ede depends on the the patterns of substitutability. If

$\emptyset_6>\emptyset_1$ domestic bonds are closer substitutes for foreign assets than for money and the impact of i is bigger in the foreign asstes market than in the money market; since the wealth effect in the money market is proportional to $\emptyset_6$ and to the wealth effect in the foreign market is proportional to $\emptyset_1$ it is clear that if bonds are closer substitutes for e+F than for M the overall effect of dB on Ede has to be positive. A positive shock to the foreign interest rate is completely offset by an opposite variation of Ede, so that the overall rate of return on foreign assets stays constant.

The domestic interest rate is a non dynamic endogenous variable, therefore a full investigation of dynamics and comparative statics requires eq.23, 24, 25 only. The state-space form of the model is defined as follows.

$$X_9 = E_3X_{10} + E_4X_{11}$$

where:

$X_9' = [de, dF]$; $X_{10}' = [e, F]$; $X_{11}' = [M, B, i^f]$

$$E_3 = \begin{bmatrix} [\emptyset_6 w_2+(1-w_2)\emptyset_1]/\emptyset^* & [\emptyset_6 w_2+(1-w_2)\emptyset_1]/\emptyset^* \\ \beta & i^f{}_o \end{bmatrix}$$

where $\emptyset^* = [\emptyset_1\emptyset_5+\emptyset_2\emptyset_6]$

$$E_4 = \begin{bmatrix} -[\emptyset_6(w_1+w_2)+(1-w_1-w_2)\emptyset_1]/\emptyset^* & \{w_1[\emptyset_6-\emptyset_1]/\emptyset^*\} & -1 \\ 0 & 0 & F_o \end{bmatrix}$$

The roots of the characteristic equation are:

$$\theta_s = 0.5\{[\emptyset_6 w_2+(1-w_2)\emptyset_1]/[\emptyset_1\emptyset_5+\emptyset_2\emptyset_6] + i^f\} - \\ -0.5\{[\emptyset_6 w_2+(1-w_2)\emptyset_1]^2/[\emptyset_1\emptyset_5+\emptyset_2\emptyset_6]^2 +4(\beta-i^f{}_o)\}^{-1/2}$$

$$\theta_u = 0.5\{[\emptyset_6 w_2+(1-w_2)\emptyset_1]/[\emptyset_1\emptyset_5+\emptyset_2\emptyset_6] + i^f\} + \\ +0.5\{[\emptyset_6 w_2+(1-w_2)\emptyset_1]^2/[\emptyset_1\emptyset_5+\emptyset_2\emptyset_6]^2 +4(\beta-i^f{}_o)\}^{-1/2}$$

The system is saddlepath stable if $\beta>i^f{}_o$; in other words the impact of a unit change of the exchange rate on the trade balance must be bigger than the change in returns on foreign investment caused by a unit variation of F. According to Branson this requirement is likely to be easily met in practice, given the existing empirical evidence about interest rates and trade elasticities. We shall turn now to the analysis of exchange rate and foreign assets dynamics. At any point in time the relation between current and equilibrium values of the endogenous dynamic variables is defined as follows.

$e_t = e_\infty + C\exp(\theta_s t)$;

$F_t = F_\infty + Cu_s\exp(\theta_s t)$;

where $[1, u_s]$ is the right eigenvector associated with the stable root.

$u_s = -\beta/(i_c^f-\theta_s)$ is negative.

Hence $C = (F_0-F_\infty)/u_s$ is negatively related to F_0-F_∞.

This closely reminds the pattern of exchange rate dynamics outlined in the Dornbusch and Fischer's model. Whenever a shock occurs implying a long term increase of foreign assets the exchange rate instantaneously depreciates.From then on the exchange rate steadily appreciates, while domestic holdings of foreign assets increase. Once again current account surpluses are associated with exchange rate appreciation. For instance, let's consider the effect of a money supply increase. The loci representing combinations of e and F that yield de=dF=0 are the following:

de=0:27)e = $-F + G_1$;

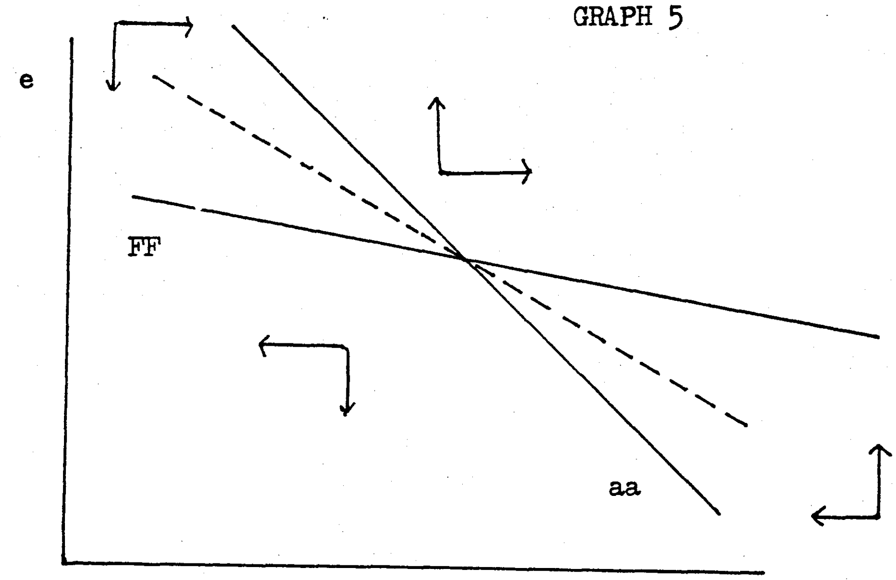
dF=0:28)e = $-(i_c^f/\beta)F + G_2$;

where G_1 and G_2 represent exogenous variables.

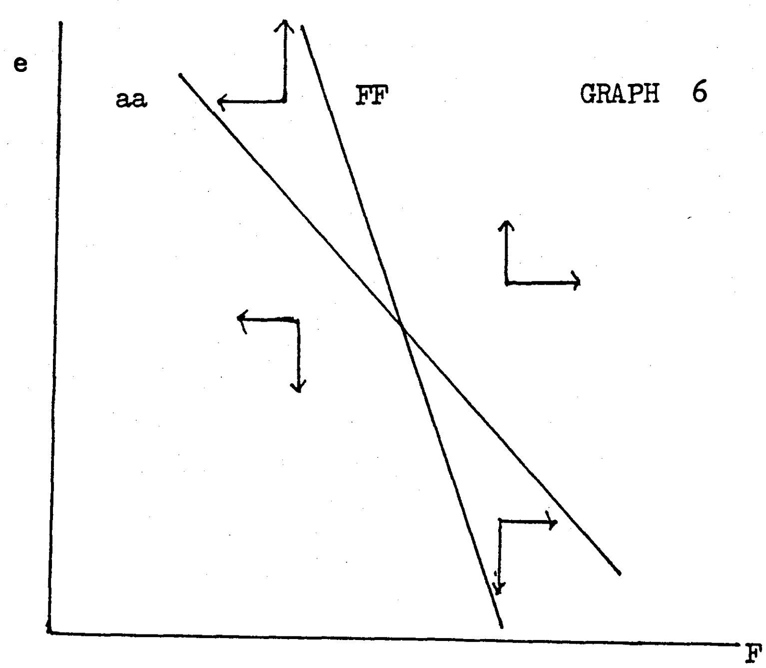
Both loci are negatively sloped.

The locus aa in graphs 5 and 6 describes eq.27. It is negatively sloped because a fall of foreign assets must be compensated for by an exchange rate devaluation, so that the valuation of wealth in domestic currency stays constant. A constant level of wealth is necessary if the financial markets are to be in equilibrium. Points above the aa locus represent a level of foreign wealth which is above equilibrium. This requires the expectation of a devaluation. The locus FF, which describes the combinations of e and F that are consistent with current account equilibrium, is negatively sloped because only an exchange rate depreciation may compensate for the fall of F; points above the FF are associated with a current account surplus and vice versa. The necessary and sufficient condition for saddlepath stability, $\beta>i_c^f$, implies that the locus de=0 is steeper. In other words, this means that if F is initially too low, the devaluation necessary to generate a current account surplus and restore the equilibrium value of foreign wealth must not raise the domestic valuation of foreign wealth above its equilibrium value. In fact, if the current account surplus may be generated only by a level of the

GRAPH 5



GRAPH 6



exchange rate which raises the domestic of foreign wealth above equilibrium the surplus is associated with a further devaluation and the system becomes unstable. Agents in the financial markets cannot select an exchange rate jump which generates convergent dynamics, (graph 5). On the other hand, if $\beta > i^f$, a devaluation may be consistent with a gradual process of wealth accumulation and exchange rate appreciation as long the initial level of (e+F) is below equilibrium. In this case, if the transversality condition holds, agents may choose the exchange rate jump which is consistent with convergent dynamics. (graph 5).

Moving from the analysis of instantaneous portfolio equilibrium to the discussion of the stability condition of the full model highlights the possibility that continuous equilibrium in the financial markets corresponds to global instability once wealth accumulation is taken into account. In the next chapter we will show how instability becomes more likely in a more general model of exchange rate determination.

Comparative statics.

$$e = \{(\beta - i^f{}_o)[\emptyset_6 w_2 + (1-w_2)\emptyset_1]/[\emptyset_1\emptyset_5 + \emptyset_2\emptyset_6]\}^{-1} - i^f{}_o i^f$$

$$-F_o i^f/\beta - i^f{}_o$$

$$\{(\beta - i^f{}_o)[\emptyset_6(w_1+w_2) + (1-w_1-w_2)\emptyset_1]/[\emptyset_6 w_2 + (1-w_2)\emptyset_1]\}^{-1}(- - i^f M)$$

$$\{(\beta - i^f{}_o)w_1[\emptyset_6 - \emptyset_1]/[\emptyset_6 w_2 + (1-w_2)\emptyset_1]\}^{-1} i^f B$$

$$- X^*/(\beta - i^f{}_o)$$

$$F = \{(\beta - i^f{}_o)[\emptyset_6 w_2 + (1-w_2)\emptyset_1]/[\emptyset_1\emptyset_5 + \emptyset_2\emptyset_6]\}^{-1}\beta i^f$$

$$+ F_o i^f/\beta - i^f{}_o \backslash$$

$$\{(\beta - i^f{}_o)^{-1}[\emptyset_6(w_1+w_2) + (1-w_1-w_2)\emptyset_1]/[\emptyset_6 w_2 + (1-w_2)\emptyset_1]\}(\beta M)$$

$$\{(\beta - i^f{}_o)^{-1} w_1[\emptyset_6 - \emptyset_1]/[\emptyset_6 w_2 + (1-w_2)\emptyset_1]\}^{-1}(-\beta B)$$

$$+ X^*/(\beta - i^f{}_o)$$

The term $(\beta - i^f{}_o)$, whose sign is decisive for saddlepath stability, also determines the direction of changes in e and F after the exogenous variables have shifted. We shall analyze comparative statics under the assumption that $\beta > i^f{}_o$. A comparison with the Dornbusch and Fischer model is problematic, since the two models differ in so many aspects.However, it must be emphasized that, while in the Dornbusch and Fischer's model the current account would be in equilibrium when W equals its "target" value, the Branson's model requires e and F, and implicitly the stock of financial wealth, to adjust at a level which ensures that, for given values of β and i^f_o, the trade balance exactly offsets returns on foreign investment. Also, e+F must ensure that portfolio equilibrium obtains jointly with de=0. When discussing comparative statics we shall look first at the values of e and F required for exchange rate and current account dynamics to be nil, then we shall consider the change in the composition of wealth determined by the shifts of e and F.

A variation of the foreign interest rate has two effects. The first is to increase the relative profitability of foreign assets, that should therefore increase[26]. As a consequence current account equilibrium requires exchange rate appreciation and a worsening of the terms of trade. The second effect is directly linked to the initial net position of the country. Therefore one cannot say a priori whether an increase of i^f has a positive or negative effect on F and e. However the change in the valuation of foreign assets in domestic currency is positive:

26Note that while in the short term Ede ensures portfolio equilibrium, in the long run Ede=0 so that F must adjust.

$$d(e+F)=\{[\emptyset_6 w_2+(1-w_2)\emptyset_1]/[\emptyset_1\emptyset_5+\emptyset_2\emptyset_6]\}^{-1} i^f;$$

An increase in domestic demand for foreign goods is matched by an exchange rate appreciation and a higher stock of foreign assets. Portfolio equilibrium requires that the valuation of foreign assets stay constant because relative rates of returns on domestic and foreign assets have not changed.

A rise of the money supply causes an increase of F and an exchange rate appreciation, needed for the current account to be in equilibrium. The model exhibits a non-neutrality, variations of M must alter portfolio composition and the differential between rates of return because, apart from induced changes of e+F, the supply of foreign bonds is fixed.

$$d(e+F)/dM = \{1 + [w_1(\emptyset_6-\emptyset_1)/\emptyset_6 w_2+(1-w_2)\emptyset_1]\}$$

The valuation of foreign wealth is positively linked to the level of the money supply; d(e+F)/dM will be more or less than unity according to the sign of $\emptyset_6-\emptyset_1$. In equilibrium the higher stock of money will be held only if the domestic interest rate is lower. This means that demand for foreign assets will be pushed up and will have to be matched by an increase of the valuation of foreign wealth. To the extent that bonds are better substitutes for money than for foreign assets, the fall of i will have smaller effects in the foreign assets market than in the money market, $d(e+F)/dM < 1$. Non neutrality of the money supply directly originates from the assumption of imperfect capital mobility and from the explicit inclusion of the supply of bonds. Comparison with the Dornbusch and Fischer's results confirms such conclusion. In fact, according to their model

$d(e+F)/dM = 1$;

$di/dM=dF/dM=0$.

The expansion of B requires a change of e+F in order to offset the effect of dB on e in the current account. The sign of d(e+F) depends on the patterns of substitutability between assets. If $\emptyset_6>\emptyset_1$, domestic bonds are closer substitutes for foreign assets than for money, d(e+F) must be negative. Given the constraint of portfolio equilibrium, current account equilibrium implies that, if $\emptyset_6>\emptyset_1$, the exchange rate depreciates and domestic holdings of foreign assets are reduced.

5.Conclusion

This chapter has reviewed the most relevant developments of the theory of flexible exchange rates in a "monetarist" macropolicy framework. A huge amount of research has been devoted to the search for plausible explanations of the exchange rate volatility observed during the 70s. A widely accepted contribution has been the Dornbusch sticky prices model. Further research, stressing the role of wealth effects and imperfect capital mobility, has pointed at the connections between exchange rate and current account dynamics. The initially prevailing view that the exchange rate is "the relative price of two national monies"[27] has been substantially amended. In the short run the exchange rate is still regarded as an asset price, although its level is set in order to clear financial markets where a wider bundle of assets than the two traditional money supplies matters. In the longer term the exchange rate depends on economic fundamentals, i.e. terms of trade and domestic holdings of foreign assets which ensure that the current account balance equals zero. Flexible exchange

27Mussa (1977)

rate models must embed the constraint that wealth accumulation/decumulation arising from trade imbalances cannot be indefinitely sustained. Despite these undeniable developments, the literature on the subject still lacks of attempts to build models sufficiently general to encompass sluggish price adjustment, imperfect capital mobility and wealth effects in consumption function[28]. A more general model of this kind will be set out and analyzed in some detail in the next chapter.

28Smith (1988) and Engle and Flood (1985) made attempts to explore the subject but their results are not entirely satisfactory.

CHAPTER 3.
MONETARIST MACROECONOMIC POLICY RULES IN A SMALL OPEN ECONOMY MODEL

1. Introduction.

This chapter presents a more general model of a small open economy where the policy makers adhere to an orthodox monetarist rule. In the models we have been analyzing so far the exchange rate is determined by the following factors: a) price dynamics; b) wealth accumulation; c) the degree of capital mobility. It is also apparent that government intervention affects the exchange rate through fiscal and monetary policy. A great deal of research has focussed on some specific aspects of the points a), b), c) but attempts of pulling together these three strands of the literature in a more general model of exchange rate determination are far less frequent[1] and no attention is usually paid to the instability potentially arising when a textbook Dornbusch model is extended to account for the current account equation and a specification of aggregate demand that considers wealth effects. According to the models we have analyzed in the previous chapter dynamic stability either always obtains, as in Dornbusch and Dornbusch and Fischer, or depends on a restricted set

1see Smith (1989)

of parameters about whose "normal" values a widespread consensus in the economic profession seems to have emerged, as in Branson. In this chapter we shall show under which circumstances a model including the current account and wealth effects may be unstable. We shall include wealth effects by assuming a life-cycle consumption function. Blanchard, (1985), has investigated the issue in a model with microfoundations[2]. He shows that current account dynamics converge if the propensity to spend out of wealth is bigger than the rate of return on foreign assets. Our conclusion is that this is a necessary but not a sufficient condition for stability to hold. It will be shown that, if output is allowed to fluctuate, the impact of a change in domestic holdings of foreign wealth on the current account depends on the relative size of the corresponding variations of imports and of foreign interest payments. If a decrease in foreign wealth improves the current account the system is stable. But this is not necessary for stability to obtain. When a fall of foreign wealth worsens the current account the exchange rate must devaluate in order to bring about the required current account

2But he assumes that the exchange rate is fixed surplus. **We will show that in this case stability obtains if the exchange rate devaluation does not raise output above its natural level.**

The rest of the chapter is laid out as follows. The next section presents the behavioral equations of the model. In section 3 we discuss the reduced form of the model. Section 4 is devoted to the analysis of stability. It will show how a more general model might be unstable and it will point out the parameters which are crucial for the determination of stability. Finally, in section 5 we point out that this more general model can have implications for comparative statics and exchange rate dynamics which are not accounted for by simpler models.

2.The model

In the model[3] we consider the financial and the goods sectors of the economy, and the accumulation of foreign wealth.

First of all, we describe the financial sector.

1) $a+F = \emptyset[i^{f} + da - (i-dp)];$

3the model is loglinear

where:
a = real exchange rate

p = domestic prices

F = domestic holdings of foreign assets (denominated in foreign currency)

i = domestic interest rate

i^f= foreign interest rate

d = differential operator

In eq.1 we consider the general case where assets denominated in different currencies are imperfect substitutes. In order to keep the model as simple as possible we do not introduce the full portfolio specification of models a` la Branson. In particular we do not explicitly model demand for domestic bonds, nor we include the quantity of money in the definition of financial wealth. This inevitably causes a loss of generality: the model does not account for the long term influence that changes of the money supply have on real variables when agents hold a fixed stock of non indexed domestic bonds, an effect discussed at length in Branson (1984) and in Eaton and Turnovsky (1983). But on the other hand, a simple portfolio structure enables one to explicitly model the dual role of money, whose demand is determined by portfolio optimization as well as by the level of real income[4], and to keep the model enough small to be tractable analytically. In eq.1) we state that "real" demand for foreign assets is always equal to the real value in domestic currency of the outstanding stock of foreign assets. Demand for financial wealth is expressed as a positive function of: a) the differential between foreign and domestic real interest rates[5]; b) the expected rate of change of the real exchange rate, set equal to its actual rate of change under the familiar assumption of perfect foresight in the financial markets. Perfect flexibility of the exchange rate ensures continuous clearing in the market for foreign assets. The parameter $\emptyset$ in eq.1) represents the impact that a change in the relative rates of return has on demand for foreign assets. A more general, non linear specification of 1) might be obtained referring to microeconomic models where agents optimize portfolio choices for given combinations of risk and return. More properly, $\emptyset$ should be expressed as a function of the expected variances of relative prices as well as of the expected rates of return of

4Branson did not consider output fluctuations
5We define i^f as the real foreign interest rate because we assume for simplicity that the foreign price level is stable

domestic and foreign assets. In order to maintain the linear form it is assumed that the variances of the terms of trade and of the exchange rate are constant. We also ignore the effect of changes of i and i^f on $\emptyset$. Eq.1) can be rearranged in the form:

2) $da = (i-dp)-i^f + (a+F)/\emptyset$;

$(a+F)/\emptyset$ being the risk premium, that is, the compensation agents require for holding assets denominated in foreign currency. It depends positively on the outstanding stock of foreign assets and is negatively related to $\emptyset$. The more sensitive is demand for foreign assets to changes in the relative returns on assets, the bigger is $\emptyset$, so that the risk premium becomes less relevant. When $\emptyset \rightarrow \infty$ agents in the financial markets are approximately risk neutral and eq.2) corresponds to the uncovered interest parity condition that is assumed to hold in the Dornbusch model.

3) $m-p = k_1 y - k_2 i$;

Eq.3) is a standard demand for money function where m is the domestic money supply and y represents output deviations from the natural rate. a more general specification would have included real financial wealth as an argument of eq.1) and 3), but it would have introduced further complications and would have rendered the model difficult to treat analytically.
We then describe the goods sector

4) $y = D$;

5) $D = \alpha[x^* + \beta a + V]$;

6) $V = \tau(a+F) - \sigma(i-dp) - \delta s$;

he set of eq.4)-6) states that output, defined in terms of deviations from the natural rate, is always equal to aggregate demand, D. α is the familiar income multiplier. β describes the impact of the real exchange rate on the trade balance, foreign demand for domestic goods is determined by the terms of trade and an exogenous shift factor, x^*. The country is assumed to be small in the market for foreign inputs, so that domestic demand does not influence foreign prices. On the other hand we assume that domestic firms face a downward sloped demand curve in the world markets:

quantities of exported goods rise only if the real exchange rate is devalued. V describes the individual sources of domestic demand. Consumption decisions depend on disposable income, financial wealth and the real interest rate. Investment depends on the current real interest rate, too. The description of domestic demand is completed by the inclusion of a shift factor which represents domestic fiscal policy, in the form of an income tax rate.

Price stickiness is one of the sources of disequilibrium in the model[6].

7) $dp = \epsilon y + dm;$

In eq.7 we assume that domestic inflation responds to :

a) deviations of current output from the natural rate;

b) the rate of change of the money supply.

The price level is pre-determined but eq.7 implies that inflation instantaneously responds to shocks and embeds some kind of forward looking behaviour through the link with the money supply rate of growth, although this

6the second one being the sluggish adjustment of financial wealth direct connection might be regarded as too simplistic[7]. Although a more sophisticated representation of the sluggish adjustment of both prices and wages, possibly including forward looking behaviour, would have been desirable, the need of making algebraic analysis of the model as easy as possible has suggested the choice of eq.7). It has been argued elsewhere[8] that the selected form of price dynamics within the class of pre-determined price equations is of second order importance. Therefore the choice of eq.7 should not undermine the relevance of our model. However a more satisfactory description of wage-price dynamics will be presented in the next chapters.

8) $dm = 0$;

In eq. 9 we assume that the government adopts a fixed money supply rule[9].

7For a closed economy model where core inflation is a weighted average of backward and forward looking behaviour see Taylor (1979)
8Engel and Frankel (1984)
9This assumption bears no influence on the stability analysis, which is the main issue to be discussed in this chapter.

Wealth accumulation is defined as follows.

9) $dF = T + i^{f}F_{o} + i^{f}_{o}F$;

10) $T = x^{*} + \beta a - \mu y$;

In eq.9 we show that foreign wealth accumulation is equal to the current account balance. This, in turn, is determined by the trade balance, T, and by returns on foreign investment, that we have linearized around equilibrium in order to assess the effects of a foreign interest rate shock. i^{f}_{o} and F_{o} are the initial levels of the interest rate and of foreign wealth[10]. The trade balance depends on foreign demand for domestic goods and on imports, which are linked to the level of output.

3.The reduced form of the model

We shall undertake the reduction of the model in steps. Substituting eq.5), 6), 7), into eq.3) and 4) we get "reduced form" equations for the endogenous non dynamic

10For a similar description of the current account see Smith (1989) variables, y and i, in terms of the endogenous dynamic variables, a, F, p, and the forcing variables, m, s, i^f, x^*.

$$(11)\ y = \pi[x^* + (\beta+\tau)a + \tau F - \delta s - (\sigma/k_2)(p-m)]$$

$$(12)\ i = (k_1/k_2)\pi[x^* + (\beta+\tau)a + \tau F - \delta s] -$$
$$-(m-p)[1-\epsilon\alpha\sigma]\{k_2[1-\alpha\sigma(\epsilon-k_1/k_2)]\}-1$$

i and y depend on foreign demand for domestic goods, the tax rate, real financial wealth and real money balances. The term

$\pi = \alpha/[1-\alpha\sigma(\epsilon-k_1/k_2)]$

is the familiar total multiplier of the IS-LM model, where the real interest rate is taken into account instead of the nominal interest rate. $1-\alpha\sigma(\epsilon-k_1/k_2)$ shows the feedback effects of output changes on aggregate demand, which operate through the real interest rate. The term k_1/k_2 represents the impact of output changes on the nominal rate, determined in the money market. ϵ measures the effect of output variations on inflation. ϵ and k_1/k_2 work in opposite directions. An increase in output raises demand for money and pushes up the interest rate. On the other hand higher inflation lowers the real interest rate and stimulates aggregate demand. The former effect should be considered an endogenous "controller" of output and inflation, the latter is unambiguously destabilizing[11]. Throughout the chapter we shall assume that

$(\epsilon-k_1/k_2)<0$,

that is , an increase in output raises the real interest rate. It is now clear that increases of a, F, x^* raise output and the interest rate, whereas higher taxes depress output and lower the interest rate. The influence of real money balances on i cannot be defined a priori. Suppose that monetary policy takes an expansionary stance. The real interest rate falls:

$d(i-dp)/dm=-[1-\alpha\sigma(\epsilon-k_1/k_2)]^{-1}$.

This, in turn, stimulates output and raises real demand for money and the interest rate. The condition $1-\epsilon\alpha\sigma<0$ means that if an increase of the money supply causes a more than proportional increment of inflation[12] the expansion of output is so strong that eventually determines an increase of the interest rate.

Let us turn now to the reduced form of the full model.

11This issue has been investigated in the seminal work of Cagan(1956)

12We refer to the impact of the money supply on inflation because the stronger is this effect, the bigger the reduction of the real interest rate and the output expansion.

Substituting eq.8, 10, 11, 12 into eq.7, 2, 9 we get:

$$11) dp = [\epsilon\pi\sigma/k_2](m-p) + [\epsilon\pi(\beta+\tau)]a + [\epsilon\pi\tau]F - [\epsilon\pi\delta]s + [\epsilon\pi]x^*$$

$$12) da = (p-m)/k_2[1-\alpha\sigma(\epsilon-k_1/k_2)] + \{\emptyset^{-1}-[(\epsilon-k_1/k_2)\pi(\beta+\tau)]\}a + \{(\emptyset^{-1} - (\epsilon-k_1/k_2)\pi\tau\}F - [(\epsilon-k_1/k_2)](x^* - \delta s) - i^f$$

$$13) dF = (\mu\pi\sigma)(p-m) + \{\beta-\mu\pi(\beta+\tau)\}a + [i^f{}_0-\mu\pi\tau]F + [\mu\pi\delta]s + [1-\mu\pi]x^* + F_0 i^f$$

From eq.11 it is straightforward to argue that a depreciation of the exchange rate, an exogenous increase of foreign demand for domestic goods, an expansion of real money balances and of foreign wealth spur inflation, whereas fiscal policy has a deflationary impact.

Positive variations of a, F, x*, raise the real interest rate. This in turn, requires the expectation of a devaluation if demand and supply of foreign assets are to be in equilibrium (eq.12). On the other hand an expansion of real money balances and a fiscal contraction lower the real exchange rate and require the expectation of an appreciation.

From eq.13 it is clear that both a and F have a positive direct impact on the current account, due to the real exchange rate and to the foreign interest rate respectively. On the other hand a and F have an indirect effect, which feeds through the propensity to import. It would seem reasonable to assume that the exports growth generated by a devaluation should be stronger than the imports flow generated by the export-led growth of income. But the model accounts for a second terms of trade effect on aggregate demand: the capital gains, in real terms, on domestic holdings of foreign assets that would be caused by a devaluation of relative prices. This effect, too, weakens the total impact of a terms of trade devaluation on the current account. Nevertheless we shall assume that a devaluation actually improves the current account balance, as this seems to be now widely accepted in the economic profession[13]. Furthermore, we have some theoretical[14] and empirical[15] support to believe that τ is rather small. In fact it seems to be generally

13See Vines et al. (1989)
14Modigliani (1966)
15Currie et al. 1986

accepted that wealth effects take a long time to significantly influence the economy[16].

The size of $\mu\pi\tau$ is very important for determining the effect on the current account of foreign assets changes. An increase of foreign assets expands aggregate demand and sucks in more imports, thereby worsening the current account. On the other hand higher interest payments on foreign investment improve it. Although one would expect that $\tau>i^f_o$, the net effect on wealth accumulation cannot be determined a priori because we have a presumption that $\mu\pi<1$. If $\mu\pi\tau$ is big enough a negative deviation of F from equilibrium causes a reduction of imports greater than the corresponding fall of interest payments on foreign investment,henceforth the current account improves and F is pushed back to equilibrium. We will consider the sign of

$i^f_o-\mu\pi\tau$

as undetermined, and indeed the discussion of stability will focus on this aspect.

16Engel and Flood, (1985)

4. Stability analysis

The analysis of the conditions which are necessary and sufficient for stability to obtain is rather complex once the standard framework of the second order dynamic system is abandoned and the model becomes third order. To facilitate the interpretation of the stability conditions of the full system we begin with the assumption that $\epsilon = 0$, therefore no price dynamics can occur when $dm = 0$. At this stage the model might be regarded as a combination of two simpler models. In the first output is fixed and wealth and exchange rate dynamics interact because foreign and domestic assets are imperfect substitutes, as in the Branson model. In the second uncovered interest parity holds but output fluctuates. We shall discuss the stability conditions of these two simpler models separately, and then analyze their implications for the stability of the full model.

4.1. The stability condition for the fixed price, fixed output model

If $dp = y = 0$ the model becomes[17]:

$$14)\ da = (a + F)/\emptyset \quad -i^{f}$$

$$15)\ dF = \beta a + i^{f}{}_{o}F + x^{*}$$

Eq.14 and 15 are indeed qualitatively identical to the reduced form of the Branson model.

The roots of the characteristic equation of this system are:

$$\theta_1 = \{-(i^{f}{}_{o}+1/\emptyset) - [(i^{f}{}_{o}+1/\emptyset)^2 + 4(\beta-i^{f}{}_{o})/\emptyset]\}0.5$$

$$\theta_2 = \{-(i^{f}{}_{o}+1/\emptyset) + [(i^{f}{}_{o}+1/\emptyset)^2 + 4(\beta-if_{o})/\emptyset]\}0.5$$

For the system to be saddlepath stable we need $(\beta-i^{f}{}_{o})>0$. This is exactly the stability condition derived for the Branson model. To grasp the economic intuition behind this result we shall make use of the familiar

17Note that in this case nominal and real exchange rate dynamics must coincide because p is fixed state space diagram.

$da = 0$: 16 $a = -F + i^{f}{}_{o}/\emptyset$

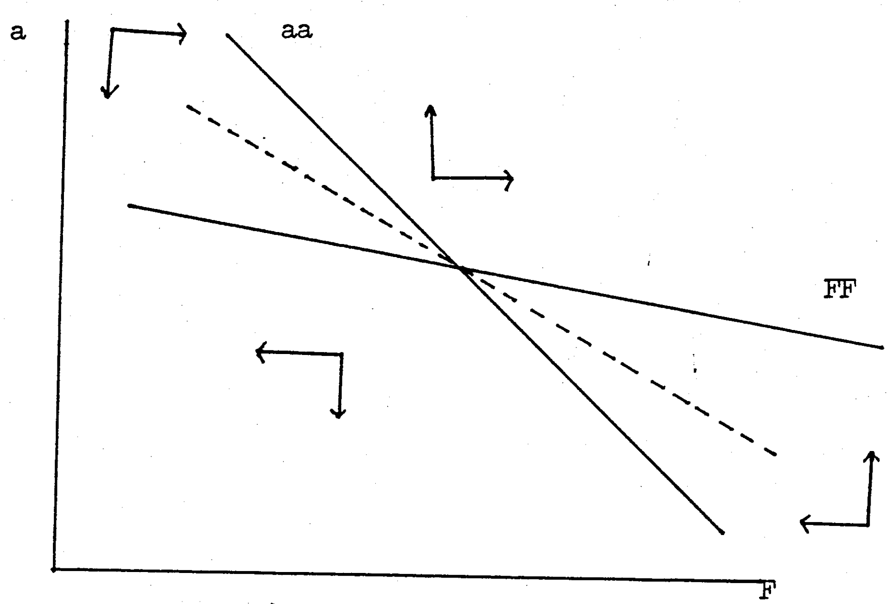
$dF = 0$: 17 $a = -(i^{f}{}_{o}/\beta)F - x^{*}/\beta$

The locus aa in graphs 1 and 2 describes eq.16. It is negatively sloped because a fall of foreign assets must be compensated for by an exchange rate depreciation, so that the valuation of wealth in domestic currency stays constant. This is the necessary condition for the financial market to be in equilibrium at da = 0

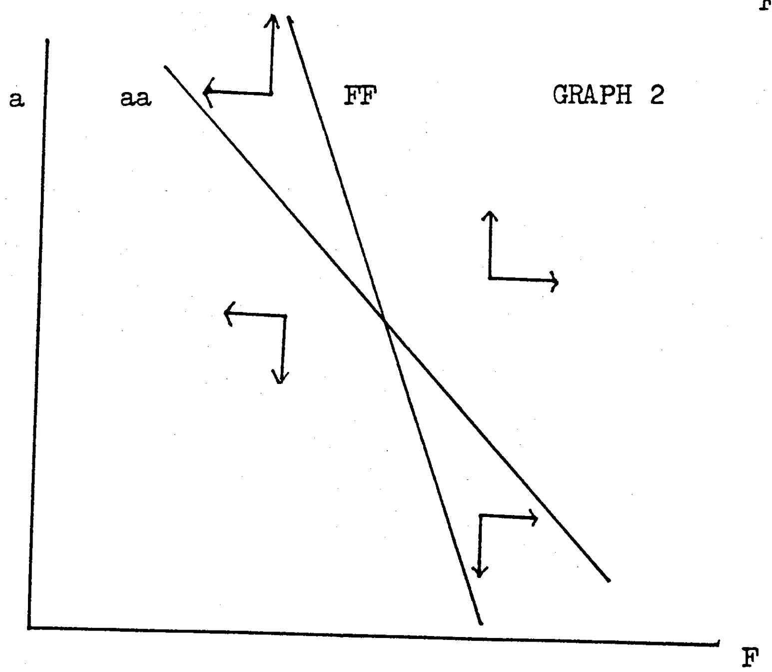
The locus FF, describing the combinations of a and F which are consistent with current account equilibrium, is negatively sloped, too. This because after a fall of F an exchange rate depreciation is necessary to balance the current account. The economic interpretation of the stability condition may be stated as follows.

Suppose that the stock of foreign assets is initially below its equilibrium level. As a result a positive exchange rate jump will be necessary to generate the current account surplus which will restore

GRAPH 1



GRAPH 2



the equilibrium level of foreign assets. For the current account to be in surplus it is necessary that the exchange rate jump sets the point representing the initial combination of a and F above the FF locus, which means that the rise of exports must be stronger than the fall of returns on foreign investment. On the other hand, if the exchange rate depreciation is to be followed by a convergent exchange rate dynamics the initial combination of a and F must lie below the aa line: the domestic valuation of foreign wealth after the jump must be lower than in equilibrium, so that the expectation of an exchange rate appreciation is necessary for the financial sector to be in equilibrium. If otherwise the initial devaluation would be followed by cumulative depreciation. For these two conditions to be satisfied it is necessary that the locus aa is steeper than the FF, that is, $(\beta-i^{*}_{o})>0$. In this case, graph 1, a possibility exists for the initial exchange rate jump to determine a current account surplus and to be followed by an exchange rate appreciation, so that dynamics may converge[18]. If the FF is steeper than the aa, graph 2, it is impossible

18This happens if the transversality condition holds for agents to select an initial exchange rate level such that dynamics converge: the model is unstable.

4.2. The stability condition for the fixed price, flexible output model under the assumption of perfect capital mobility

Let us turn now to the analysis of a model where p is fixed, uncovered interest parity holds and output fluctuations occur. Its reduced form is:

18) $da = [k_1/k_2)\pi_1(\beta+\tau)]a + [(k_1/k_2)\pi_1\tau]F + G_1$

19) $dF = [\beta-\mu\pi_1(\beta+\tau)]a + [i^f{}_o-\mu\pi_1\tau]F + G_2$

where G_1 and G_2 represent the set of forcing variables we are not interested in for the moment.

$\pi_1 = \alpha/(1+\alpha\sigma k_1/k_2)$ corresponds to the π coefficient analyzed above under the assumption that the price level is fixed.

The roots of the characteristic equation are

$\theta_1 = 0.5[L + (L2+4T)1/2$

$\theta_2 = 0.5[L - (L2+4T)1/2$

where $L = \{k_1/k_2)\alpha(\beta+\tau)/\pi_1\} + i^f{}_o - \mu\alpha\tau/\pi_1$

$T = (k_1/k_2)\alpha[\beta(\tau-i^f{}_o) - \tau i^f{}_o]/\pi_1\}$

For the system to be saddlepath stable we need

$20)\beta(\tau-i^{f}_{o}) - \tau i^{f}_{o}>0$,

but that is not guaranteed. At this stage the familiar state space diagram might be helpful. The loci representing combinations of a and F such that no terms of trade or wealth dynamics occur are defined as follows

da=0: 21) $a = -[\tau/(\beta+\tau)]F + G_1$

dF=0: 22) $a = -\{[i^{f}_{o} - \mu\pi_1\tau]/[\beta - \mu\pi_1(\beta+\tau)\}F + G_2$

The locus aa represents combinations of a and F that leave da= 0. Its slope is unambiguously negative. This can be explained as follows. When F is below equilibrium, the low level of wealth has a deflationary impact on aggregate demand, so that the real interest rate falls. This would require, for the financial markets to be in equilibrium, the expectation of an exchange rate appreciation. Therefore, in order to achieve da = 0, the exchange rate must depreciate to compensate for the negative impact of lower foreign wealth in aggregate demand. In fact, along the aa locus output is constant at the natural rate. Points to the right of aa are associated with levels of output and the real interest rate which are above equilibrium, and therefore a cumulative terms of trade depreciation, whilst points to the left of the aa curve are associated with continuous appreciation. Let us consider now the locus FF, representing combinations of a and F that leave the current account in equilibrium. Its slope can be either positive or negative according to the sign of $i^{f}_{o}-\mu\alpha\tau/\pi_{1}$. For the moment we assume that:

$i^{f}_{o}- \mu\pi_{1}\tau < 0.$

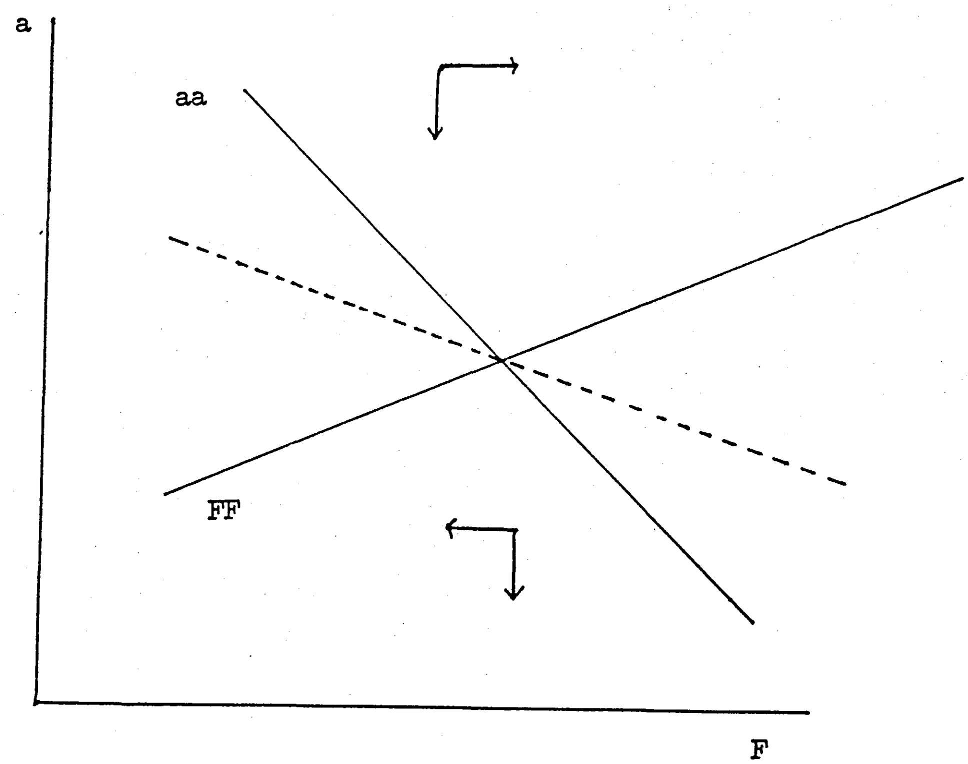
The FF curve is positively sloped, graph 3. Shocks to F trigger a self stabilizing dynamic process of wealth accumulation because the variation of imports is bigger than the corresponding change of interest payments on foreign investment. In this case the model is saddlepath stable. After a negative shock to F output and the interest rate fall. This requires the expectation of an appreciation: the exchange rate must overshoot. However, the combination of a and F after the exchange rate jump must be represented by a point below the aa locus, so that the expectation of an appreciation is actually generated. As long as $i^{f}_{o}-\mu\pi_{1}\tau < 0$ this point will certainly be associated with a current account surplus. Therefore if agents in the financial markets choose the appropriate initial terms of trade jump the economy converges to equilibrium.

Let us now discuss the case where:

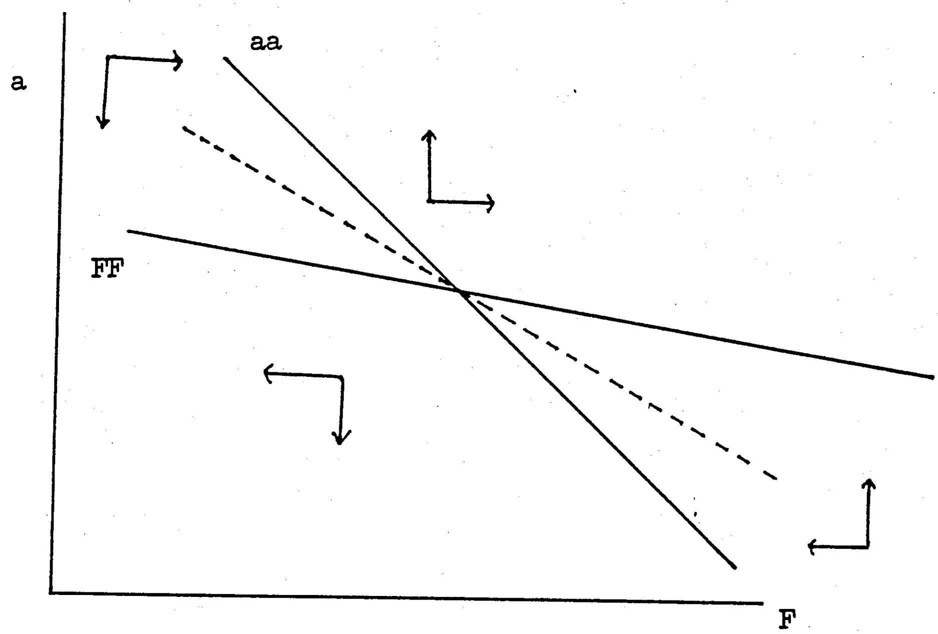
$i^f_o > \mu\pi_1\tau$

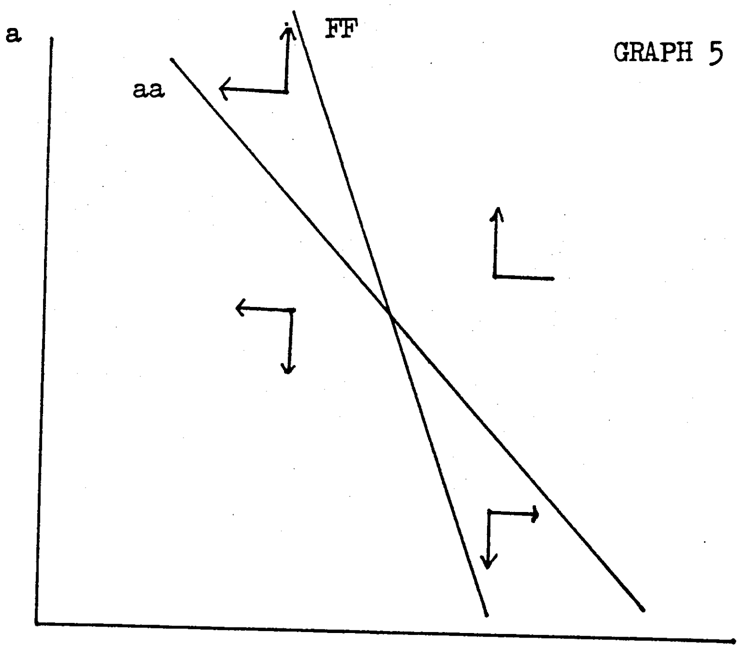
The FF locus is negatively sloped. Combinations of F and a represented by points above the FF locus are associated with surpluses; points to the left of FF correspond to deficits. After a fall of F the self-stabilizing mechanism embedded in the wealth accumulation process cannot work: the change of foreign payments originating from a deviation of foreign wealth

GRAPH 3



GRAPH 4





GRAPH 5

from equilibrium always dominates the corresponding variation of imports. Only a terms of trade devaluation can generate a current account surplus and restore the equilibrium level of financial wealth. For F to move back into equilibrium the terms of trade jump must be such that the initial combination of F and a is represented by a point above the FF locus, thereby causing dF to be positive. But this initial point must also be located to the left of the aa locus, otherwise exchange rate dynamics would diverge. Hence stability requires that the aa is steeper than the FF. Graphs 4 and 5 give a diagrammatic exposition of the two alternative outcomes.The algebraic condition ensuring that aa is steeper than FF is :

$\tau/(\beta+\tau)>[i^{f}_{o} - \mu\pi_{1}\tau]/[\beta - \mu\pi_{1}(\beta+\tau)$;

which corresponds to:

20) $\beta(\tau-i^{f}_{o}) - \tau i^{f}_{o} > 0$.

If $i^{f}_{o} > \mu\pi_{1}\tau$ only an exchange rate devaluation may generate converging dynamics for wealth accumulation. But if condition 20 is not satisfied agents in the financial markets cannot select such a level of the exchange rate. If the initial overshooting is to be followed by an appreciation, wealth accumulation is negative. On the other hand, if the initial "jump" is to generate a current account surplus the initial combination of F and a must lie above the aa curve, which represents combination of foreign wealth and the real exchange rate such that output is constant. This implies that the improvement of the trade balance must be so strong that output will eventually expand and raise the interest rate. But in this case equilibrium in the financial markets will require a further devaluation. Indeed the whole issue of stability eventually boils down to the requirement that after the necessary initial exchange rate jump the current account surplus may be associated to an output level which is below the natural rate despite the positive influence of the devaluation, so that the interest rate falls and the exchange rate may gradually appreciate afterwards. But if the necessary depreciation raises output above the natural rate the model is unstable.

4.3. The stability condition of the full model

We turn now to the stability analysis of the full model, which is inevitably more complex, the model being third order. The state space form of the model is defined as follows.

$$H = AZ + BG$$

where $H' = [dp, da, dF]$ $Z = [p, a, F]$ $G = [X^{*}, s, m, i^{f}]$

$$A = \begin{bmatrix} -\epsilon\alpha\sigma/k_2\pi & \epsilon\alpha(\beta+\tau)/\pi & \epsilon\alpha\tau/\pi \\ 1/k_2\pi & \{-(\epsilon-k_1/k_2)\alpha(\beta+\tau)/\pi\}+1/\emptyset & (1/\emptyset)-(\epsilon-k_1/k_2)\alpha\tau/\pi \\ \mu\alpha\sigma/\pi & \beta-\mu\alpha(\beta+\tau)/\pi & i^{f}{}_{o}-\mu\alpha\tau/\pi \end{bmatrix}$$

$$B = \begin{bmatrix} \epsilon\alpha\sigma/k_2\pi & -\epsilon\alpha\delta/\pi & \epsilon\alpha/\pi & 0 \\ 1/k_2\pi & \{(\epsilon-k_1/k_2)\alpha\delta/\pi\}+1/\emptyset & 1/k_2\pi & -1 \\ -\mu\alpha\sigma/\pi & \mu\alpha\delta/\pi & 1-\mu\alpha/\pi & F_o \end{bmatrix}$$

The sign of the roots of the characteristic equation $\|A-\theta I\| = 0$ cannot be analytically determined anymore.

Nevertheless, looking at the coefficients of the characteristic equation it is possible to draw some meaningful conclusions. Having defined

$$\| A-\theta I \| = \theta_3 + b_1\theta_2 + b_2\theta + b_3 = 0$$

it can be shown that

$$-b_1 = \theta_3 + \theta_2 + \theta_3 = a_{11}+a_{22}+a_{33}$$

$$b_2 = \theta_3\theta_2 + \theta_3\theta_1 + \theta_1\theta_2 = a_{11}a_{33} - a_{13}a_{31} + a_{22}a_{11} - a_{12}a_{21} + a_{22}a_{33} - a_{32}a_{23}$$

$$b_3 = -\| A \|$$

If the determinant of the dynamic matrix is negative the system cannot be saddlepath stable. In fact, if $\| A \| < 0$ the characteristic equation has either 1 or 3 roots with negative real parts. Blanchard and Kahn (1980) have shown that for this class of models to be stable the number of non pre-determined variables must equal the number of roots with positive real parts. The model admits only one non pre-determined variable, henceforth saddlepath stability is precluded when $\| A \| < 0$. In this case the model must be either unstable (two roots with positive real parts) or globally stable (three negative roots) and undetermined in its dynamics.

Stability therefore requires:

23) $\|A\| = [(\beta - i^{f}_{o})/\emptyset + \beta(\tau - i^{f}_{o}) - \tau i^{f}_{o}]\epsilon\alpha/\pi k_{2} > 0$

Quite strikingly 23 is a combination of the two conditions necessary for stability to hold in the simpler models discussed above. Under perfect capital mobility 23 and 22 would exactly coincide: stability would obtain if it were possible for a depreciation to be consistent with a current account surplus and to be followed by an appreciation. Under imperfect capital mobility this condition is somewhat relaxed if[19]:

$\beta - i^{f}_{o} > 0$

However we would not emphasize this aspect too much as $\emptyset$ should be very big relatively to $\beta - i^{f}_{o}$.

Provided that 23 holds, coefficient b_2 might provide some further information on the roots of the characteristic equation.

19Note that if $\beta - i^{f} < 0$ the model cannot be saddlepatyh stable anyway. Straightforward manipulations show that in this case
$\beta(\tau - i^{f}_{o}) - \tau i^{f} = \tau(\beta - i^{f}_{o}) - \beta i^{f}_{o} < 0$

$$b_2=-[\epsilon\alpha/k_2\pi][(i^f{}_o+\emptyset-1)\sigma+\beta+\tau]+$$

$$+[i^f{}_o-\beta+\mu\alpha\beta/\pi]\emptyset-1+[(k_1/k_2-\epsilon)/\pi][\tau(i^f{}_o-\beta)+\beta i^f{}_o]$$

$b_2<0$ rules out the possibility that the roots of the characteristic equation have the same sign. If $b_2<0$ the system is either unstable, when $\|A\|<0$, or saddlepath stable, when $\|A\|>0$. We maintain that $(k_1/k_2-\epsilon)>0$. If $\|A\|>0$ then $i^f{}_o-\beta<0$ and $\tau(i^f{}_o-\beta)+\beta i^f 0<0$ or very close to 0. Therefore we would reasonably argue that $b_2<0$ and the system is stable.

Concluding the discussion of the stability issue, it would seem appropriate to point out that standard models a\` la Dornbusch are unable to highlight the risk of instability inherent to open economies where the policy rule follows the orthodox monetarist prescriptions. Nor can models a\` la Dornbusch and Fischer give more helpful insights.It is only when a proper description of the current account is introduced and output fluctuation are considered, that the potential instability can be properly assessed. The Branson model points at the real exchange rate trade balance elasticity and at the foreign interest rate as the determinants of stability. Blanchard model simply requires the propensity to spend out of wealth to be bigger than the foreign interest rate. Our results suggest alternative conclusions. The model may be unstable if, when foreign assets are below equilibrium, a depreciation is necessary to improve the current account because the import leakages determined by lower domestic demand are dominated by the fall of foreign interest payments. In this case stability requires that the necessary devaluation does not set output above the natural rate. However, a proper evaluation of the instability risk would require a thorough examination of empirical evidence about the key parameters.

5. Comparative statics and dynamic adjustment

Equilibrium values of the endogenous variables are obtained from the state space form of the model setting $dp=da=dF=0$.

$$Z= (-1)A^{-1}G$$

$$p = m - \{k_2\delta(\beta-i^f_o)/\emptyset[\beta(\tau-i^f_o)+ (\beta-i^f_o)/\emptyset -\tau i^f_o]\}s +$$
$$+ \{k_2[(\beta-i^f_o) -\tau i^f_o-\beta F_o]/[\beta(\tau-i^f_o)+ (\beta-i^f_o)/\emptyset -\tau i^f_o]\}i^f$$
$$+\{k_2[(i^f_o)/\emptyset[\beta(\tau-i^f_o)+ (\beta-i^f_o)/\emptyset -\tau i^f_o]\}X^*$$

$$a = -\delta i^f{}_o s/[\beta(\tau - i^f{}_o) + (\beta - i^f{}_o)/\emptyset - \tau i^f{}_o]$$
$$-\{\sigma i^f{}_o + (\tau + 1/\emptyset)F_o/[\beta(\tau - i^f{}_o) + (\beta - i^f{}_o)/\emptyset - \tau i^f{}_o\} i^f$$
$$-\{(\tau - i^f{}_o + 1/\emptyset)/[\beta(\tau - i^f{}_o + 1/\emptyset) - i^f{}_o(\beta + 1/\emptyset)]\} x^*$$

$$F = +\delta\beta s/[\beta(\tau - i^f{}_o) + (\beta - i^f{}_o)/\emptyset - \tau i^f{}_o]$$
$$+\{\sigma\beta + (\beta + \tau + 1/\emptyset)F_o/[\beta(\tau - i^f{}_o) + (\beta - i^f{}_o)/\emptyset - \tau i^f{}_o]\} i^f$$
$$+\{(\tau + \sigma/\emptyset)/[\beta(\tau - i^f{}_o) + (\beta^- i^f{}_o)\sigma/\emptyset - \tau i^f{}_o]\} x^*$$

The money supply has no permanent effect on real variables. In equilibrium monetary shocks affect the price level only, leaving terms of trade and foreign assets unchanged. The initial terms of trade jump can been expressed as a function of the deviation of pre-determined variables from their equilibrium values.

$a(0) - a_\infty = T_1(p_o - p_\infty) + T_2(F_o - F_\infty)$

where $(x_o - x_\infty)$ is the initial deviation of each endogenous dynamic variable from its equilibrium value, a(0) is the level of the real exchange rate after its initial jump, [1, T1, T2] is the left eigenvector associated with the unstable root of A. The system is too complex for an analytical determination of the signs of T1 and T2 to be carried out. The analysis of simpler models and numerical simulations[20] have shown that when the money supply increases the terms of trade must initially overshoot. This result cannot be guaranteed for more complex models like the one we are dealing with. However, it must be emphasized that terms of trade deviations from equilibrium will necessarily generate wealth accumulation/decumulation which must be reversed later on, given that monetary shocks are neutral in the long run[21]. This contradicts one of the basic and most widely accepted results of the Dornbusch model:the fact that after a monetary shock adjustment is monotonic and both the exchange rate and the price level smoothly adjust to their long run values. This is obviously due to to third order dynamics, taking into account the process of foreign wealth accumulation as well as price and terms of trade dynamics. Fiscal policy moves the equilibrium terms of trade and the stock of foreign assets in opposite directions[22].An increase in real taxation leads to a permanently higher stock of foreign assets. Current account equilibrium requires that higher interest payments on foreign debt must be matched by lower net exports. This implies a

20Smith (1989)
21A similar result has been obtained by Driskill (1981)
22As in Smith (1989)

terms of trade revaluation. Once again the model contradicts the popular wisdom that after a fiscal contraction the terms of trade depreciation is necessary in order to keep aggregate demand in equilibrium. Higher real taxation will also permanently alters the interest rate differential because of the higher risk premium commanded by increased holdings of foreign assets; the lower $\emptyset$ the more powerful is the effect of fiscal policy on i, with relevant implications for capital accumulation. Unfortunately these effects cannot be properly analyzed under the assumptions made here. In the money market the fall of i raises demand for money, so that in equilibrium the domestic price level is lower. After an exogenous rise of foreign demand domestic holdings of foreign assets rise and the exchange rate appreciates.The valuation of foreign wealth in domestic currency increases:

$a+F = i^f{}_o x^* / [\beta(\tau - i^f{}_o) + (\beta - i^f{}_o)/\emptyset - \tau i^f{}_o]$

As a consequence, the domestic interest rate must fall, because the risk premium is higher. In the goods market the terms of trade appreciation offsets the initial shock and the inflationary pressures originating from the rise of F and the fall of i.

An increase of the real foreign interest rate affects the financial markets and the current account, the latter effect being different from the former because it depends on the sign and amplitude of the initial stock of foreign assets, Fo. The portfolio reallocation following the foreign interest rate rise raises domestic holdings of foreign assets as well as interest payments on foreign investment, to be offset by a terms of trade revaluation. The domestic interest rate will change as well, in order to keep aggregate demand at its equilibrium level. Under perfect capital mobility $di = di^f$. If capital is not perfectly mobile the change of i will in general be lower than the change in i^f. When the combination of parameters is very close to zero, in other words when the system is not very far from falling into the instability trap, it is possible that an increase in i^f causes i to fall.This stresses the role of capital mobility in determining both the stability of the model and the equilibrium values of some of its variables, namely the domestic interest rate and the price level. To a certain extent a lower degree of capital mobility will isolate the economy's equilibrium position from shocks originating abroad. Also, the lower Ø the more powerful is the effect of fiscal policy on i, with relevant implications for capital accumulation. Unfortunately these effects cannot be properly analyzed under the assumptions made here. The "current account" effect of a foreign interest rate change depends on F_o. If the country is initially a net creditor domestic holdings of foreign assets increase and the exchange rate appreciates. The valuation of foreign wealth in domestic currency must rise:

$d(a+F)/di^f = \beta F_o$.

As a consequence the risk premium rises and the domestic interest rate falls correspondingly. Equilibrium in the money market requires higher real money balances, so that the price level is lower. It is now clear that one cannot state a priori the overall impact of a foreign interest rate change on endogenous variables.

6.Conclusions

The model is an extremely simplified representation of an open economy under a monetarist policy rule. A fundamental weakness is the insufficient description of the stock accumulation process. The stock-flow mechanism operating through the current account is analyzed but no discussion is provided of "policy induced" accumulation of money and government bonds through fiscal imbalances. Also, the process of capital accumulation is kept out of the picture. However, these shortcomings are common to most of the literature on the field.

Basically the model highlights the implications for stability and comparative statics arising from the inclusion in the Dornbusch model of of imperfect capital mobility and wealth effects. Comparative statics shows that the standard Fleming-Mundell-Dornbusch result about the effect of a permanent fiscal change is reversed once wealth effects and the current account identity are considered. In the long run a fiscal expansion depreciates the terms of trade in order to restore current account equilibrium at a lower level of returns from foreign investment. When a monetary "surprise" occurs the model shows that, if the money supply is to be neutral in the long run, the dynamic path towards equilibrium cannot be monotonic. Temporary current account imbalances must be reversed in the future. When a devaluation is needed to improve the current account, but at the same time this devaluation raises output above the natural rate, the model is unstable under the assumption of perfect capital mobility. On the other hand, the lower the degree of capital mobility the more likely is the system to be stable. The empirical relevance of these results is obviously questionable. Nevertheless, on theoretical grounds, the model casts serious doubts on the desirability of monetarist policies relying on a priori assumptions about the self stabilizing properties of the economic system.

But even assuming that the model is stable, the policy rule might not satisfactorily protect the economy from shocks originating abroad. In addition to the already well known result about the interdependence arising from short term price stickyness[23] the model points at the foreign interest rate and at foreign demand for domestic goods as the transmission channels that enable foreign shocks to affect the equilibrium values of real domestic variables. The amplitude of the necessary shifts in the equilibrium position of the system is inherently connected to the stability condition. The lower $\beta(\tau-i^{f})-\tau i^{f}$ and the higher the degree of capital mobility, the wider the amplitude of the necessary adjustment of endogenous variables to foreign shocks.

23Obstfeld, (1985)

CHAPTER 4

SIMPLE POLICY RULES FOR THE OPEN ECONOMY: EVALUATING ALTERNATIVE PROPOSALS.

1. Introduction

The design of macroeconomic stabilization policies has undergone a thorough revision over the last few years. After the collapse of monetarism as a philosophy of economic policy making, many in the economic profession have suggested the abandonment of open-loop rules in favour of more "interventionist" policies. However, an important legacy of monetarism is the emphasis on the importance of rules that stabilize the economy because they are known to the private sector and perceived as credible. The search for simple feed-back rules that work better than open-loop policies and are credible because of the government's pre-commitment and because, being simple, are easy to understand and to monitor, has been an important feature of recent work in the field of macroeconomic policies. Several proposals have been advocated that are concerned with macroeconomic stabilization in open economies, all belonging to the class of "decoupled" control rules, that contemplate the assignment of each instrument to a specific target. They differ in the number of instruments and objectives and/or assign the same policy weapon to different targets.

The first rule we consider is akin to the standard "monetarist" policy, as it is concerned only with monetary control of domestic inflation. It involves a real interest rate feed-back on a nominal income target, instead of the traditional fixed rate of growth of the money supply.

The second rule adds fiscal control of a foreign wealth target to the assignment of monetary policy to the nominal income target.

The third rule reverses this assignment: fiscal policy is concerned with the domestic target and monetary policy controls the foreign wealth target.

The fourth rule implements the "target zones" proposal as it has been spelled out in Williamson (1987) and Edison, Miller, and Williamson (1987).

Attempts to make a comparative evaluation of some of these rules have already been carried out with the aid of large econometric models (Currie and Wren-Lewis, 1988, Frenkel, Goldstein and Masson, 1988). But those simulations overlook a key feature of the working of the international economic system: the link between cumulating current account imbalances, foreign interest payments and wealth effects in domestic demand. This paper investigates this issue in the context of a small open economy. We shall also present some algebraic results about the dynamic stability of the economy under each assignment and the permanent effects that real and monetary shocks have on variables whose control is not contemplated in the proposals. Finally, numerical simulations of a small theoretical model will give some insights on the dynamic performance of the economy under the alternative assignments.

The main conclusions of the chapter are summarized as follows. First, the algebraic analysis of the model under each rule shows that the monetarist rule is prone to the same risk of instability discussed in the former chapter, whereas this does not happen under the other assignments. Second, when permanent real shocks hit the economy the necessary permanent variations of foreign wealth and the exchange rate are substantially larger under a monetarist policy. Assignments three and four, involving fiscal control of the domestic objective, are relatively more effective at stabilizing inflation, foreign wealth and the exchange rate, but involve significantly wider swings of the tax rate. Third, under each assignment disinflation policy requires an output loss, but the target zones regime also requires a permanent redistribution of foreign wealth and a corresponding permanent variation of the equilibrium exchange rate. Fourth, assignment two avoids the danger of instability inherent to a monetarist rule, substantially limits permanent changes of foreign wealth and the exchange rate, does not require wide swings of fiscal policy.

The rest of the chapter is organized as follows. Section 2 describes the small open economy model and the parameter values we use for the simulations. Section 3 discusses the rationale for each policy assignment. Section 4 presents the algebraic results and evaluates the dynamic performance of the economy.

2.THE MODEL

The structural equations combine three popular strands of the literature about open economy models which have developed in the 70's, mainly originating from the seminal works of Dornbusch (1976), Branson (1979) and Dornbusch and Fischer (1981). In fact it represents a more complex version[1] of the model discussed in chapter

1Unlike the models discussed in the former chapters, the present one is defined in levels and not in logs. This because in the numerical simulations we make use of the plausible parameters presented in Currie et al., (1986), whose model is defined in levels.

3. We follow Dornbusch in assuming that prices in the financial markets adjust to shocks much faster than prices in the goods markets, but we consider a more complex, albeit standard description of inflation dynamics. On the other hand we emphasize, as Branson and Dornbusch and Fischer do, the importance of the current account for determining the equilibrium exchange rate: in fact we append the current account equation to what would otherwise be a simple open economy model of the Dornbusch type. As in chapter 3 we consider wealth effects in aggregate demand. The country is assumed to be "small" in the market for imported goods, whilst world demand for domestic goods is represented by a downward sloped curve. World interest rates are not affected by domestic financial policies. We shall carry out numerical simulations of the model as an informative complement to the analytical results to be discussed in section 3. The plausible parameter values we use are mainly drawn from Currie et al.(1986)[2]

2Unlike the models discussed in the former chapters, the present one is defined in levels and not in logs. This because the plausible parameters presented in Currie et al. are referred to a model which is specified in levels.

Table 1: the model
(deviations from equilibrium)
Numerical simulations
Block 1
Output and inflation

1)$dp = dw + dx$;
1b)$dx = da - \epsilon_1[x - (\mu/1-\mu)a]$;
2)$dw = \epsilon y + \pi$;
3)$y = \alpha[\beta a - H_3] + \tau aF - \alpha\sigma r - \alpha\delta s + H_2$;
4)$d\pi = \Phi(dp - \pi)$;
5) $\pi = \Phi\epsilon z + \Phi x + H_1$;
6) $z = \int_{t}^{\infty} y\,dt$

Block 2
Wealth accumulation

7) $aF = a_0F + F_0a$;
8)$dF = T + r^f F$;
9) $T = \beta a - \mu y - H_3$;

Block 3
Exchange rate dynamics
10)$Eda = da$
11)$Eda = r - r^f$;

Block 4
Policy assignments[3]

Assignment 1: a "monetarist" rule
12)$dr = k_1(y_0dp + p_0dy) + 0.5k_1(y_0p + p_0y)$;

Assignment 2: "Meade" rule
13)$dr = k_1(y_0dp + p_0dy) + 0.5k_1(y_0p + p_0y)$;
14)$ds = -k_2dF$;

Assignment 3: reversed "Meade" rule
15)$ds = n_1(y_0dp + p_0dy) + 0.5n_1(y_0p + p_0y)$;
16)$dr = n_2dF$;

Assignment 4: "target zones" rule
17)$ds = n_1(y_0dp + p_0dy) + 0.5n_1(y_0p + p_0y)$;

3variables are defined in levels, hence nominal income must be linearized around the initial equilibrium, p_0y_0, $p_0 = 1$, $y_0 = 100$.

Definition of variables

y = output deviations from the natural rate;
a = real exchange rate;
F = net domestic holdings of foreign assets, denominated in foreign currency;
r = real interest rate;
s = income tax rate;
p = index of consumption prices;
w = index of domestic wages;
x = domestic price of imports from abroad
π = core inflation;
z = cumulated deviations of output from equilibrium;
T = trade balance
H1= inflation shock, (supply side shock)
H2= domestic demand shock
H3= competitiveness shock

Parameter values

$\alpha = 1.35$; $\sigma = 134$; $\Phi = 0.5$; $\epsilon = \epsilon_1 = 0.005$; $\tau = 0.08$; $\delta = 80$; $r^f = 0.05$; $a_0 = 1$; $k_1 = 0.59$; $k_2 = 0.017$; $n_1 = 1$; $n_2 = 0.01$

	low interdependence	high interdependence
β =	0.1	0.3
μ =	0.1	0.3

The model is split into four main blocks. Block 1 describes price dynamics in the goods markets. The general price level is a weighted average of domestic and imported foreign goods. The price of domestic goods is set as a mark-up on production costs. Inflation is a weighted average of wage inflation and the rate of change of the domestic price of imports from abroad. (eq.1). (Miller,1985) As in Miller et al. (1987) we assume that the latter variable gradually adjusts to exchange rate "surprises": its dynamics follow a standard "error correction" mechanism.(eq.1b) Domestic wages are a pre-determined or "sluggish" variable, whose dynamic path is described as an augmented Phillips curve. (eq.2) (Miller,1985) Output deviations from the natural rate are entirely determined by demand, which depends on the real exchange rate, wealth effects, the real interest rate and fiscal policy.(eq.3) Parameter α is the familiar Kahnian Keynesian multiplier. The core, underlying rate of inflation gradually adjusts to the actual rate of change of the price level. (eq.4) Therefore current core inflation depends on cumulated past deviations of output from equilibrium (eq.6) and on the current domestic price of foreign imports.(eq.5)

Block 2 describes wealth accumulation. The only form of wealth we consider here are net domestic holdings of assets denominated in foreign currency. The reason we do this is that we wish to emphasize the link between current account imbalances, wealth effects and the process of dynamic adjustment under alternative policy rules. Wealth is assumed to be held in domestic currency by domestic residents. In eq.7 we consider a linear approximation to its real value in domestic currency. To some extent the initial value of F, F_o, affects the dynamic performance of the model; to assess this we have carried out several simulations where F_o varies in a range of ±30% of national output. In the current account equation (eq.8) we consider both the service of foreign investment and the trade balance (eq.9), which is determined by the cyclical position of domestic output and by the real exchange rate. This definition of the current account follows the work of Currie et al. (1986) and Smith (1989). The numerical simulations will allow for different values of the trade balance elasticities.

Block 3 refers to financial markets. Exchange rate expectations are forward-looking: under the assumption of perfect foresight expected and actual exchange rate changes always coincide (eq.10). Needless to say, the exchange rate is the only "free" or non pre-determined variable. We assume that assets denominated in domestic and foreign currency are perfect substitutes (eq.11).
Block 4 defines targets, instruments and alternative policy assignments.

In the next sections we shall assume that the government controls a short-term rate of interest with the aim of setting a real interest rate which is assigned to the preferred target for monetary policy, as in Miller,(1985), and Edison Miller and Williamson, (1987). Fiscal policy is concerned with setting a rate of income tax.

Monetary targets have for long been the intermediate target for the internal objective, but if disturbances in international capital markets or shifts in the velocity of circulation occur, the setting of a fixed path for the money stock will lead to undesired fluctuations in the real exchange rate and output even in the absence of domestic inflationary pressures. More recently money GDP targets, initially advocated by Meade, have found wide acceptance, despite the criticism that if a target path for nominal income is specified, the policy implies a one for one trade-off between inflation and deviations of output from the natural rate. According to Fischer (1988) this might be difficult to accept for the policy-maker if it were to be put explicitly. Nonetheless we define nominal income as the domestic target when numerical simulations are carried out; the control rule will include both a proportional and an integral term.

The policy instrument assigned to the external objective is targeted on a stock variable: net domestic holdings of foreign assets. We shall discuss this choice in the next section.

To make the comparative evaluation of the policy proposals easier, we have "normalized" the parameters of the government reaction function, so that the anti-inflationary and the current account stabilizing policies have the same impact on aggregate demand under each rule. Hence the effect of a unit deviation from equilibrium of nominal income is constrained to be:

$\sigma k_1 = \delta n_1 = \Omega_1$;

Unit deviations from equilibrium of the foreign wealth target have the following impact on output[4]:

$|\sigma k_2| = |\delta n_2| = |\Omega_2|$.

This procedure, which corresponds to the one followed by Edison, Miller and Williamson (1987), is obviously open to criticism because of its "naivetè", but has the advantage of being easy to implement. The arguments for and against each of the proposed policy assignments are spelled out in some detail in the next section.

4Only the absolute value of the impact on output of wealth control can be normalized, as under assignments 2 a low level of wealth triggers a tax rise whereas under assignment 3 the real interest rate is reduced

Table 2: the simplified model (algebraic analysis)
(deviations from equilibrium)
Algebraic analysis

Block 1
Output and inflation
1c) $dp = dw + \mu da$;
2) $dw = \epsilon y + \pi$;
3) $y=\alpha[\beta a + H_3]+\tau aF-\alpha\sigma r-\alpha\delta s+H_2$;
4) $d\pi = \Phi(dp-\pi)$;
5b) $\pi = \Phi\epsilon z + \Phi\mu a + H_1$;
6) $z = \int_c^{\infty} y\,dr$

Block 2
Wealth accumulation
7) $aF = a_0F + F_0a$;
8) $dF = T + r^fF$;
9) $T = \beta a - \mu y + H_3$;

Block 3
Exchange rate dynamics
10) $Eda = da$
11) $Eda = r-r^f$

Block 4
Policy assignments

Assignment 1: a "monetarist" rule
12b) $r = k_1\pi$;

Assignment 2: "Meade" rule
13b) $r = k_1\pi$;
14) $s = -k_2F$;

Assignment 3: reversed "Meade" rule
15b) $s = n_1\pi$
16) $r = n_2F$;

Assignment 4: "target zones" rule
17b) $s = n_1\pi$

In order to keep the model tractable when carrying out the algebraic analysis of the stability conditions under alternative assignments we have decided to make some useful simplifications. Domestic core inflation has been selected as the internal target, and the policy feed-back has been limited to the proportional term, although this implies that long run stability of the price level cannot be achieved. But one should also bear in mind that keeping the price level stable might require wide fluctuations and prolonged persistence of disequilibria so that a more "accomodative" policy rule like the one proposed here might turn out to be preferable. Edison,Miller and Williamson, (1987), adopt a nominal income rule but choose to endogenize the money GDP path in order to dampen fluctuations, so that the target is revised at each period by taking into account past deviations of output and inflation from their desired values; as a result inflation control allows for substantial permanent deviations of the price level from its initial value. We do not follow their strategy because it would render the model analytically intractable. Hence we shall describe the policy assignments by means of eq.12b), 13b), 15b) and 17b), instead of eq.12), 13), 15) and 17).

As a further simplification we have assumed that the domestic price of foreign goods instantaneously adjusts to exchange rate shocks. Hence[5] eq. 1) is replaced with eq.1c.) $dp = dw + \mu da$.

3.Proposals for macroeconomic stabilization in open economies.

To some extent the debate on macroeconomic stabilization has been concerned with the choice between fully optimal policies and simple feedback rules. We have chosen not to implement a fully optimizing rule. Optimal policies are shock contingent and usually have a complex dynamic structure, often difficult to understand and to implement. But exceedingly complex rules might raise serious problems of credibility (Fischer,1988). Furthermore, the literature on dynamic inconsistency, following the seminal work of Kydland and Prescott has stressed the importance of pre-commitment in the conduct of stabilization policy. Over the last few years more work has been devoted to the search for simple, linear feedback rules which, albeit sub-optimal, may be more easily understood and implemented, thereby enhancing the sustainability of the policy stabilization process. In this context simplicity means that the policy rule must have a simple dynamic structure <u>and</u> that it should

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5this definition follows Miller(1985)

respond to a restricted set of variables. Within this class fall the so called "decoupled" control rules which assign each instrument to a single target variable (Vines et al., 1983) Following this approach, we will explore the implications that some existing proposals for policy stabilization have in terms of: a) the stability of the system; b) the permanent effects of shocks on some variables which are not directly controlled but whose evolution might well be object of legitimate concern for governments. In general no simple feed-back rule will dominate the others for all the shocks, however this exercise might be useful in the search for rules that perform reasonably well and are robust.(Edison, Miller, Williamson, 1987).

The first proposal we consider (eq.12), suggests that governments should focus on the internal objective, neglecting the evolution of the current account, whose balance is merely regarded as the result of saving-consumption decisions of the private sector. This proposal is deeply rooted in the monetary approach to the balance of payments[6]. Typically, its advocates assert that, as long as the budget is balanced, governments should not be concerned with external

6Frenkel and Johnson (1976)

disequilibria simply because the private sector will not run a permanent deficit. We label this proposal as "monetarist", although it departs from the standard monetarist orthodoxy by setting a closed loop rule, because it is restricted to the use of monetary policy only and completely overlooks fiscal policy as a viable instrument for stabilization purpose. This approach seems open to criticism for two main reasons. First of all, external deficits increase the consumption of current generations at the expenses of the future ones (Cooper, 1985). It might be legitimate for governments to ensure that such a transfer is consistent with the collective preferences of the public (Boughton, 1988). Secondly, the danger of withdrawal on short notice might turn external debt into a serious threat to national independence (Dornbusch and Park,1988).

The second proposal, (eq.13 and 14), has been advocated, in a broad form, by Genberg-Svoboda (1988), Boughton (1989) and the Cambridge Group working with Meade. It combines monetary control of the domestic objective with the assignment of fiscal feedback to the current account. We see two intuitions underlying this assignment. The first is that neglecting the current account balance is dangerous, partly because of the

reasons stated above, partly because in the long run cumulating external imbalances require a real exchange rate adjustment and this is likely to complicate the task of controlling domestic inflation. The second is that fiscal policy has a comparative advantage over monetary policy when controlling the current account. Boughton (1989) has argued that whenever monetary policy becomes expansionary in order to depreciate the exchange rate and improve the trade balance, the gains from the terms of trade devaluation are at least partly offset by the higher volume of imports which is the direct consequence of the positive stimulus that lower interest rates exert on domestic demand.
To assess the relevance of this claim we have chosen to consider an alternative rule: fiscal control of domestic inflation and assignment of monetary policy to the external objective. (assignment 3, eq.15 and 16)

From the above discussion it should now be clear why we chose to set the stock of foreign wealth as the external target instead of the current account balance. By stating an explicit target for F the government unambiguously determines the choice to be a net creditor or debtor country, and the preferred pattern of intertemporal allocation of future national consumption. It will also become clear that the government thereby unambiguously determines the long term exchange rate.

Finally, assignment 4, (eq.17), describes stabilization policy under a "target zones" regime. Advocates of this proposal have suggested that fiscal policy should target domestic inflation, whereas monetary policy should be left as a "reserve weapon" against speculative bubbles in the foreign exchange markets. Edison, Miller and Williamson (1987) evaluated this proposal in a two-country model, but their exercise suffered from two serious shortcomings. First, they did not model the current account, nor did they allow for wealth effects. Secondly, they considered an inflationary shock only, completely overlooking the implications of "real" shocks.

4.EVALUATING THE ALTERNATIVE POLICY ASSIGNMENTS

We follow the work of Frenkel, Goldstein and Masson (1989) and Edison, Miller, Williamson, (1987), by not ranking the performance of each assignment according to a formal utility function of the government, requiring explicit weights for the deviations from equilibrium of some key variables.

Instead we have chosen to stress some apparent strengths and weaknesses of each assignment. This is done by means of:

a) the algebraic analysis of a simplified version of the model set out in section 1;

b) numerical simulations of the full model

5.STABILITY ANALYSIS

In this section we are interested in showing the manner in which the choice of the policy assignment has implications for the dynamic stability of the model. We wish to emphasize that in general dynamic stability is not independent from the government reaction function and that it should not be taken for granted. Therefore we shall explore the stability conditions for each assignment in turn.

The general state-space form of the system is:

$$dX = A_1X + B_1G \ ;$$

$X = [z, F, a]$; $dX = [dz, dF, da]$; $G = [H_1, H_2, H_3]$

X, the vector of the endogenous dynamic variables, includes past deviations of output from equilibrium, foreign wealth and the real exchange rate. G is the vector representing the shocks, namely an inflation shock, a domestic demand shock and a shock concerning a fall of foreign demand for domestic goods. The subscripts i relate to each assignment.

The dynamic system is obtained by substituting eq.2), 3), 5), 6), 7), 9), 10) and the selected policy equations into eq. 1c), 8),11). Obviously, the structure of A_i and B_i changes with the policy assignment and is to be specified below.

It is well known that in the class of models we consider stability is ensured and dynamics are unambiguously determined when the number of unstable roots is equal to the number of non pre-determined variables (Blanchard and Kahn, 1980). Since the exchange rate is the only non pre-determined variable the model allows for, it is necessary (although not sufficient) that[7] $|A_i|>0$. We shall focus on this condition in order to assess the influence that each rule has on $|A_i|$.[8]

7 $|A|= \theta_1*\theta_2*\theta_3$ where θ_i are the roots of the characteristic equation; hence if one root only is to be positive $|A|>0$. But this does not rule out global instability : if the three roots are positive $|A|>0$.

8 We shall not discuss other conditions that might be sufficient for the system to be stable because one might easily show that under the rules considered here it is always possible to choose parameters of the government reaction function which ensure that the trace af A_i is negative. In that case at least one of the three roots must be negative, but given that $|A_i|>0$ the stable roots must be 2. Alternatively, the policy

5.1"Monetarist" rule (assignment 1)

Under this assignment the real interest rate is targeted on the internal objective and fiscal policy is not activated. The dynamic system is third order and the economic interpretation of the stability condition is rather difficult. Therefore we shall undertake the analysis of stability in stages.

Eq.5b defines core inflation. Since we have assumed that the price of foreign imports instantaneously adjusts to exchange rate "surprises"[9], core inflation is immediately affected by exchange rate jumps. As a preliminary step we assume that the core,. underlying rate of inflation is determined only by cumulated past deviations of output from equilibrium:

$\pi = \Phi \epsilon z$

In this case the transition matrix has the following structure[10]:

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mix should guarantee that the coefficient b_2 of the characteristic equation $|A_1 - \theta I| = 0 = \theta^3 + b_1\theta^2 + b_2\theta + b_3$ is negative. In fact $b_2 = \theta_1\theta_2+\theta_1\theta_3+\theta_2\theta_3$. If it is negative at least one negative root must exist, ruling out the possibility of three unstable roots.

9Note that we make this assumption only to make the model simple enough to be analytically tractable.

10We remind the reader that Ω_1 describes the policy induced impact on output of a 1% deviation of inflation from target. As defined in section 2 we have "normalized" coefficients k_1 and n_1 so that fiscal and monetary policy exert the same impact on output.

$$A_1^* = \begin{bmatrix} -\alpha\Omega_1\Phi\epsilon & \alpha\tau & \alpha(\beta + \tau F_o) \\ \mu\alpha\Omega_1\Phi\epsilon & i^f - \mu\alpha\tau & \beta-\mu\alpha(\beta + \tau F_o) \\ \Omega_1\Phi\epsilon/\sigma & 0 & 0 \end{bmatrix}$$

Cumulated past deviations of output from the natural rate drive the rate of core inflation and trigger the policy feedback, in the form of an interest rate change. Whenever interest rates at home and abroad differ real exchange rate dynamics occur. The exchange rate affects the current account in two ways. First, it determines foreign demand for domestic goods: a depreciation raises net exports and improves the current account. Secondly, it has an influence on aggregate demand as it alters the valuation of foreign wealth in domestic currency. From eq.7 it is clear that a depreciation raises domestic demand and worsens the current account when the initial stock of foreign wealth is positive and vice versa. We shall assume throughout the chapter that the overall influence of a depreciation on the current account is positive. We shall also make the plausible assumption that the absolute value of the wealth effect of the real exchange rate is smaller than the terms of trade influence on domestic demand. This guarantees that even when the initial stock of foreign assets is negative a depreciation expands domestic demand. An increase of the stock of foreign wealth raises both foreign interest payments and domestic demand for foreign goods. The global effect of a change of F on the current account cannot be determined a priori.

It should be now clear that the structure of the transition matrix under this assignment is very similar to the one discussed in the former chapter, under a standard monetarist rule.

The stability condition relating to the simplified system described by matrix A^{*} is:

$$5.1.1)\ |A_1^{*}| = [\alpha\Omega_1\Phi\epsilon/\sigma]\{\beta(\tau-i^{f}) - \tau i^{f}F_o\}$$

An intuitive interpretation of 5.1.1 can be given as follows. When $i^{f}>\mu\alpha\tau$,

that is, when a loss of foreign assets worsens the current account, the devaluation of the terms of trade is necessary to generate a current account surplus and to restore the equilibrium stock of foreign wealth. In the domestic goods market the loss of wealth weakens demand and output, whereas the devaluation exerts the opposite effect. If the depreciation dominates the effect of the loss of wealth and raises output above the natural rate the model becomes unstable. In fact the output expansion triggers a rise in inflation. This, in turn, will cause an increase of the domestic interest rate and a further depreciation[11]. In this case wealth and the exchange rate will take an everincreasing path. The stability condition simply requires that the necessary depreciation is associated to a current account surplus and to a level of output which is below the natural rate.

From the transition matrix one may derive the combinations of a and F which leave output and the current account in equilibrium[12].

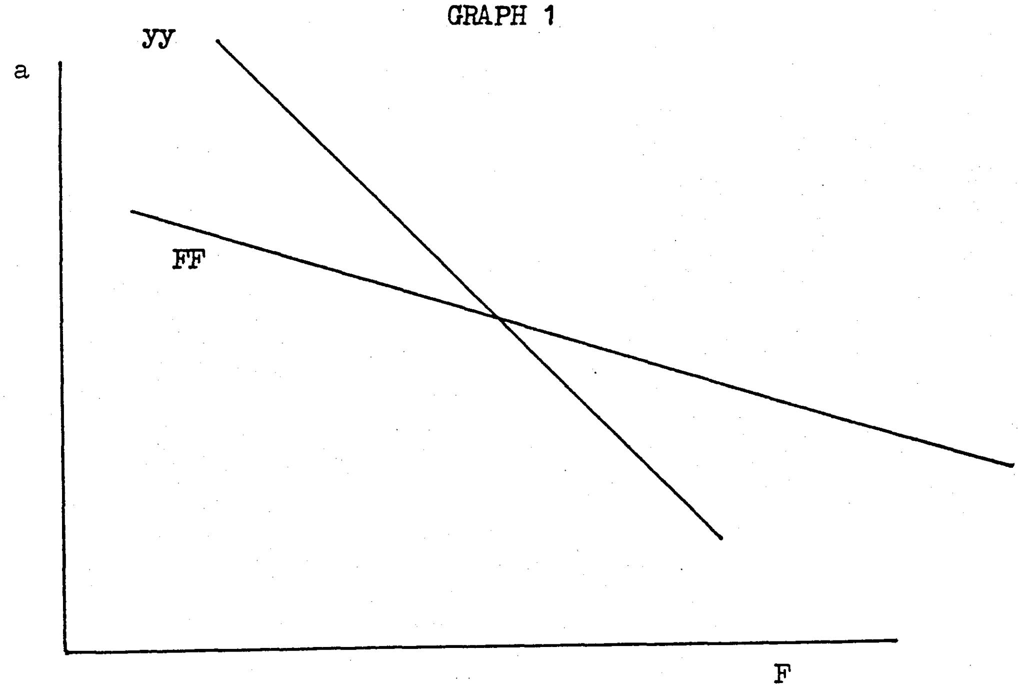
5.1.2) $y = 0$: $a = -[\tau/(\beta + \tau F_o)]F$

5.1.3) $dF = 0$: $a = -\{(i^f - \mu\alpha\tau)/[\beta - \mu\alpha(\beta + \tau F_o)]\}F$

11cfr.eq.11
12Holding z constant

in Graph 1 the locus yy represents the combinations of wealth and the exchange rate which leave output at the natural rate (eq.5.1.2). The locus FF represents the

GRAPH 1



combinations of wealth and the exchange rate which are consistent with current account equilibrium[13]. Stability requires that the initial combination of wealth and the exchange rate is set above the FF (so that wealth is accumulated) and below the yy (so that output is below the natural rate). This may happen only if the slope of the FF is smaller than the slope of the yy:

5.1.4 $[\tau/(\beta + \tau F_o)] > (i^f - \mu\alpha\tau)/[\beta - \mu\alpha(\beta + \tau F_o)]$

5.1.4 holds when the stability condition 5.1.1 is satisfied.

On the other hand, when $i^f < \mu\alpha\tau$, that is, when a loss of foreign wealth improves the current account, the depreciation is no longer necessary to restore the equilibrium level of wealth and it is always possible for the initial combination of wealth and the exchange rate to be consistent with a current account surplus and a recession in the goods market. In fact 5.1.1

13Under the assumption that $i^f > \mu\alpha\tau$

implies that when $i^{*}<\mu\alpha\tau$ saddlepath stability is guaranteed[14].

Let us turn now to the analysis of the system, under the assumption that:

$\pi = \Phi\epsilon z + \Phi\mu a$

The transition matrix becomes:

$$A_1 = \begin{bmatrix} -\alpha\Omega_1\Phi\epsilon & \alpha\tau & \alpha(\beta + \tau F_o - \Omega_1\Phi\mu) \\ \mu\alpha\Omega_1\Phi\epsilon & i^{*} - \mu\alpha\tau & \beta-\mu\alpha(\beta + \tau F_o - \Omega_1\Phi\mu) \\ \Omega_1\Phi\epsilon/\sigma & 0 & \Omega_1\Phi\mu/\sigma \end{bmatrix}$$

Inflation instantaneously responds to exchange rate "surprises" and triggers an interest rate feed-back. This, in turn, affects output, the current account and interest rate dynamics. A first fundamental difference between A_1^{*} and A_1 is that the direct link between the interest rate and the exchange rate substantially dampens the expansionary effect of a devaluation on output because the depreciation is followed by a monetary contraction. Furthermore, the interest rate feedback has a positive effect on the current account,

14To show this is straightforward. Assume that $i^{*} = \mu\alpha\tau-j$, where j is a positive integer. In this case the stability condition becomes: $\tau[\beta - \mu\alpha(\beta + \tau F_o)] + j(\beta + \tau F_o)>0$

as the flow of imports associated to the devaluation is reduced. On the other hand the rise of the real interest rate has a destabilizing effect on exchange rate dynamics: after the initial exchange rate jump the monetary contraction requires the expectation of a further devaluation, if the financial markets are to be in equilibrium. Quite strikingly, the stability condition associated to the A_1 is identical to the 5.1.1:

5.1.1b) $|A_1| = [\alpha\Omega_1\Phi\epsilon/\sigma]\{\beta(\tau-i^f) - \tau i^f F_o\}$

Condition 5.1.1b shows that the stabilizing influence of the interest rate on output and the current account is exactly offset by the effect of the interest rate rise on exchange rate dynamics.

If a negative shock occurs to F the policy feedback is activated only to the extent that the change in domestic expenditure drives inflation away from the desired path, regardless of the need of achieving long run equilibrium in the stock of wealth. If the reduction of imports associated to the loss of wealth is dominated by the fall of foreign interest payments, only an exchange rate depreciation can restore wealth equilibrium. Condition 5.1.1b shows that the policy feed-back has no influence on stability. Instead the system can be stable if, before taking into account the interest rate feedback associated to an exchange rate change, the devaluation which is necessary to generate a current account surplus is consistent with a level of output which is below the natural rate.

5.2.Meade assignment. (assignment 2)

This rule differs from the monetarist assignment because it sets an explicit wealth target for fiscal policy.

Under the simplifying assumption that

$\pi = \Phi \epsilon z$

the transition matrix has the following structure:

$$A_2 = \begin{bmatrix} -\alpha\Omega_1\Phi\epsilon & \alpha(\tau+\Omega_2) & \alpha(\beta + \tau F_o) \\ \mu\alpha\Omega_1\Phi\epsilon & i^f - \mu\alpha(\tau+\Omega_2) & \beta-\mu\alpha(\beta + \tau F_o) \\ \Omega_1\Phi\epsilon/\sigma & 0 & 0 \end{bmatrix}$$

Fiscal policy strengthens the contractionary effect of a loss of foreign assets on output. The loci describing combinations of wealth and the exchange rate which ensure current account and output equilibrium are defined as follows:

5.2.5) $y = 0$: $a = -[(\tau+\Omega_2)/(\beta + \tau F_o)]F$

5.2.6) $dF = 0$: $a = -\{[i^f-\mu\alpha(\tau+\Omega_2)]/[\beta-\mu\alpha(\beta + \tau F_o)]\}F$

Fiscal policy increases the absolute size of the slope of the locus which represents equilibrium in the goods market and correspondingly reduces the slope of the locus representing current account equilibrium. If fiscal control is sufficiently strong stability is ensured. In fact stability requires:

5.2.7) $|A_2^*| = [\alpha\Omega_1\Phi\epsilon/\sigma]\{\beta(\tau-i^f) -\tau i^f + \beta\Omega_2\}>0$

If 5.2.7 holds

$$[(\tau+\Omega_2)/(\beta + \tau F_o)]>[i^f-\mu\alpha(\tau+\Omega_2)]/[\beta-\mu\alpha(\beta + \tau F_o)]$$

We get the same result under the assumption that:

$\pi = \Phi\epsilon z + \Phi\mu a$

In this case the transition matrix becomes:

$$A_2 = \begin{bmatrix} -\alpha\Omega_1\Phi\epsilon & \alpha(\tau +\Omega_2) & \alpha(\beta + \tau F_o - \Omega_1\Phi\mu) \\ \mu\alpha\Omega_1\Phi\epsilon & i^f-\mu\alpha(\tau +\Omega_2) & \beta-\mu\alpha(\beta + \tau F_o - \Omega_1\Phi\mu) \\ \Omega_1\Phi\epsilon/\sigma & 0 & \Omega_1\Phi\mu/\sigma \end{bmatrix}$$

But the stability condition is identical to the 5.2.7. A sufficiently strong fiscal control prevents instability, because the $\Omega_2\beta$ term can dominate the unstable effects which might arise when only monetary policy is activated. Under this assignment the fiscal instrument is assigned the task of strengthening the impact that changes in domestic holdings of foreign assets have on domestic demand. This is now unambiguously enhanced relatively to the destabilizing role of interest payments in the current account.

5.3.Reversed "Meade" assignment (assignment 3)

Under this rule fiscal policy controls the internal objective and the monetary instrument is assigned to a foreign wealth target.

$$A_3 = \begin{bmatrix} -\alpha\Omega_1\Phi\epsilon & \alpha(\tau - \Omega_2) & \alpha(\beta + \tau F_0 - \Omega_1\Phi\mu) \\ \mu\alpha\Omega_1\Phi\epsilon & i^f - \mu\alpha(\tau - \Omega_2) & \beta-\mu\alpha(\beta + \tau F_0 - \Omega_1\Phi\mu) \\ 0 & \Omega_2/\sigma & 0 \end{bmatrix}$$

Monetary control of foreign wealth exploits the exchange rate swings determined by differentials between the domestic and foreign interest rates. But in doing so it also has a "perverse" influence on the current account. Suppose the stock of foreign assets is initially too low. The domestic real interest rate is then reduced in order to bring about a depreciation. This certainly raises foreign demand for domestic goods but also sucks in more imports, as the monetary stance is expansionary. The condition which is necessary for stability to hold, $|A_3|>0$, is always guaranteed, as:

$$|A_3| = \alpha\Omega_1\Phi\epsilon\beta\Omega_2/\sigma$$

In order to assess Boughton's warning about the risk of instability under this assignment we shall analyze the stability condition under the assumption that the government does not control inflation but sets a foreign wealth target. In this case the system has the following state-space form:

$$dF = [i^f - \mu\alpha(\tau - \Omega_2)]F + [\beta-\mu\alpha(\beta + \tau F_0)]a + G_1$$

$$da = (\Omega_2/\sigma)F + G_2$$

where G_1 and G_2 represent the forcing variables we are not interested in at the moment. The roots of the characteristic equation are:

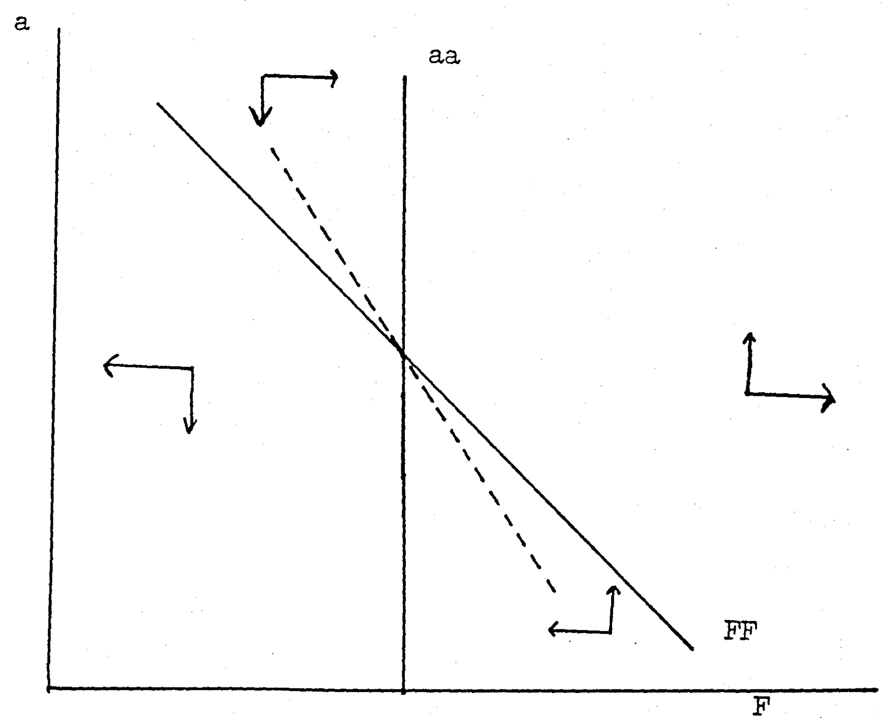
$$\theta_1 = 0.5\{[i^f - \mu\alpha(\tau - \Omega_2)]\}+$$
$$0.5\{[i^f - \mu\alpha(\tau - \Omega_2)]^2+4\Omega_2/\sigma[\beta-\mu\alpha(\beta + \tau F_o)]\}^{1/2}$$

$$\theta_2 = 0.5\{[i^f - \mu\alpha(\tau - \Omega_2)]\}-$$
$$0.5\{[i^f - \mu\alpha(\tau - \Omega_2)]^2+4\Omega_2/\sigma[\beta-\mu\alpha(\beta + \tau F_o)]\}^{1/2}$$

If a devaluation improves the current account[15] the system is saddlepath stable. The destabilizing influence of the policy feedback on domestic demand does not affect stability because it is always possible that an appropriate exchange rate jump generates convergent wealth and exchange rate dynamics. We show this with the aid of the familiar state-space diagram (graph 2). Along the the aa locus domestic and foreign interest rates are equal. It is vertical on the foreign wealth target, as exchange rate changes do not cause any interest rate feed-back. When foreign assets are above equilibrium the real interest rate is increased, hence equilibrium in the international financial markets requires an exchange rate depreciation. The FF curve represents combinations of foreign wealth and the

15But the rationale for this assignment relies on the presumption that a devaluation improves the current account

GRAPH 2



exchange rate which yield current account equilibrium. It is negatively sloped under the assumption that a loss of foreign assets worsens the current account because the corresponding reduction of the interest rate expands domestic demand and dominates the negative wealth effect caused by the fall of F[16]. Points above the FF are associated with a current account surplus and vice versa. Suppose that foreign wealth falls below target. Monetary policy takes an expansionary stance and this requires the expectation of a devaluation if the international financial markets are to be in equilibrium. As a result the exchange rate must depreciate. Graph 2 shows that if a devaluation improves the current account the initial exchange rate jump can generate the current account surplus necessary to restore the equilibrium level of foreign wealth. Thus, the gradual accumulation of foreign assets is followed by the increase of the real interest rate and by the exchange rate appreciation.

16This assumption is by no means necessary to show that stability obtains. We make it here as this case is more akin to Boughton's example.

5.4.Target zones regime. (assignment 4)

Fiscal policy is assigned to the domestic target and monetary policy is not activated.

$$A_4 = \begin{bmatrix} -\alpha\Omega_1\Phi\epsilon & \alpha\tau & \alpha(\beta + \tau F_o - \Omega_1\Phi\mu) \\ \mu\alpha\Omega_1\Phi\epsilon & i^f-\mu\alpha\tau & \beta-\mu\alpha(\beta + \tau F_o - \Omega_1\Phi\mu) \\ 0 & 0 & 0 \end{bmatrix}$$

$|A_4| = 0$ as a direct consequence of a policy assignment designed to prevent real exchange rate dynamics. But one may solve the characteristic equation and determine algebraically the signs of the 3 roots: $|A_4-\theta I|=0$ if

$$\theta[\theta^2 -(i^f - \mu\alpha\tau \ -\alpha\Omega_1\Phi\epsilon)\theta -i^f\alpha\Omega_1\Phi\epsilon] = 0$$

which implies:

$$\theta_1 = 0;$$

$$\theta_2 = 0.5\{i^f-\mu\alpha\tau-\alpha\Omega_1\Phi\epsilon+[(i^f-\mu\alpha\tau \ -\alpha\Omega_1\Phi\epsilon)^2+4i^f\alpha\Omega_1\Phi\epsilon]^{-1/2}\};$$

$$\theta_3 = 0.5\{i^f-\mu\alpha\tau-\alpha\Omega_1\Phi\epsilon-[(i^f-\mu\alpha\tau-\alpha\Omega_1\Phi\epsilon)^2+4i^f\alpha\Omega_1\Phi\epsilon]^{-1/2}\};$$

It is clear that $\theta_2>0$, $\theta_3<0$. Therefore the model is always saddlepath stable.

Given the structure that this assignment imposes upon the dynamic matrix, exchange rate dynamics can never occur so that the possibility of undershooting or overshooting is ruled out. Nevertheless the exchange rate is an endogenous variable because the model includes the current account equation. Stability requires that the real exchange rate initially jump onto its long run value. The intuitive explanation of this conclusion is very simple indeed: whenever the nature of a shock is such that in the long run domestic holdings of foreign assets must change, the exchange rate must adjust correspondingly in order to ensure that the system converges to current account equilibrium at this new long run level of wealth. A comparison with assignment 3 suggests that when fiscal policy is assigned to the domestic objective monetary control of a foreign wealth target is not necessary to ensure stability, provided that the real exchange rate is allowed to adjust once and for all in the face of permanent variations of foreign wealth.

5.5. Summarizing remarks

From the analysis carried out so far it emerges quite clearly that dynamic instability might well occur in open economy models which include wealth effects and the current account. The danger of instability is a consequence of the presence of foreign investment/debt service in the current account: if $i^f = 0$ the condition $|A_1|>0$ would always obtain. The choice of the policy rule has important implications. Under a "monetarist" assignment the system might turn out to be inherently unstable, independently from the strength of the policy feedback. But adding fiscal control of the external objective might have a quite favorable effect. On the other hand, if the authorities exert fiscal control on domestic inflation (assignments 3 and 4) the model is saddlepath stable. If the government adheres to a target zones rule the exchange rate target cannot be considered as exogenous: when permanent changes of foreign wealth occur the terms of trade must be initially adjusted to that level which will ensure current account equilibrium in the long run.

6. Comparative statics and simulation of the dynamic adjustment to equilibrium.

6.1. Introduction

The policy rules outlined above probably imply different dynamic adjustment paths in response to shocks. To a certain extent this is also true for the required permanent changes of some endogenous variables. This section gives a detailed analysis of these differences. The dynamic performance of the model under each policy regime and the long run changes of z, F and a after permanent shocks are evaluated by means of numerical simulations. We shall also present some algebraic results concerning the theoretical determination of these long run changes. The procedure for computing the long run values of the endogenous variables under assignments 1, 2 and 3 substantially differs from the one which is necessary when we discuss assignment 4. This solution method is original and has the merit of highlighting the interaction between dynamics and long term equilibrium under a target zones regime.

Assignments 1-3.

Since the general representation of the system in state-space form is

$$dX = A_i X + B_i G \;;$$

the equilibrium set of endogenous variables is

$$X = A_i^{-1} B_i G$$

The structure of the B_i matrices, related to the forcing variables vector, is the following:

$$B_1 = \begin{bmatrix} \alpha & \alpha & -\alpha\Omega_1 \\ -\mu\alpha & 1-\mu\alpha & \mu\alpha\Omega_1 \\ 0 & 0 & \Omega_1/\sigma \end{bmatrix}$$

$$B_2 = \begin{bmatrix} \alpha & \alpha & -\alpha\Omega_1 \\ -\mu\alpha & 1-\mu\alpha & \mu\alpha\Omega_1 \\ 0 & 0 & \Omega_1/\sigma \end{bmatrix}$$

$$B_3 = \begin{bmatrix} \alpha & \alpha & -\alpha\Omega_1 \\ -\mu\alpha & 1-\mu\alpha & \mu\alpha\Omega_1 \\ 0 & 0 & 0 \end{bmatrix}$$

Assignment 4

Under assignment 4 $|A_4| = 0$, therefore A_4^{-1} can no longer be computed. But the long run solution can then be found as follows. Consider

$$6.1.1)\ dz = -\alpha\Omega_1\Phi\epsilon z + \alpha\tau F + \alpha(\beta + \tau F_o - \Omega_1\Phi\mu)a + \alpha(H_2 - H_3) - \alpha\Omega_1\Phi\epsilon H_1$$

$$6.1.2)\ dF = \mu\alpha\Omega_1\Phi\epsilon z + [i^f - \mu\alpha\tau]F + [\beta - \mu\alpha(\beta + \tau F_o - \Omega_1\Phi\mu)]a + -\mu\alpha H_2 - (1-\mu\alpha)H_3 + \mu\alpha\Omega_1\Phi\epsilon H_1$$

This is the dynamic structure of the model under a target zones regime, as no exchange rate dynamics may occur because real interest rates are equalized across countries. However, the exchange rate must be regarded as an endogenous variable. The analysis of stability has shown that under this regime the characteristic equation has one unstable root and equilibrium is a saddlepoint. In this class of models stability requires that the number of unstable roots is matched by the number of non pre-determined variables. Since both F and z are pre-determined, dynamics may converge only if

the exchange rate is initially set at a level consistent with stability. Intuitively, it should be clear that only an exchange rate jump may ensure current account equilibrium when permanent changes of foreign wealth occur. The following discussion will provide a more formal argument.
To find the long run values of z, F ans a one should take into account that, as Dixit and Blanchard-Kahn have shown,

6.1.3) $a(0) - a_{\infty} = v_1(z_0 - z_{\infty}) + v_2(F_0 - F_{\infty})$

where $[-1, v_1, v_2]$ is the left eigenvector associated to the unstable root and a(0) is the exchange rate level after the "jump" required by the transversality condition. Condition (3.2.3) shows that the initial exchange rate overshooting is a function of initial deviations of pre-determined variables from equilibrium. But when a target zones regime is enforced in a deterministic setting temporary deviations of the exchange rate from equilibrium cannot occur. Hence $a(0) = a_{\infty}$ and

6.1.4) $F_{\infty} - F_0 = -(v_1/v_2)(z_{\infty} - z_0)$.

By redefining the dynamic variables in terms of deviations from equilibrium one may substitute for F in 6.1.1) and 6.1.2) from the 6.1.4. At that stage, having imposed dz = dF = 0, it becomes straightforward to find the long run values of a, z and F. It is clear that a_∞, F_∞, z_∞ are jointly determined. On one hand the real exchange rate must adjust to changes in F to balance the current account. On the other, since the process of expectations formation forces the exchange rate to jump before the dynamic adjustment begins and this jump affects both wealth accumulation and output, F_∞ and z_∞ cannot be determined independently from a_∞. A clear example of how this mechanism works is provided in section 6.2.

Under a target zones regime the structure the B_4 matrix has the following structure:

$$B_4 = \begin{bmatrix} \alpha & \alpha & -\alpha\Omega_1 \\ -\mu\alpha & 1-\mu\alpha & \mu\alpha\Omega_1 \\ 0 & 0 & 0 \end{bmatrix}$$

6.2. Disinflationary policy

We assume that initially core inflation is 10% higher than its desired value.

6.2.1. Long run values

Assignments 1-3

Except that under a target zones regime, disinflation has no effect on foreign wealth and the exchange rate; the total output loss required to bring down inflation amounts to[17]:

$z_{\infty}-z_{0} = -H_{1}/\Phi\epsilon = -40\%$.

17This is a standard result in the literature since the work of Buiter and Miller(1982)

Assignment 4

Comparative statics of the simplified model yields:

$$a_{\infty} = -[H_1/\Phi\epsilon][(i^f/\beta)*(v_1/v_2)]/\{1+(v_1/v_2\Omega_1\Phi\epsilon)[\tau- -i^f(\beta+\tau F_o-\Omega_1\Phi\mu)/\beta]\} <0$$

$$F_{\infty} = [H_1/\Phi\epsilon]*(v_1/v_2)/\{1+(v_1/v_2\Omega_1\Phi\epsilon)[\tau - i^f(\beta+\tau F_o- -\Omega_1\Phi\mu)/\beta]\} >0$$

$$z_{\infty} = -[H_1/\Phi\epsilon]/\{1+(v_1/v_2\Omega_1\Phi\epsilon)[\tau - i^f(\beta+\tau F_o-\Omega_1\Phi\mu)/\beta]\}<0$$

We get to these conclusions about the long run effects of the disinflationary policy because:

$v_1/v_2 = (\theta_2 + \alpha\Omega_1\Phi\epsilon)/\beta\alpha\Omega_1\Phi\epsilon + [\beta-\mu\alpha(\beta+\tau F_o - \Omega_1\Phi\mu)]\theta_2$ is positive;

$\tau > i^f$ [18]

$(\beta+\tau F_o-\Omega_1\Phi\mu)/\beta <1$ if $F_o<0$ or fiscal control is sufficiently strong.

Under a target zones regime, when fiscal policy controls domestic inflation and monetary policy is not activated, disinflation determines permanent changes of F and a. The fiscal contraction, necessary to control domestic inflation, reduces domestic demand for foreign goods and causes a permanent accumulation of foreign

18On the rationale for assuming $\tau > i^f$ see Blanchard (1985) wealth. If the current account is to be in equilibrium in the long run, a permanent exchange rate appreciation is required. Assignment 4 causes a permanent wealth redistribution because, unlike the other rules, it does not determine an exchange rate undershooting during the recession which is necessary to curb inflation. Under the other rules exchange rate swings prevent the domestic output loss from permanently affecting foreign wealth. By contrast, under a target zones regime the exchange rate simply jumps onto the new equilibrium value, which accounts for the current account surpluses accumulated during the disinflation. Another interesting feature of this regime is that the permanent terms of trade appreciation reduces the necessary output loss.

Table 3. Permanent effects of a disinflationary policy under a target zones regime when nominal income is the domestic target

	low interdependence	high interdependence
z	-39,6%	-38.3%
F	+3.5%	+10%
a	-1.2%	-2%

The numerical simulations confirm our algebraic analysis and imply that the size of the wealth transfer is positively related to the trade elasticities, mainly to the income elasticity. Although we do not make great claim of realism, this result suggests that the wealth redistribution might be substantial. In a way one might argue that a deflationary policy under this assignment turns out to be another kind of beggar-thy-neighbor policy, as the renounce to temporarily "export" inflation abroad by means of a terms of trade appreciation[19] is matched by the permanent increase of national disposable income obtained by raising domestic holdings of foreign wealth. Further research should investigate whether this outcome would be more

19But the country carrying forward the disinflation ends up with an appreciated currency anyway.

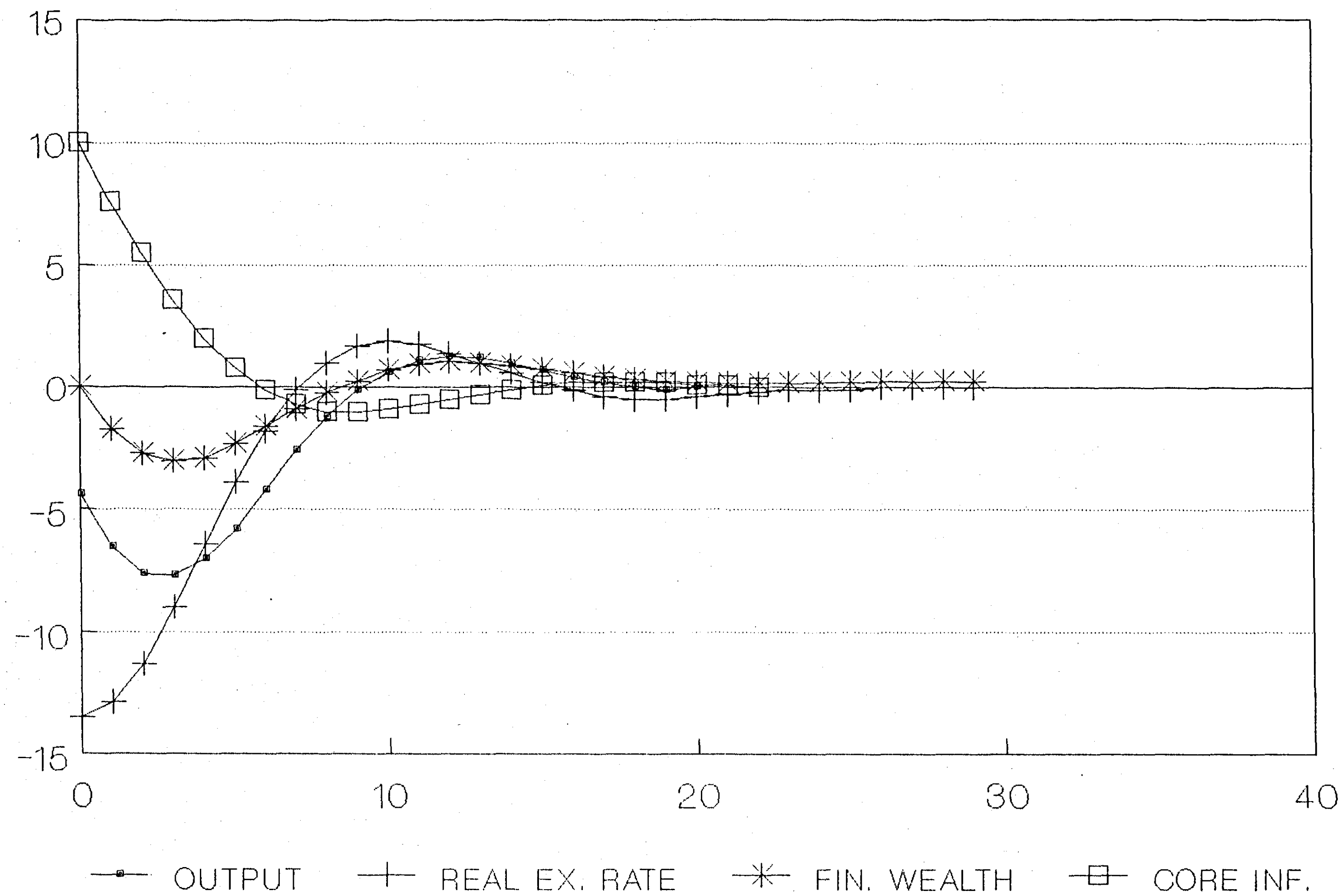
or less likely to induce retaliatory policies from the commercial partners of the country than the fluctuation of the real exchange rate.

6.2.2.Dynamics

Let us turn now to an analysis of the dynamic performance of the model under the alternative rules. When monetary policy is activated (assignments 1,2,3) the real exchange rate initially appreciates. Later on it gradually depreciates toward its equilibrium value. Comparing assignment 1 and 2 we observe that the latter requires a more moderate initial jump of the exchange rate, probably because the fiscal control, by depressing domestic demand in order to achieve the wealth target, has a favorable side-effect on the domestic objective. Relatively to the performance of assignment 1 fluctuations of financial wealth are dampened. If the model is simulated assuming lower values of the trade balance elasticities wider fluctuations of the exchange rate and the monetary instrument occur under both rules.

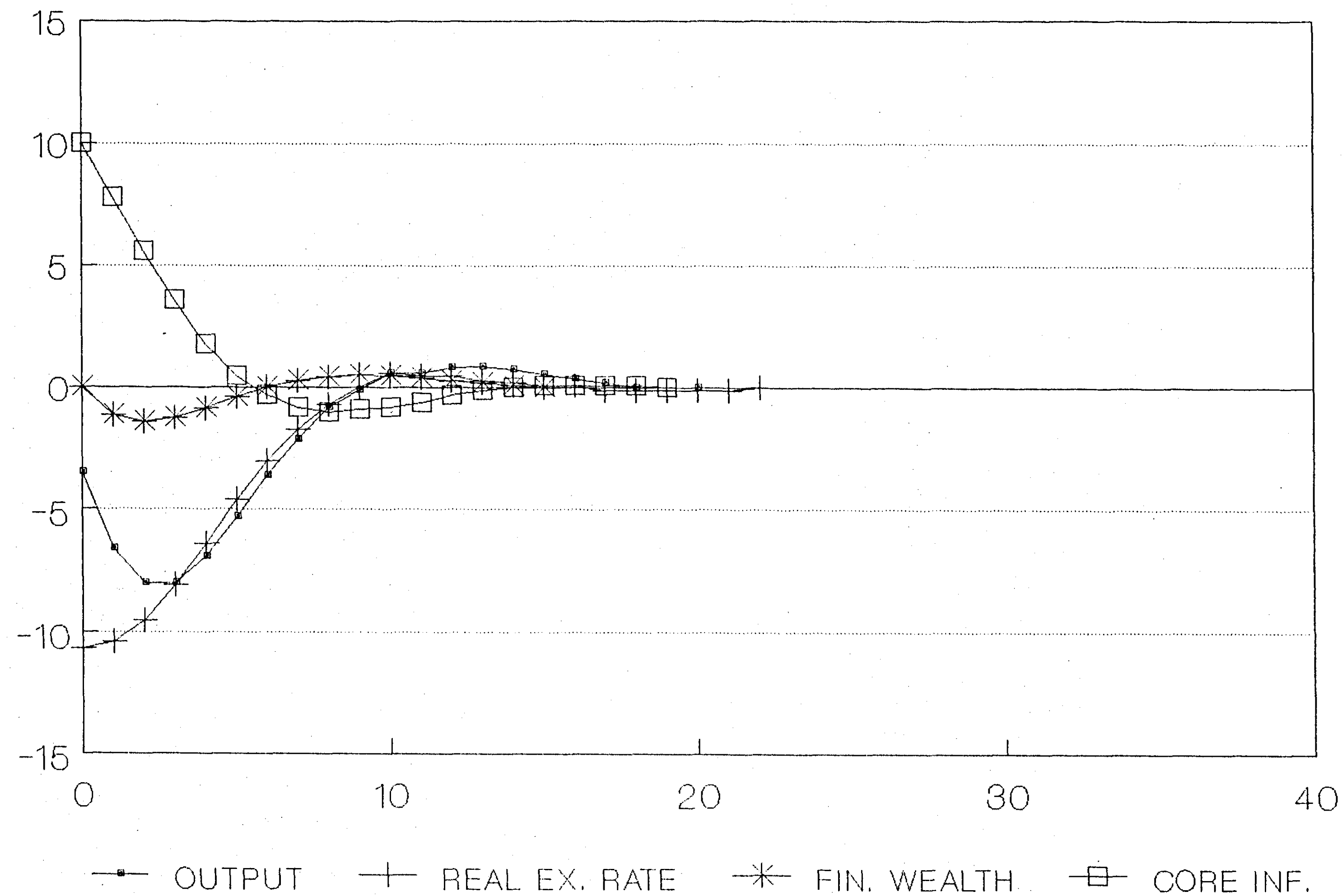
Under assignment 3 the disinflation policy works as follows. The fiscal contraction reduces output, turning the current account into surplus. External equilibrium requires a temporary exchange rate appreciation, which is achieved by increasing the domestic real interest rate. Again, as in the case of assignment 2, exchange rate, fiscal and monetary policy exert a contractionary stimulus, but with a different mix, fiscal policy being more strongly activated than monetary policy. Also, the terms of trade appreciation necessary to control the current account is milder than the revaluation required to bring down inflation under assignments 1 and 2. If the trade balance elasticities are low, the exchange rate deviations from equilibrium are relatively smaller, whereas under assignments 1 and 2 they turned out to be enhanced. This probably happens because the positive influence of the fiscal contraction on the current account is weaker, so that the necessary rise of the domestic interest rate is milder.One might argue that assignment 3 has the appealing implication of imposing less deflationary pressure upon the sector open to international competition relatively to the one producing non-traded goods. Boughton's claim that under this rule current account control would be relatively more difficult than in the case of assignment 2 does not seem confirmed: wealth fluctuations are less wide than under assignment

DISINFLATION POLICY
ASSIGNMENT 1



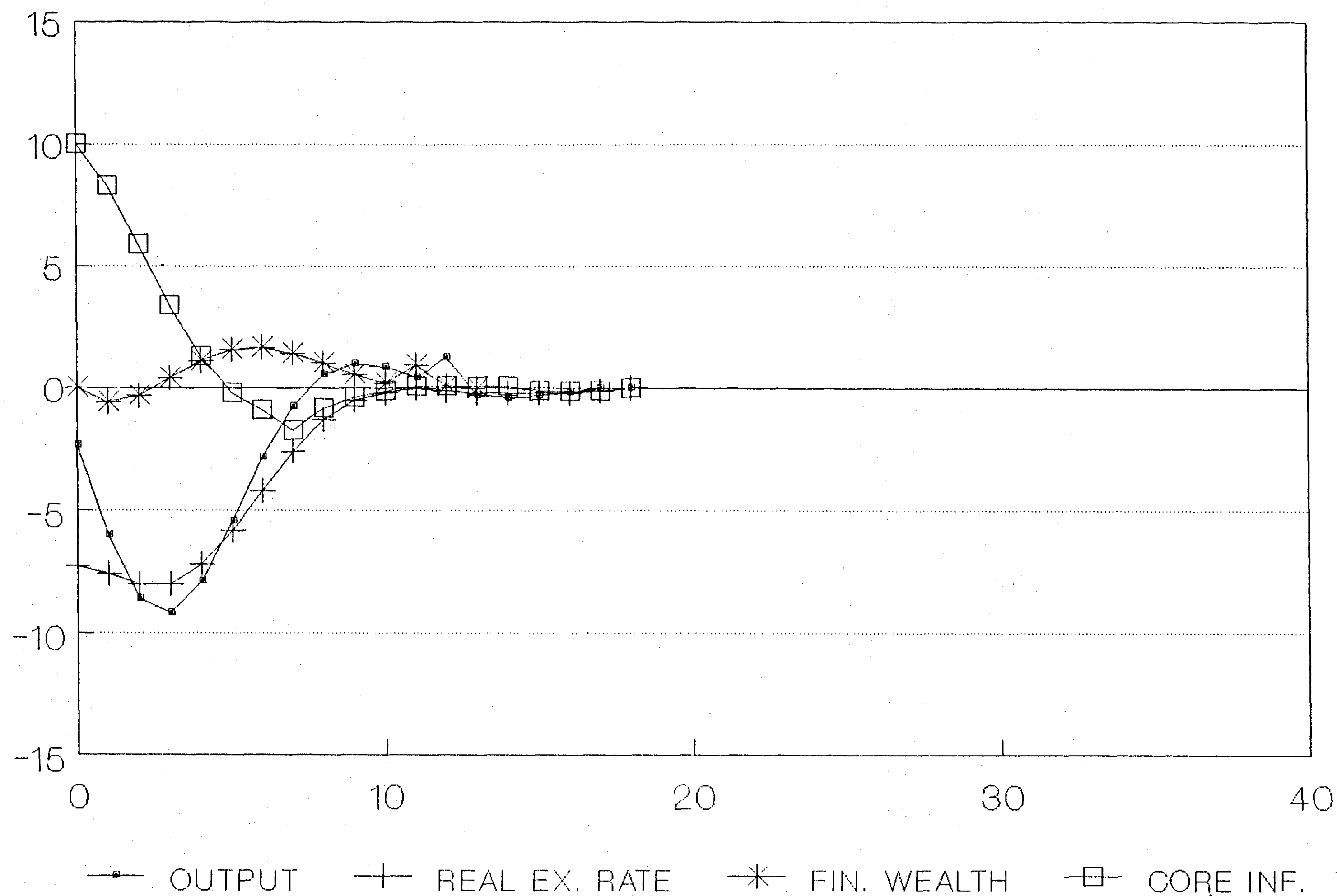
HIGH INTERD.

DISINFLATION POLICY
ASSIGNMENT 2



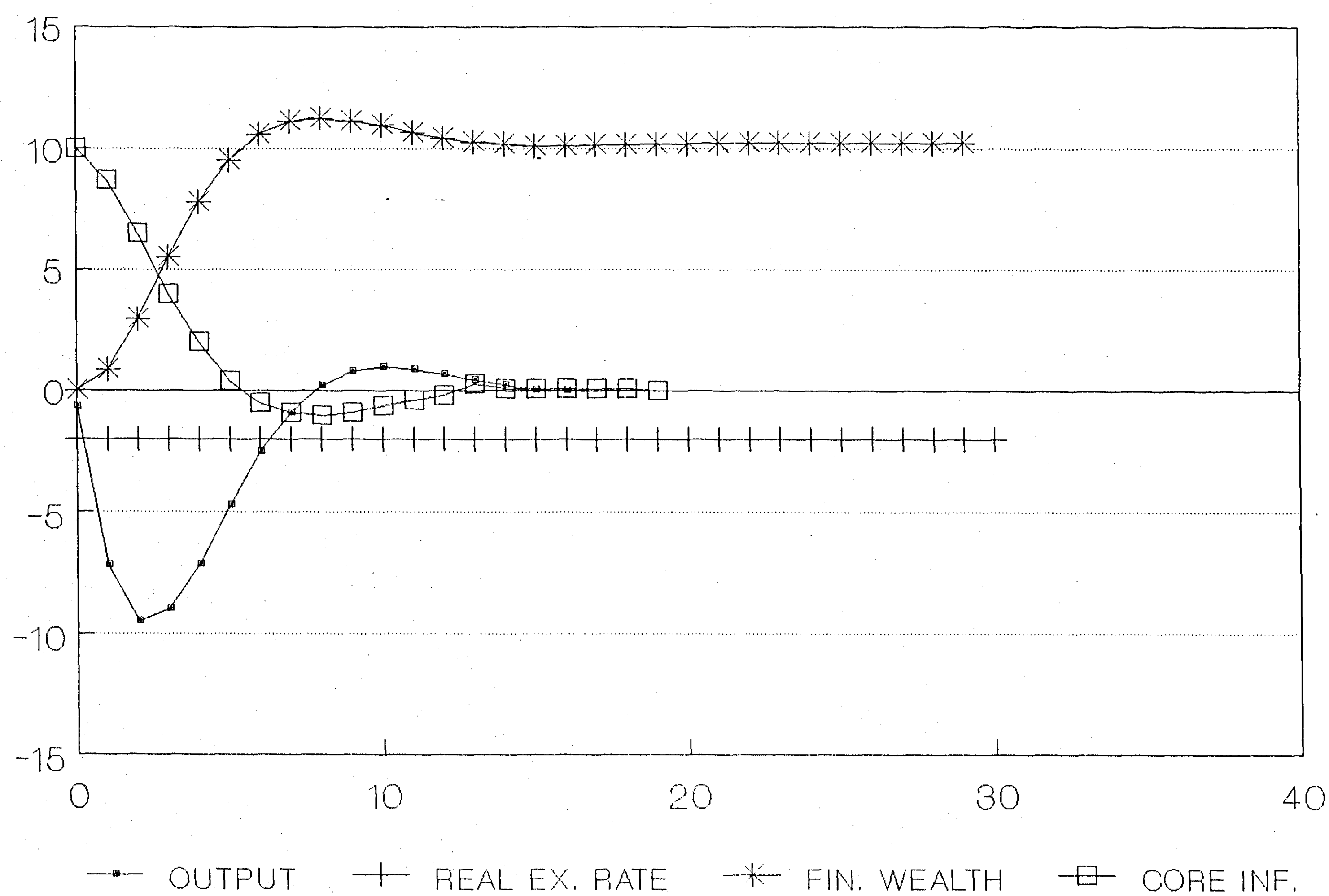
HIGH INTERD.

DISINFLATION POLICY
ASSIGNMENT 3



HIGH INTERD.

DISINFLATION POLICY
ASSIGNMENT 4



HIGH INTERD.

2. But this probably happens because the fiscal contraction necessary to bring inflation down helps in keeping wealth close to the target and not by own virtue of the monetary policy rule.

Finally, table 4 presents the cumulated deviations of policy instruments from equilibrium. We include the exchange rate because under assignments 1,2 and 3 terms of trade fluctuations are exploited for the purpose of targets stabilization. The implied costs in terms of interest rate and relative prices disequilibria are gradually reduced when moving from assignment 1 to 4. The opposite conclusion holds when one considers tax deviations from equilibrium. Compared to assignment 1 rule 2 cuts down exchange rate deviations from equilibrium by approximately one third and requires a substantially more moderate use of the monetary instrument, -50%. This at the cost of a rather limited use of the fiscal weapon. By contrast, assignment of fiscal policy to the domestic target requires fluctuations of the tax rate which are far wider than those necessary to control the current account. When weighing the relative merits of each rule account for this should be made. It has been rightly claimed that disinflation policies exploiting the appreciation of the exchange rate might heavily alter the patterns of international trade, but on the other hand one should bear in mind that the alternative involving fiscal control of the domestic objective might imply substantial deviations of the tax rate from the desired equilibrium level. Graph 3 shows that assignments 3 and 4 require a tax rate hike that can be as high as 8% and this might simply be not feasible. Furthermore an evaluation of assignment 4 would require taking into account the permanent changes of wealth and the exchange rate that become necessary under this rule.

GRAPH 3 DISINFLATION POLICY
ALTERNATIVE PATHS OF THE TAX VARIABLE

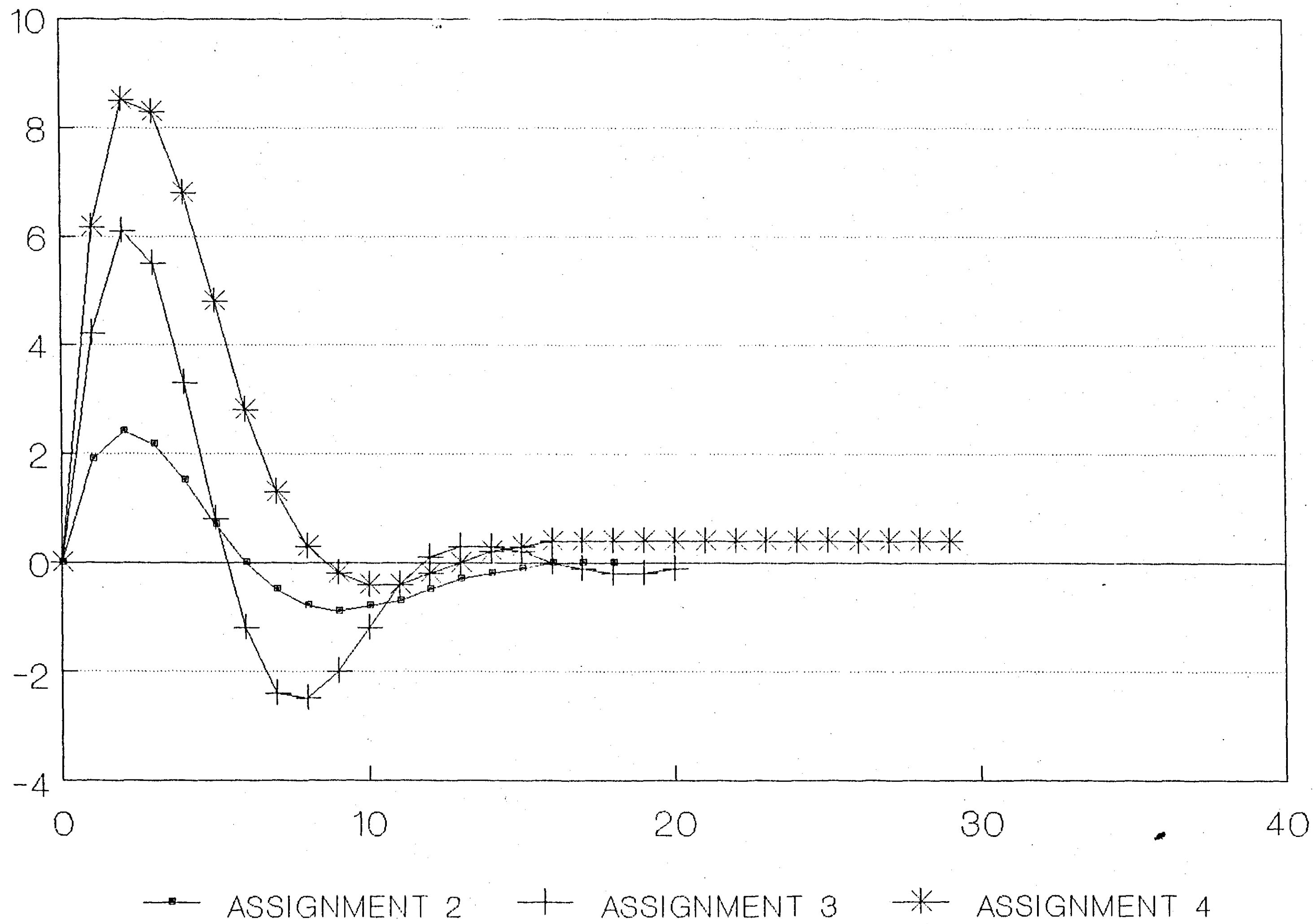


Table 4. Disinflation policy: cumulated squared deviations from equilibrium of policy instruments (percentage values)

low interdependence

Assignm.	1	2	3	4
r	81.95	46.13	5.64	0
s	0	20.16	263.5	266
a	948	599.1	238.57	0

high interdependence

Assignm.	1	2	3	4
r	94.76	15.23	10.68	0
s	0	19.78	115.02	256.5
a	632.15	454.36	348.2	0

6.3. Control of domestic demand

We consider a 5% permanent[20] rise of domestic demand in real terms.

Long run effects

Assignment 1

$$z_{\infty} = \{-\mu i^{f}/[\beta(\tau - i^{f}) - \tau i^{f} F_{0}]\} H_{2}$$

$$F_{\infty} = -\beta H_{2}/[\beta(\tau - i^{f}) - \tau i^{f} F_{0}]$$

$$a_{\infty} = i^{f} H_{2}/[\beta(\tau - i^{f}) - \tau i^{f} F_{0}]$$

Policy control is activated only to the extent that excess demand raises inflation, regardless of the current account, which turns into a deficit. Eventually, the real exchange rate must depreciate in order to ensure external equilibrium. Wealth effects in aggregate demand will compensate for the initial shock.

$$dF_{\infty}/d\tau = \beta(\beta - i^{f} F_{0})/[\beta(\tau - i^{f}) - \tau i^{f} F_{0}]^{2}$$

---

20 Assuming permanent instead of temporary shocks is obviously arbitrary. It relates to the debate between those who take the view that economic variables are driven by stochastic trends and those who believe that economic variables are better described by unexpected shocks around a deterministic trend.

If the model is to be stable $(\beta - i^f F_o) > 0$, hence $dF_\infty/d\tau > 0$; the stronger are wealth effects in aggregate demand the smaller is the necessary loss of financial assets.

$$da_\infty/d\tau = -i^f(\beta - i^f F_o)/[\beta(\tau - i^f) - \tau i^f F_o]^2 < 0$$

Stronger wealth effects require a smaller devaluation of the real exchange rate. In terms of domestic output the foreign wealth transfer is very likely to be stronger than the initial expansion of domestic demand. Simulation results show that under this assignment the transfer of foreign wealth can be huge, but it substantially decreases when wealth effects are stronger. The sign and magnitude of F_o may have a significant effect on F_∞ via the change in the valuation of F in domestic currency. If $F_o < 0$ the required long run exchange rate devaluation raises the value of external debt and, by exerting a negative wealth effect, reduces the necessary loss of foreign assets. By contrast, when $F_o > 0$, the depreciation raises the valuation of financial wealth in domestic currency, exerting a "perverse" impact on the current account and on F_∞.

Assignment 2

Assignment of fiscal control to the external equilibrium substantially changes the picture.

$$z_\infty = \{-\mu i^f/[\beta(\tau - i^f) - \tau i^f F_o + \beta\Omega_2]\}H_2$$

$$F_\infty = -\beta H_2/[\beta(\tau - i^f) - \tau i^f F_o + \beta\Omega_2]$$

$$a_\infty = i^f H_2/[\beta(\tau - i^f) - \tau i^f F_o + \beta\Omega_2]$$

To the extent that fiscal control is sufficiently strong, the wealth redistribution and the exchange rate devaluation are drastically reduced. Fiscal policy acts far more quickly than wealth effects in curbing the excess of domestic demand[21].

The dynamic performance of the model improves, too. Under a "monetarist" rule the model exhibits prolonged

21However, under this rule, as well as under assignments 3 and 4, only a permanent increase of the tax rate may compensate for the permanent shock to aggregate demand. One might expect that including the government budget constraint in the model, the prolonged fiscal contraction would reduce domestic holdings of government debt, so that eventually this negative wealth effect would keep aggregate demand in equilibrium.

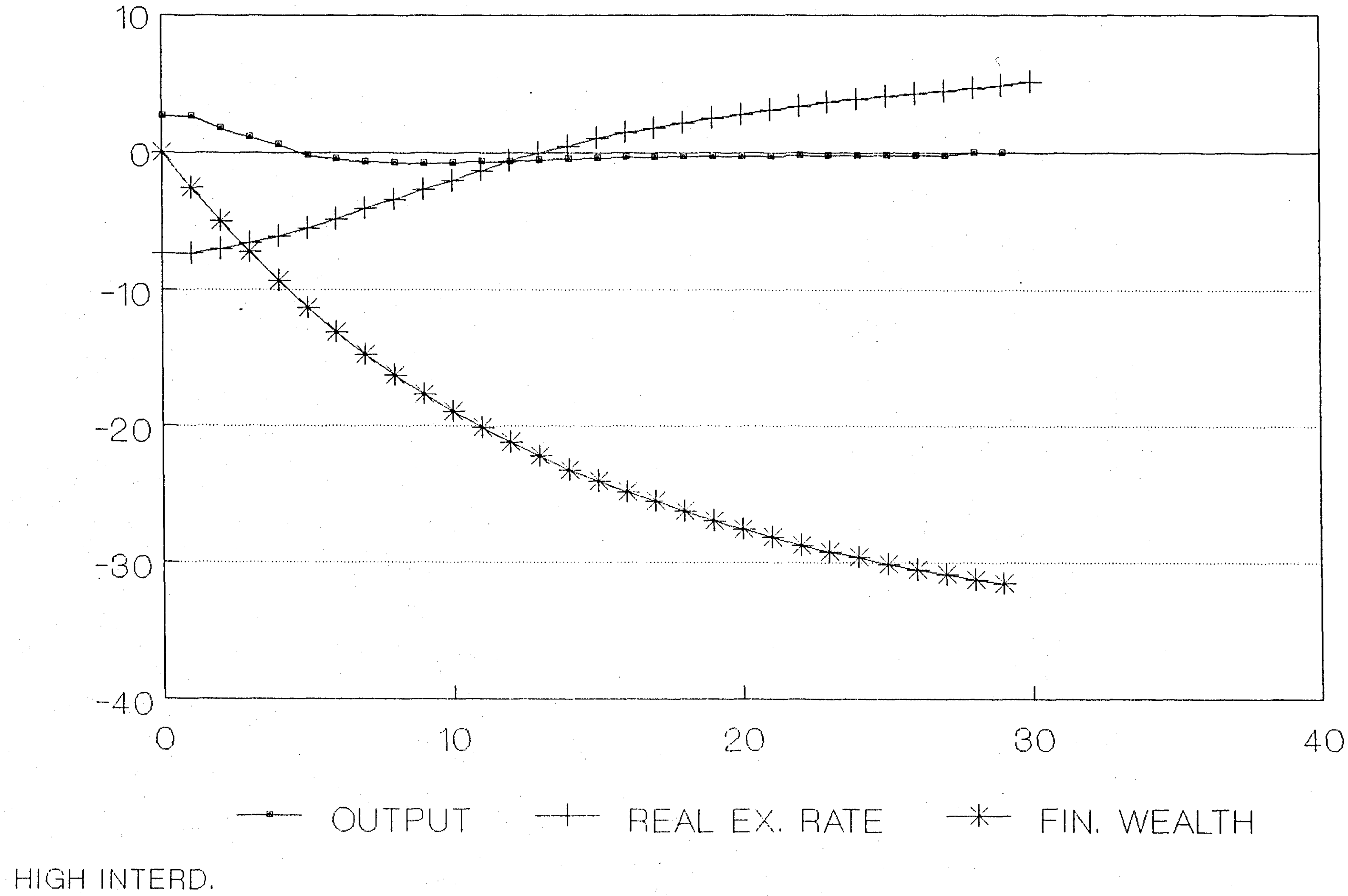
persistence and huge swings in the exchange rate. Excess demand impinges on core inflation and this stimulates a monetary contraction; as a result the terms of trade must appreciate initially, about 8% when interdependence is high, 20% when it is limited. However, equilibrium requires a permanent depreciation, which occurs slowly over time, along with the decumulation of foreign assets. The strength of the initial appreciation is clearly determined by the need to achieve a cumulated output loss, necessary to pin down inflation in spite of the permanent devaluation of the exchange rate. Both the output loss and the exchange rate swings are caused by the weakness of wealth effects and the absence of fiscal control. By contrast, under assignment 2 wealth and exchange rate swings are very limited, convergence is certainly faster.

Table 5 Simulation results.
Long run effects of a domestic demand shock (τ = 0.15)

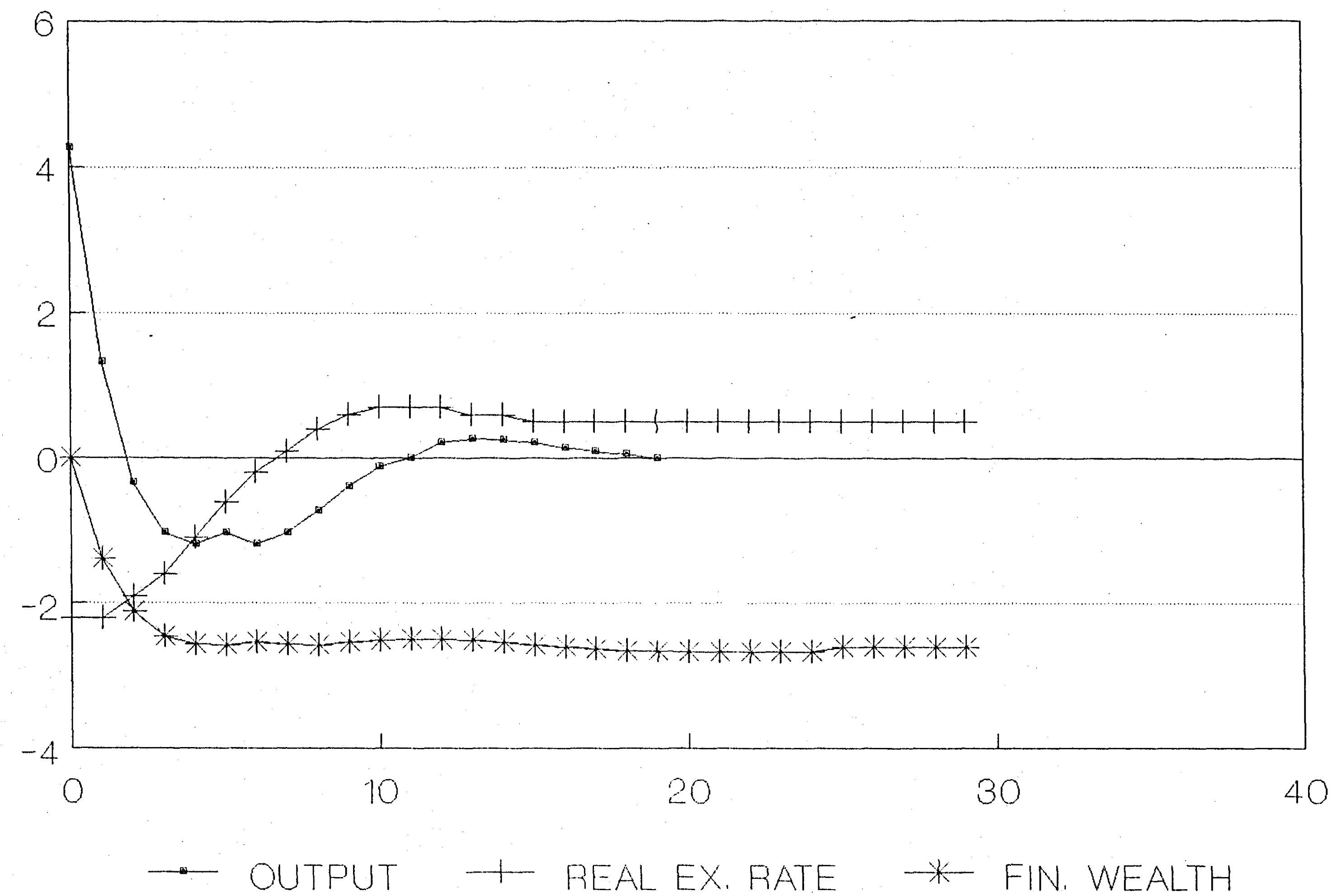
	Assignment 1			Assignment 2		
F_o	z	F	a	z	F	a
		(high interdependence)				
-30%	-5.8%	-35%	+ 6.8%	-0.5%	-2.6%	+0.5%
-10%	-6.1%	-38%	+ 7.8%	-0.5%	-2.6%	+0.5%
+10%	-6.5%	-40%	+ 8.0%	-0.5%	-2.6%	+0.5%
+30%	-7.0%	-42%	+ 8.1%	-0.5%	-2.6%	+0.5%

(deviations from initial equilibrium; z and F are "normalized" with respect to equilibrium output)

DOMESTIC DEMAD SHOCK
ASSIGNMENT 1



DOMESTIC DEMAND SHOCK
ASSIGNMENT 2



HIGH INTERD.

Assignment 3

When monetary policy is assigned to a wealth target and fiscal policy controls domestic inflation

$z_\infty = H_2/\Omega_1\Phi\epsilon$

$F_\infty = 0$

$a_\infty = 0$

In contrast to assignment 2 permanent changes of wealth and the exchange rate do not occur[22]. Initially excess demand spurs inflation and raises imports. The policy response involves a fiscal contraction and the fall of the domestic interest rate. The latter is necessary to bring about a temporary exchange rate devaluation and a reduction of the current account deficit. The early

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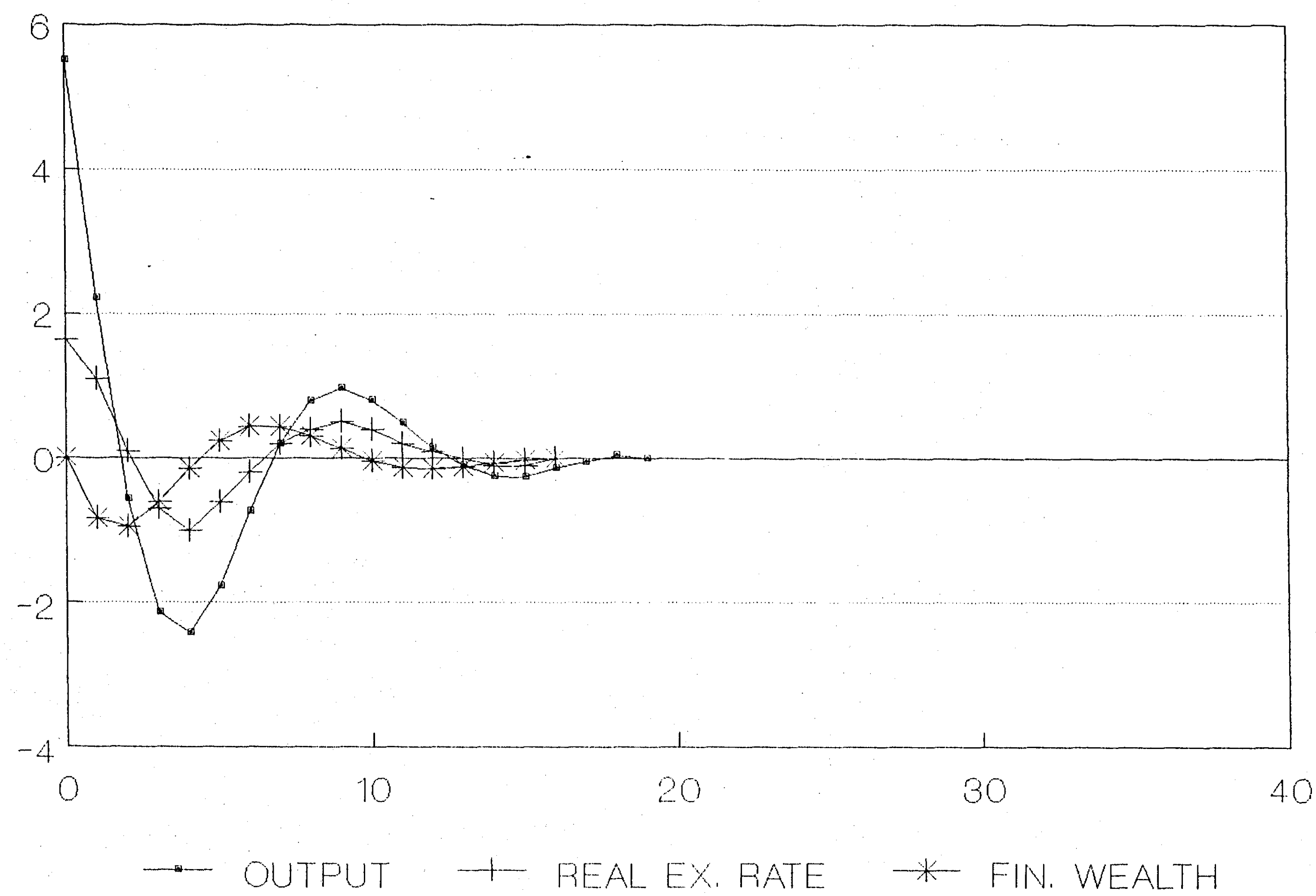
22this happens because monetary policy is assigned to the wealth target. Suppose that perfect capital mobility holds. In this case the domestic interest rate is tied to the foreign one, therefore $F_\infty=0$, otherwise the interest rate differential would trigger exchange rate dynamics.

DOMESTIC DEMAND SHOCK
ASSIGNMENT 3



HIGH INTERD.

stages of the cycle show inflationary growth and a very moderate current account deficit, followed by a recession and wealth accumulation.

Assignment 4

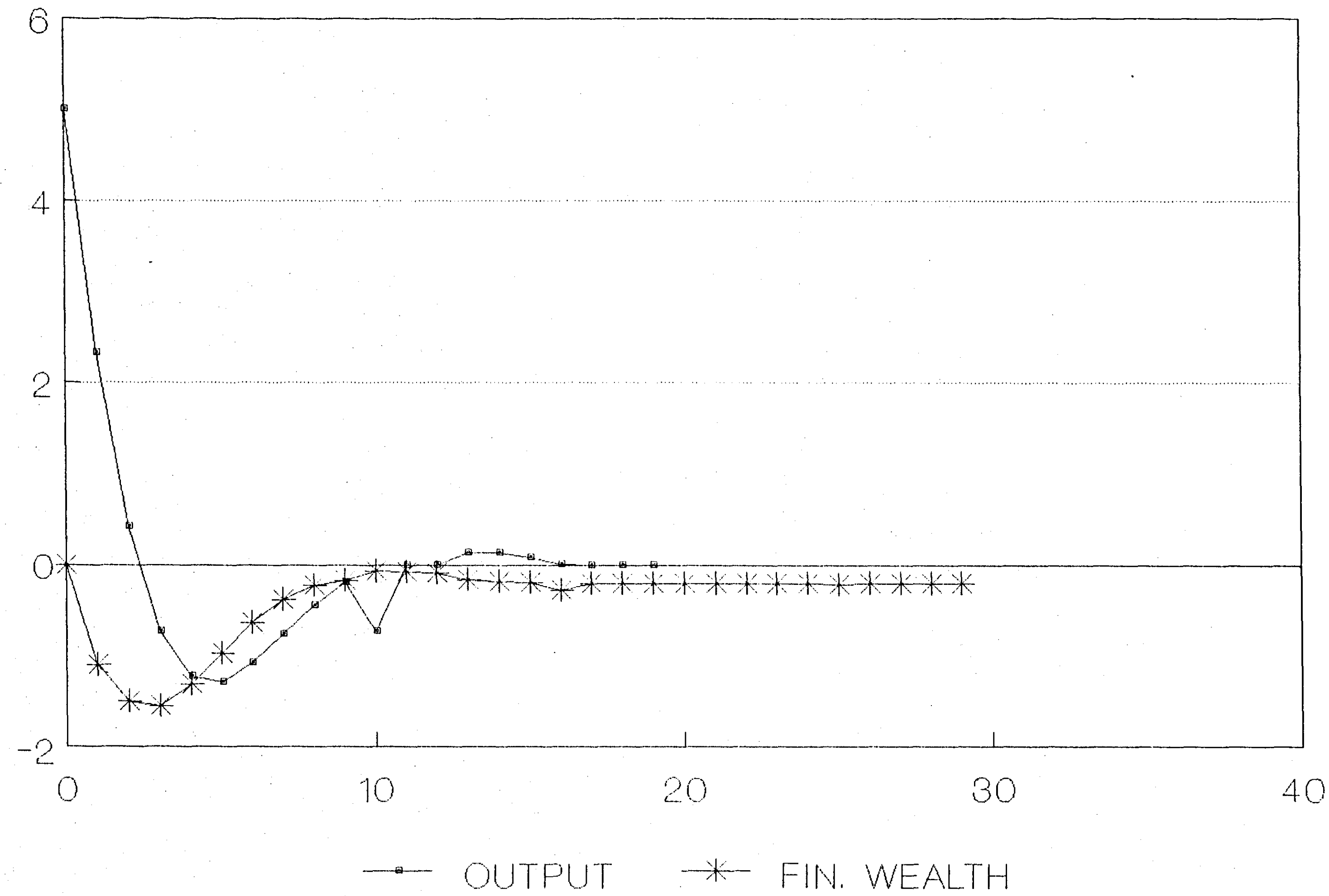
$$a_{\infty} = H_2[(i^f/\beta)*v_1/v_2] / \{\alpha\Omega_1\Phi\epsilon + [v_1/v_2][\tau - i^f(\beta + \tau F_o - \Omega_1\Phi\mu)/\beta]\}$$

$$F_{\infty} = -H_2(v_1/v_2) / \{\alpha\Omega_1\Phi\epsilon + [v_1/v_2][\tau - i^f(\beta + \tau F_o - - \Omega_1\Phi\mu)/\beta]\}$$

$$z_{\infty} = +H_2/\{\alpha\Omega_1\Phi\epsilon + [v_1/v_2][\tau - i^f(\beta + \tau F_o - \Omega_1\Phi\mu)/\beta]\}$$

Domestic holdings of foreign assets decrease, the exchange rate depreciates and cumulated excess demand is positive. In fact simulations show that these permanent changes are negligible, always below 1%, with the exchange rate variation being very close to zero. Dispensing with monetary policy altogether only marginally affects the fluctuations of inflation and output, with the desirable result of achieving almost complete exchange rate stability. But of course the cost is more fiscal flexibility than under assignments 1 and 2

DOMESTIC DEMAND SHOCK
ASSIGNMENT 4



HIGH INTERD.

Fluctuations of policy instruments

The analysis of cumulated deviations from equilibrium of the policy instruments shows that assignments 2 and 4 respectively dominate assignments 1 and 4. When interdependence is low assignment 4 seems to be preferable, whereas when interdependence is high the choice between rules 2 and 4 should depend on the relative cost associated to fluctuations of the tax rate and of the terms of trade. Note that monetary control of the wealth target complicates the task of fiscal policy: assignment 4 causes less fiscal intervention than assignment 3. This is even more true when interdependence is high, simply because in that case the interactions between the current account and aggregate demand become stronger.

Table 6. Shock to domestic demand: cumulated squared deviations from equilibrium of policy instruments (percentage values)

	Assignments			
	low interdependence			
	1	2	3	4
r	11.1	7.05	0.31	0
s	0	18.32	13.6	9.8
a	2100	55.6	1.14	0
	high interdependence			
	1	2	3	4
r	8.51	0.98	2.38	0
s	0	5.78	21.37	9.2
a	1960	10.1	7.36	0

6.4.A fall of foreign demand for domestic goods

We consider a permanent reduction of foreign demand for domestic goods equivalent to 5% of domestic output.

Assignment 1

$$z_{\infty} = \{-(\mu/\epsilon)(i^{f}-\tau)/[\beta(\tau-i^{f}) - \tau i^{f}F_{o}]\}H_{s}$$

$$F_{\infty} = F_{o}\tau H_{s}/[\beta(\tau-i^{f}) - \tau i^{f}F_{o}]$$

$$a_{\infty} = (i^{f}-\tau)H_{s}/[\beta(\tau-i^{f}) - \tau i^{f}F_{o}]$$

In equilibrium permanent changes of F and a are necessary to balance the current account. The exchange rate must depreciate.The variation of domestic holdings of foreign assets depends on the wealth effect of the devaluation. If the country is initially a net debtor the devaluation reduces domestic demand, holdings of foreign assets increase. On the other hand, when $F_{o}>0$ domestic demand rises after the depreciation, hence F_{∞} must be lower. If the model is stable $\tau > i^{f}$, hence cumulated output deviations from equilibrium are negative. The exchange rate devaluation necessary to equilibriate supply and demand for exports has a positive effect on core inflation, which must be compensated by a cumulated output loss. If z_{∞} holds core inflation down at its target level, F_{∞} must balance aggregate demand. Domestic holdings of foreign assets are not affected by the temporary slump in foreign demand for domestic goods; instead they depend on the wealth effect of the devaluation.

Assignment 2

$$z_{\infty} = \{-(\mu/\epsilon)(i^{f}-\tau-\Omega_{2})/[\beta(\tau-i^{f}) + \beta\Omega_{2} - \tau i^{f}F_{0}]\}(-H_{3})$$

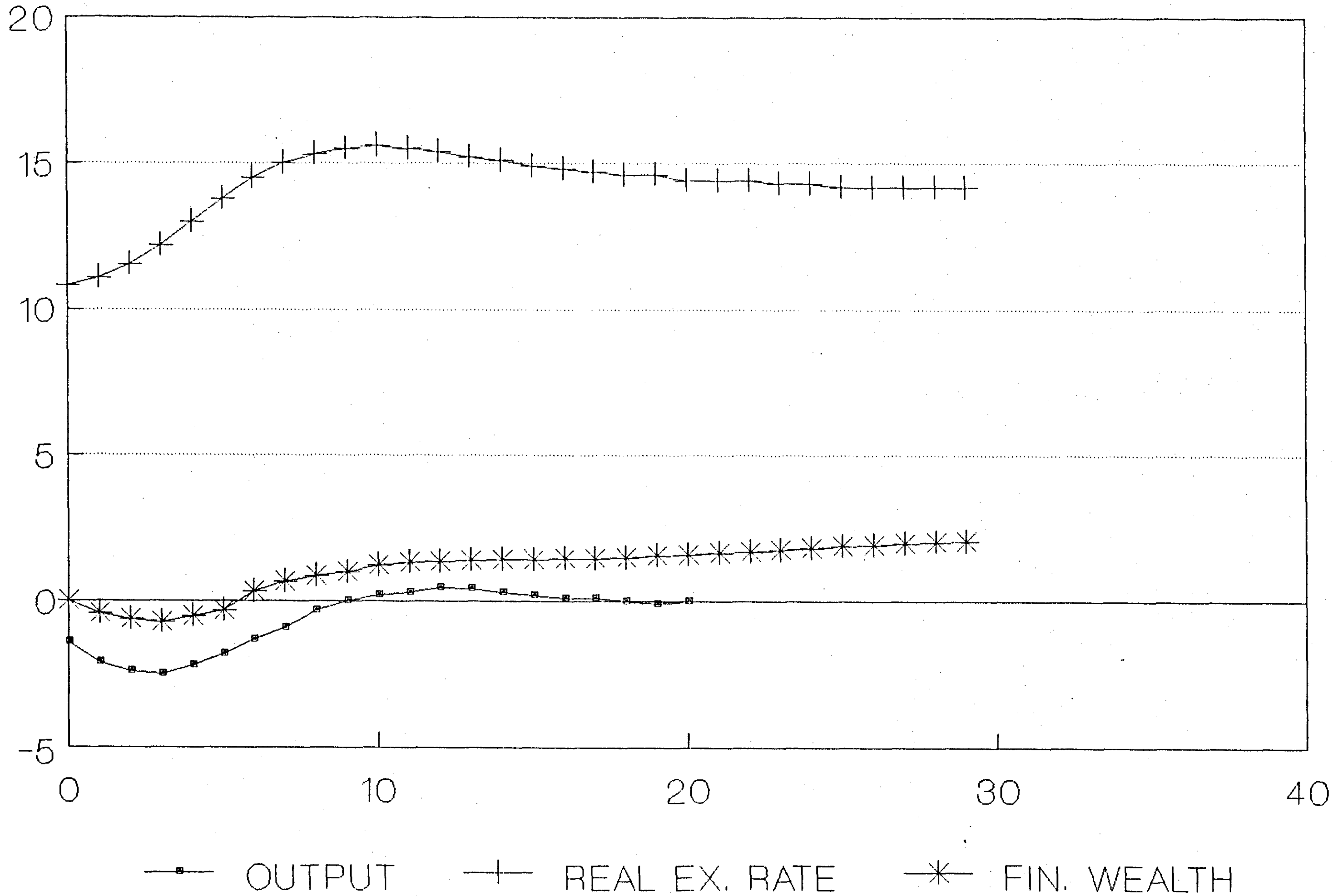
$$F_{\infty} = -F_{0}\tau H_{3}/[\beta(\tau-i^{f}) + \beta\Omega_{2} - \tau i^{f}F_{0}]$$

$$a_{\infty} = -(i^{f}-\tau-\Omega_{2})H_{3}/[\beta(\tau-i^{f}) + \beta\Omega_{2} - \tau i^{f}F_{0}]$$

Once again fiscal policy limits the effect of permanent real shocks on the country's foreign investment. Table 3 shows that fiscal control of the current account can be quite effective in limiting permanent wealth transfers.

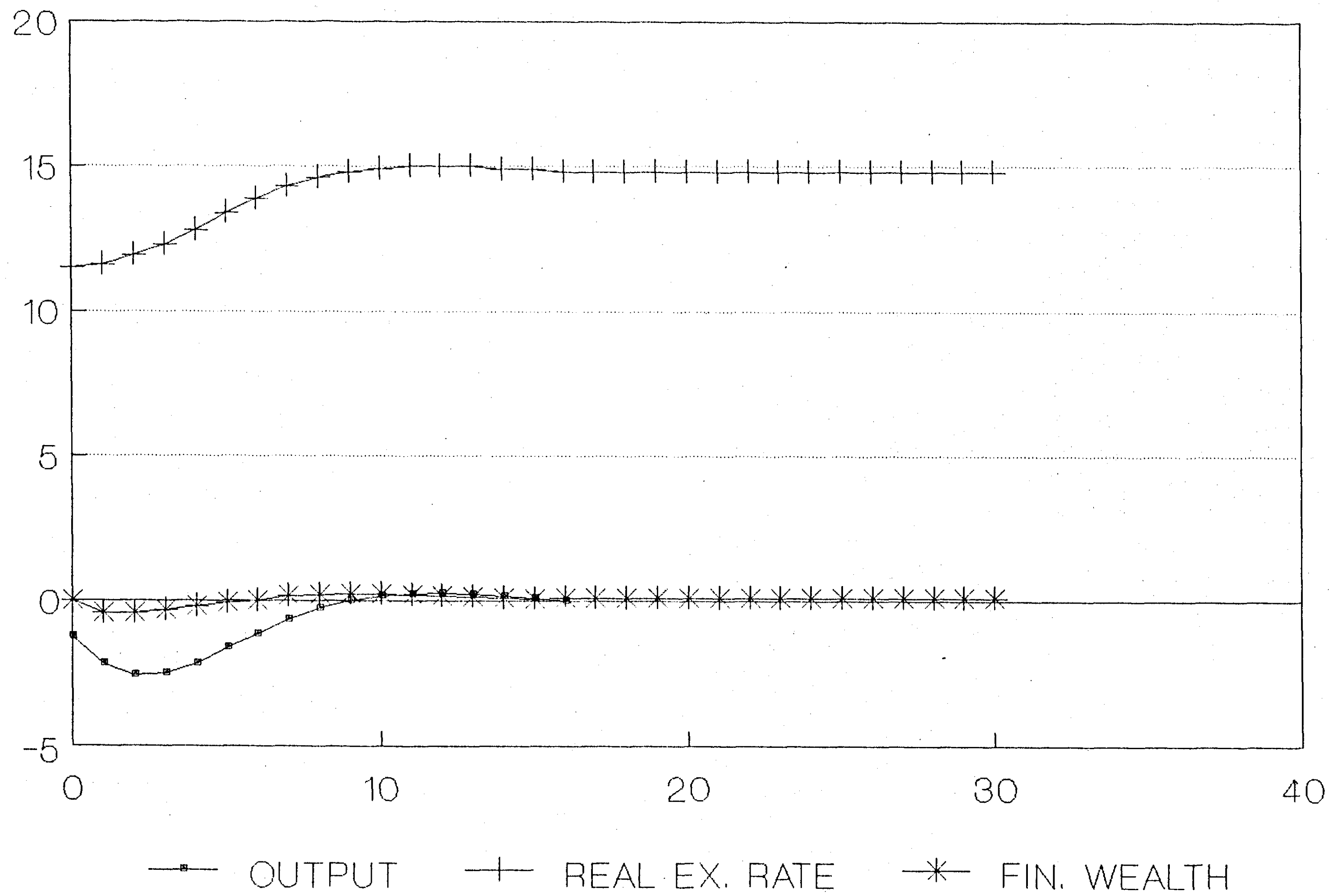
As far as dynamics are concerned, assignments 1 and 2 do not substantially differ. The initial exchange rate jump undershoots its long run value. After that, the dynamic path of a and F is monotonic. On the other hand output exhibits something of a cycle, but without huge swings. However persistence is limited when fiscal policy controls the current account.

ASSIGNMENT 1



HIGH INTERD.

ASSIGNMENT 2



HIGH INTERD.

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Table 7: simulation results
Long run effects of a fall of foreign demand for domestic exports.

	Assignment 1			Assignment 2		
F_o	z	F	a	z	F	a
		(high interdependence)				
-30%	-11.1%	9.0%	+13.1%	-12.5%	0.3%	+14.8%
-10%	-12.1%	3.0%	+14.2%	-12.5%	0.1%	+14.8%
+10%	-13.2%	-3.3%	+15.5%	-12.5%	-0.1%	+14.8%
+30%	-14.4%	-11.3%	-17.0%	-12.5%	-0.3%	+14.9%
		(low interdependence)				
-30%	-6.2%	18.0%	+28.0%	-8.1%	+0.7%	+36.0%
-10%	-7.1%	7.1%	+33.0%	-8.2%	+0.2%	+36.0%
+10%	-9.0%	-8.9%	+41.0%	-8.2%	-0.2%	+37.0%
+30%	-10.9%	-27,8%	+49.0%	-8.3%	-0.7%	+37.0%

(percentage deviations from initial equilibrium; z and F are "normalized" with respect to equilibrium output)

Assignment 3

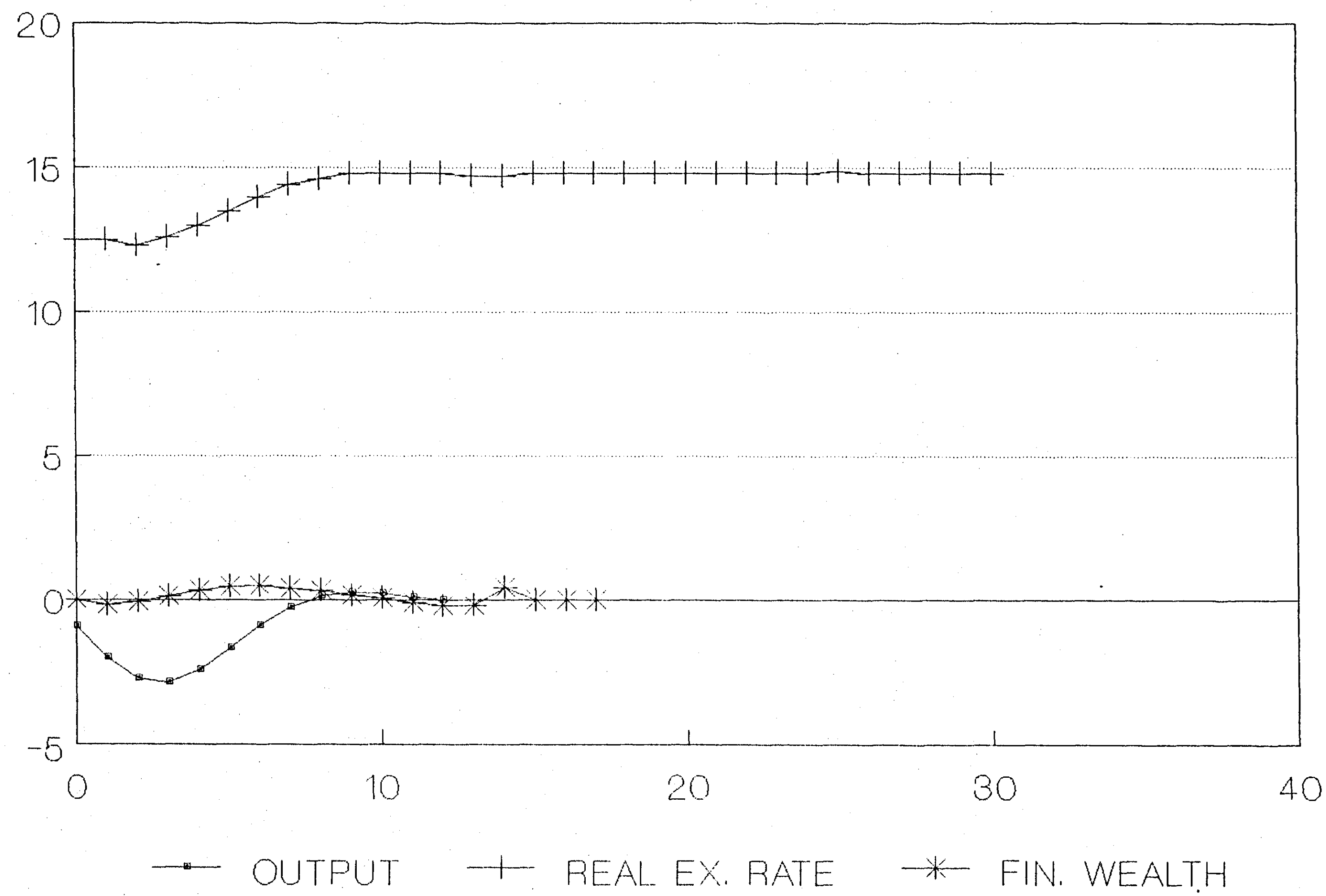
$$z_\infty = (\Omega_1\Phi\mu-\tau F_o)(-H_3)/\sigma\Omega_1\Phi\epsilon\beta$$

$$F_\infty = 0$$

$$a_\infty = H_3/\beta$$

F does not change and the exchange rate depreciation offsets the initial fall of foreign demand for domestic goods. Cumulated deviations of output from equilibrium depend on the size of the devaluation. If the exchange

FALL OF EXPORTS
ASSIGNMENT 3



HIGH INTERD.

rate had no wealth effects z would be certainly negative. Simulations confirm these results. Dynamic paths of output, inflation, wealth and the exchange rate do not significantly differ from those observed under assignments 1 and 2.

Assignment 4

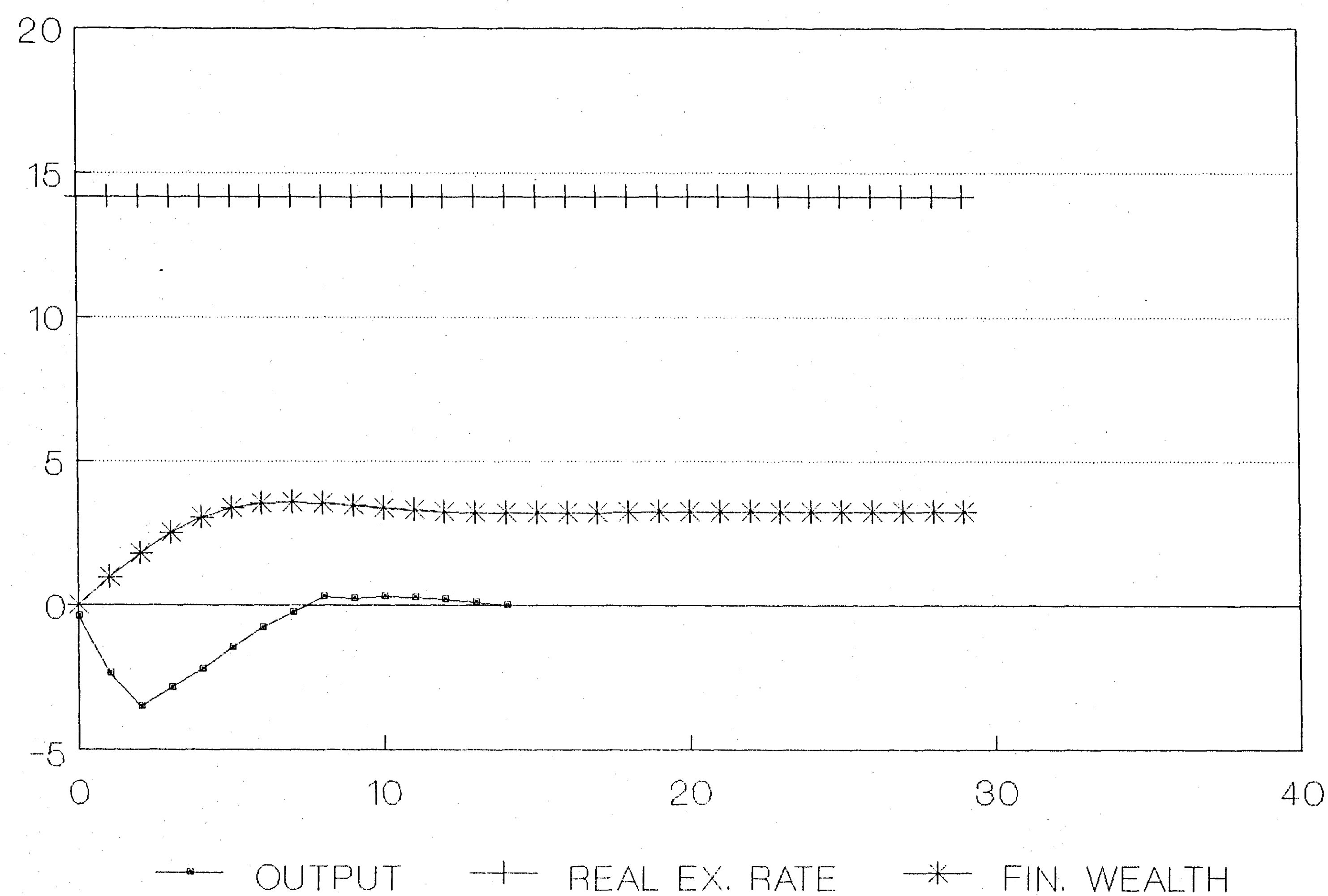
$$a_\infty = -H_3*[(i^f-\alpha\tau)*v_1/v_2 \ -\Omega_1\Phi\epsilon] \ /\{\alpha\beta\Omega_1\Phi\epsilon + [v_1/v_2][\tau- - i^f(\beta + \tau F_o - \Omega_1\Phi\mu)]\}$$

$$F_\infty = -H_3*(\tau F_o - \Omega_1\Phi\mu)*(v_1/v_2) \ /\{\alpha\Omega_1\Phi\epsilon + [v_1/v_2][\tau \ - - i^f(\beta + \tau F_o - \Omega_1\Phi\mu)/\beta]\}$$

$$z_\infty = H_3*(\tau F_o - \Omega_1\Phi\mu)/\{\alpha\Omega_1\Phi\epsilon + [v_1/v_2][\tau \ - i^f(\beta + \tau F_o - -\Omega_1\Phi\mu)/\beta]\}$$

The exchange rate depreciates. When $F_o<0$ the cumulated deviations of output from the natural rate are negative. When $F_o>0$ they are still negative if the wealth effect of a devaluation is dominated by the fiscal contraction required to control inflation. Net domestic holdings of foreign assets are a negative function of cumulated deviations of output from the natural rate, hence they must be positive in equilibrium. Simulations confirm these algebraic results. The dynamic path of output and the policy

FALL OF EXPORTS
ASSIGNMENT 4



HIGH INTERD.

instrument, the tax rate, are nearly identical to the case of assignment 3.

The analysis of cumulated deviations from equilibrium of the policy instruments shows that assignment 2 dominates assignment 1 and assignment 4 is preferable to assignment 3. Once again the choice between rules 2 and 4 should be determined by the government's preference between tax and exchange rate fluctuations.

Table 8. A negative shock to foreign domestic demand: cumulated squared deviations from equilibrium of policy instruments (percentage values)

Assignments

low interdependence

	1	2	3	4
r	3.4	0.68	0.23	0
s	0	2.52	11.5	10.8
a	128.3	5.35	9.77	0

high interdependence

	1	2	3	4
r	3.2	1.5	1.02	0
s	0	2.15	10.47	23.1
a	355	40.2	33.72	0

7. Conclusions

This chapter has analyzed alternative policy assignments in a theoretical model of a small open economy. We summarize here the properties of each regime.

Assignment 1. The paper stresses two fundamental weaknesses of a "monetarist" rule. First, our algebraic results show that monetary control of the internal objective does not prevent the risk of dynamic instability arising from the interaction between wealth effects in aggregate demand and foreign interest payments in the current account. Secondly, under this rule permanent real shocks cause uncontrolled transfers of foreign wealth and require large adjustments of the real exchange rate; this is particularly true when the shock affects domestic demand.

Assignment 2. By defining a foreign wealth target, the Meade assignment avoids the risk of instability. Also, it requires far lower international transfers of wealth in the face of "real" shocks. Furthermore, it significantly improves the overall dynamic performance of the model: the "Meade" rule always requires smaller deviations from equilibrium than the "monetarist" rule.

Assignments 3 and 4. Under the reversed "Meade" assignment the exchange rate fluctuations necessary to bring down inflation are substantially reduced. If the target zones regime is enforced they do not occur at all. But these two rules shift the burden of adjustment on the fiscal instruments, requiring revisions of the tax rate which might be difficult to implement.

When real shocks occur monetary control of the current account does not improve on assignment 4. Fiscal control of the domestic objective coupled with an exchange rate adjustment which occurs once and for all seems to be quite effective. To some extent this result confirms Boughton's skepticism about the effectiveness of monetary control of the external objective: one step changes of the exchange rate seem to be more efficient. Nevertheless, the target zones proposal, ultimate object of Boughton's criticism, still retains validity, being supported by the rather favorable results obtained under rule 4.

Under a target zones regime disinflation has permanent effects on foreign wealth and the exchange rate: this outcome is inevitable if governments wish to avoid exchange rate cycles. But we stress that under this regime disinflation policy at home might generate international conflict, as it implies a permanent loss of financial wealth and disposable income for the commercial partners of the country.

Our results suggest that the inclusion of fiscal control in a policy package prevents instability, no matter whether this instrument is assigned to the internal or the external objective. Furthermore, combined use of two weapons substantially improves on a purely "monetarist" rule. But we do not account for the possible existence of institutional lags in the implementation of the fiscal feedback. This is a widespread criticism to the use of such instrument and some commentators have argued that fiscal control should be assigned to slow moving variables. Obviously this will be more or less true according to the institutional context of each country, but should fiscal policy be actually considered an instrument not very flexible, then the desirability of assignments like the Meade proposal, already shown to be considerable, would be further enhanced.

PART II

SIMPLE RULES FOR POLICY COORDINATION

CHAPTER 5

Macroeconomic policy and interdependence: the debate on international policy coordination

Introduction

Part two of the thesis deals with the issue of policy coordination. The next chapter will investigate the performance of alternative simple rules for policy coordination in a two-country model which includes the current account. In this chapter we review the literature on coordination and we do not claim to have made any original contribution. However, the present discussion will serve as a general introduction to the issues to be discussed in chapter 6.

The rest of the chapter is laid out as follows. Section one deals with the issue of interdependence under a flexible exchange rate regime. Section two is a brief review of the game-theoretic approach to policy coordination. Section three is a background to our own work and is concerned with alternative proposals which involve simple policy rules.

1. Why is cooperation needed. The recognition of interdependence

In part one of the thesis we have shown that macroeconomic policies may have substantial spill-over effects abroad. Under monetarist policies changes of the monetary rule, albeit neutral in the long run, may have prolonged effects on the real exchange rate and on the current account. This happens because when prices in the goods sector are sticky forward-looking expectations in the financial markets cause exchange rate overshooting. If the domestic economy is not "small" this affects both international trade and the foreign rate of inflation. Secondly, unilateral fiscal policy shifts entail a permanent change in the net external position of each country and permanently alter the real exchange rate and the trade balance. The alternative policy rules we have considered still involve substantial spill-over effects. Foreign wealth targeting may ensure long term stability of the real exchange rate and of trade flows, but it does not prevent exchange rates swings. In fact rules requiring the opening of a differential between domestic and foreign interest rates cause exchange rate dynamics and so doing affect inflation abroad. On the other hand, the assignment of fiscal policy to inflation control may require permanent wealth transfers across countries[1].

But if countries are interdependent, decentralized policymaking may cause undesired effects abroad and generate conflict among countries. Typically, uncoordinated policies might result in mutually inconsistent exchange rate and balance of payments targets and eventually determine a generalized reduction of welfare. Advocates of international coordination suggest that governments commit themselves to alter their policies in order to achieve some common goal, for instance the reconciliation of mutually inconsistent targets, or to help each government to achieve its own objectives, on the grounds that this would be beneficial for all coordinating countries.

> **"The point is that by internalizing the spill-overs of individual policy actions, coordination widens the area of discretion for all participants to approach more closely their objectives"**[2]

1This issue will be discussed at great length in the next chapter
2See Artis and Ostry (1986)

Assessing the gains from coordination has been the focus of the literature following the game-theoretic approach to the analysis of policy coordination. It is to a brief review of such literature that we now turn.

2.Strategic interdependence and policy coordination

Applications of the game-theoretic approach to the issue of policy coordination have rapidly grown in number and relevance over the last few years. Both game theory and the economic theory of externalities and market failures show that decentralized decision making can generate outcomes which are outside the set of Pareto-optimal outcomes that may be potentially attained through cooperative solutions. The game-theoretic approach to policy coordination aims to assess how outcomes generated by decentralized policy actions differ from the outcomes which might prevail under cooperative behaviour. We shall consider static games first.

Static games

In a number of seminal papers Hamada (1974, 1976, 1979) investigated the strategic interdependence among national policy makers under different exchange rate regimes. He contrasted non-cooperative outcomes, of the Nash or Stackelberg type, with those which might be achieved through cooperation. In the typical description of policy formation, the behaviour of each government is described by a reaction curve, showing how it will alter one of his policy instruments in response to a change in the other country' policy. Changes of exogenous variables, such as "real shocks", determine a shift of the curve. Each government is assumed to maximize a utility function, typically quadratic. The game is a variable sum game, otherwise no benefit from cooperation, as opposed to decentralized policy action, would arise in principle. This is obtained by making the plausible assumption that policymakers have more targets than instruments. Hamada points out that gains from coordination do exist as cooperation prevents governments from designing mutually inconsistent policies. For instance he shows that under a fixed exchange rate regime, if countries have one instrument, the level of domestic credit, and two targets, domestic output and the level of foreign reserves, a non-cooperative solution leads to over-contractionary policies, as both countries attempt to build up reserves by generating current account surpluses. He shows that the size of the gains from coordination crucially depend on the governments' utility functions and on the signs of the spill-over effects. Later research has focussed on the outcomes occurring under a flexible exchange rate regime. Two complementary studies carried out by Canzoneri and Gray and Oudiz and Sachs show that the cooperative outcome dominates the non-cooperative one. Once more the outcome depends on the signs of the spill-over effects and on the preferences of the government. Canzoneri and Gray argue that if governments assign preeminence to short run output gains and the transmission of monetary policy is negative, which means that a monetary expansion in the home country depreciates the exchange rate, raises domestic output and has a contractionary effect abroad, the Nash equilibrium is associated with over-expansionary monetary policy as each country pursues beggar-thy neighbor policies by depreciating the exchange rate but no one succeed. On the other hand, Oudiz and Sachs, (1985) get to the conclusion that the Nash equilibrium is over-contractionary if governments are mainly concerned with reducing inflation in the short run and try to export inflation by simply appreciating the exchange rate. To clarify the issue further we analyze in detail the model which yields the over-contractionary outcome under flexible exchange rates[3]. The model is defined as follows.

1) $m - p = k_1 y - k_2 i$;

2) $y = \alpha\beta(e+p^f-p) - \sigma i$;

3) $p_c = (1-\mu)p + \mu(e+p^f-p)$;

4) $i = i^f$;

5) $m^f - p^f = k_1 y^f - k_2 i^f$;

6) $y^f = -\alpha\beta(e+p^f-p) - \sigma i^f$;

7) $p_c^f = (1-\mu)p^f - \mu(e+p^f-p)$;

where:

$m - p$ = log of real money balances.

y = log of real output.

e = log of the nominal exchange rate

p_c = log of consumer price

There are two symmetric countries. Foreign variables are denoted by the superscript f. The model is standard and we may be brief in commenting it. It is

3this model has been outlined in McKibbin and Sachs (1986) and in McKibbin (1988) composed of an IS curve, eq.2 and 6, and an LM curve, eq.2 and 5. Capital is perfectly mobile, eq.4. In equations 3 and 7 we describe the deflator of domestic consumption for each country, where μ is the share of imports in domestic consumption. Output prices are fixed and normalized at

$p = p^f = p_o > 0$.

p_o may also be considered as an initial price shock. Exchange rate expectations are static. We solve the model to determine the signs of the spill-over effects.

8) $y = \theta_1 m - \theta_2 m^f - (\theta_1 - \theta_2) p_o;$

9) $y^f = \theta_1 m^f - \theta_2 m - (\theta_1 - \theta_2) p_o;$

10) $e = (m - m^f)/2\beta k_1$

11) $p_c = p_o + \mu(m - m^f)/2\beta k_2$

12) $p_c^f = p_o - \mu(m - m^f)/2\beta k_2$

where:

$\theta_1 = (2\sigma k_1 + k_2)/2k_1(\sigma k_1 + k_2)$

$\theta_2 = k_2/2k_1(\sigma k_1 + k_2)$

Spill-over effects are negative: the appreciation of the domestic real exchange rate raises output abroad. We can easily see why it happens. The monetary contraction at home raises the domestic interest rate, but this is inconsistent with the uncovered interest parity condition, eq.4. Equilibrium requires that the exchange rate appreciates, depressing output at home and raising it abroad, so that interest rates are equalized across countries.

Given the assumption that p and p^f are fixed, consumer price deflation can only be pursued by appreciating the exchange rate. From eq.10 we see that deflation is achieved only if the monetary stance is more contractionary at home than abroad.

Comparison of coefficients θ_1 and θ_2 highlights another key feature of the model. When the two countries adopt the same policy stance, the negative spill-overs originated by domestic policy tend to offset the impact of foreign policy on foreign output and vice versa, but since $\theta_1>\theta_2$ the domestic impulse will dominate in each country[4].

To analyze the implications of the game we must introduce the familiar loss function, which is assumed identical for the two policy-makers.

13) $U = y^2 + \tau(p_c)^2$

14) $U^f = (y^f)^2 + \tau(p_c{}^f)^2$

4This point is important for determining what happens when countries choose to adopt an identical policy, as discussed below. In principle, the existence of negative spillovers might more than offset the influence of domestic policy in each country.

where τ is the importance attached to the consumer deflator relatively to output.

Under a Nash equilibrium[5] each policy-maker minimizes the loss function taking as given the behaviour of the other government. By differentiating the 13) the domestic government should set:

15) $y(dy/dm) = -\tau p_c(dp_c/dm)$;

substituting eq. 8 and 11 in the 15 yields the reaction function of the domestic government:

16) $m = \Sigma_1 m^f + \Sigma_2 p_o$;

where:

$\Sigma_1 = [\theta_1\theta_2 + (\tau\mu/2\beta k_2)^2]/[(\theta_1)^2 + (\tau\mu/2\beta k_2)^2]$

$\Sigma_2 = [\theta_1(\theta_1 - \theta_2) - (\tau\mu/2\beta k_2)^2]/[(\theta_1)^2 + (\tau\mu/2\beta k_2)^2]$

The Nash equilibrium obtains when $m = m^f$. The implications for output and the price level are as follows. If $m = m^f$ then:

$m = [\theta_1(\theta_1 - \theta_2) - (\tau\mu/2\beta k_2)]/\theta_1(\theta_1 - \theta_2)p_o < 0$

$p_c = p_c{}^f = p_o$

$y = y^f = -(\tau\mu/2\beta k_2\theta_1)p_o$

5The Nash equilibrium is the only form of non-cooperative outcome that we discuss here. A more general treatment of the subject would involve at least the analysis of the Stackelberg equilibrium, where one country acts as a leader and is assumed to take into account the reactions of the other country when setting its own policy.

The non-cooperative outcome implies a loss of output for both countries, and neither country manages to achieve a fall of consumption prices. In fact in the symmetric case, as the two countries pursue the same policy, neither can succeed in appreciating the exchange rate.

In discussing the cooperative case we assume that a "global planner" undertakes the optimization, so as to "internalize" in the optimization process the externalities of the independent policy decisions. Each country is assigned the same weight[6]. When policy-makers do not cooperate and the Nash equilibrium prevails, each government has the perception that:

$dy/dm = \theta_1$ and $dp_c/dm = (\tau\mu/2\beta k_2)$

whereas the true derivatives are

$dy/dm = \theta_1 - \theta_2 > 0$ and $dp_c/dm = 0$

A deflationary policy can only be implemented by appreciating the exchange rate, but this outcome is prevented because the two countries have the same target, so p_c cannot be deflated. Thus the optimal

6Therefore we ignore the bargaining process which might eventually yield a cooperative outcome giving different weights to each country policy involves "accomodation" of the initial price shock, so as to avoid output losses[7]:

$m = m^{f} = p_{o}$

In principle, the case for coordination might seem straightforward. But this result is open to an obvious criticism. The implementation of coordinated policies would require binding rules and appropriate penalties, otherwise each country would be better off "cheating" on the agreement. The incentive for an individual country free-ride on the behaviour of others and to renege on cooperative agreements lays at the roots of the so called "enforcement problem"[8] which has been regarded as one of the major obstacles to policy coordination, due to the absence of supranational authorities capable of enforcing cooperative agreements. A way out which is common to game theory, is the design of appropriate threat strategies. Some scholars[9] have taken the view that the emphasis on moral hazard problems has perhaps been excessive: in a multi-period context, the early gains from reneging on the cooperative policy must be contrasted against the

7Note that the cooperative outcome generated by the model implies that a fixed exchange rate regime is Pareto-efficient, but different, more general models would imply alternative conclusions.

8Frankel (1989)

9See Frankel (1989) and Hughes Hallett (1987) future welfare losses caused by the likely retaliation from partner countries. On the other hand, Currie and Levine (1987) pointed out that the commonly used threat of reversing to a Nash non-cooperative behaviour might not constitute a credible deterrent, as it might amount to a threat to fully destabilize the system. As a consequence, a strong incentive might emerge for each country to renege first. The results emerging from the literature are somewhat mixed, however the debate on the free-rider problem has stressed the importance of a multi-period setting for a proper assessment of the gains from and the obstacles to policy coordination. Indeed, a few conclusions emerging from the literature following the static games approach must be reconsidered when economic actors, both governments and the private sector, take into account the future implications of current behaviour

Dynamic games

We turn now to the analysis of dynamic games. The introduction of dynamics substantially alters the nature of the game being played. This brings two important points of realism into a static game. The first is that the pay-offs of non-cooperative, beggar-thy-neighbor policies may look very different in a multi-period game. For instance, if the initial exchange rate appreciation is to be followed by a long run depreciation[10] the early inflation gains will be reversed in the future, as inflation is reimported through a depreciating exchange rate[11]. To the extent that forward-looking governments realize the longer term implications of their actions, beggar-thy-neighbor policies lose appeal and, by the same token, gains from cooperation are reduced. Secondly, when the governments which undertake the intertemporal optimization process face a forward-looking private sector, the issue of time inconsistency arises. Rogoff (1985b) has argued that policy coordination can be counterproductive if it undermines the credibility of governments' commitment to control inflation. He draws on the work of Barro, which we have already reviewed in chapter 1. The Barro model is built on the assumption that government and wage setters have different objectives. The government is more keen to reduce real wages through monetary "surprises" in order to achieve a relatively higher

10indeed this is the final outcome one would predict on the grounds of models which include the current account (cfr. chapters two and three

11see Buiter and Miller, (1982), for a formal demonstration of the long run ineffectiveness of exchange rate appreciations on the total output cost necessary to permanently curb inflation.

output target. The wage setters have a relatively higher wage target and are then prepared to accept lower output. If the wage setters realize that the government has an incentive to "reoptimize" and shift the policy towards a more expansionary stance, then they will try to anticipate future "surprises" by setting from the start a higher wage rate. Thus, an inflationary bias is regarded as inherent to the interaction between government and wage setters as long as their objectives differ and both adopt a forward-looking behaviour. In the open economy, the government incentive to exploit the short run rigidity of nominal wages is weakened by the inflationary consequences of the depreciation that would follow the monetary shock. Forward-looking wage setters realize this and lower their claims, as they perceive that the government is now less likely to alter its policy. But if countries cooperate, and cooperation takes the form of a fixed exchange rate, then the inflationary bias is likely to reappear, as wage setters perceive that governments might also agree to jointly adopt unexpected expansionary policies. As a result inflation under cooperation might be higher than inflation under decentralized policy making. The logic of the argument is indeed quite simple. If an inflationary bias is inherent to the closed economy because government policies are time-inconsistent, the deflationary bias inherent to the sort of Nash equilibria prevailing in the open economy under flexible exchange rates has the desirable feature of offsetting it, by reducing the governments' incentive to reoptimize their policies. To make this point Rogoff appealed to a standard result from game theory: in a multi-player game cooperation between a subset of players may make matters worse for those cooperating if the remaining players adopt a non-cooperative behaviour. But Rogoff's result might not be robust to extensions of the model. For instance Carraro and Giavazzi (1988) show that under no circumstances policy coordination may decrease welfare in a two-economy model with three sectors for each economy, namely governments, firms and wage setters. Van der Ploeg (1988) has analyzed the same issue in a two country general equilibrium model which allows, in contrast with most of the literature on policy coordination, for a long run trade-off between output and inflation that is caused by the presence of distortionary taxes. This assumption has the desirable feature of enabling one to assess the gains from coordination when some long run "conflict of interest" might potentially arise. In fact, most of the literature is concerned with models where output and inflation are independent in the long run, so that in equilibrium output is always set at the natural rate and each country achieves its own inflation target by letting the exchange rate free to fluctuate. He shows that a "world planner" would obtain no tax distortions and optimal quantities of money. But in a decentralized economy this outcome cannot be attained. Coordinated, time inconsistent policies avoid tax distortions but do not achieve the optimal level of real money balances because governments lack of credibility and, just as in Rogoff's case, cooperation raises the governments' incentive to renege on the private sector. His conclusion is that without pre-commitment policy coordination reduces welfare. The theoretical results on this issue may then look somewhat inconclusive. However, this strand of the literature has the merit of stressing the importance of reputation. In fact the adoption of cooperative reputational policies may solve the Rogoff conundrum as in this case cooperation is extended from a subset of players, the two governments, to the whole set of players. In fact reputational policies may be thought of as policies where governments and the private sector cooperate, with the government acting as a leader[12]. Currie and Levine (1987b) investigate the gains from coordination with or without pre-commitment. They set up a two-country model, with three players, the two governments and one private sector, assumed to be forward-looking. In this context policies are classified by whether they are designed cooperatively and whether policies they are reputational or non-reputational. Reputational policies rely on pre-commitment, non-reputational policies are designed in such a way that the government has no incentive to re-optimize in the future The results about the relative desirability of a non-reputational coordinated policy versus a non-reputational non-coordinated policy was inconclusive, as the ranking of the two policies crucially depended on the nature of the shock. Cooperation without reputation decreased welfare in the case of aggregate supply disturbances, but performed better under demand shocks. The worst performance was achieved under a non-cooperative reputational policy, which also seemed to be prone to instability. This was

12Currie and Levine (1987b)

confirmed in a later paper[13] which assessed the empirical relevance of this issue. Under reputational policies governments rely heavily on the effect of announcing future policy actions. To the extent that these announcements are believed, policies become effective before the governments actually move their instruments. With discounting this has the advantage of reducing the welfare loss. Under flexible exchange rates, reputational monetary policies typically exploit the exchange rate, as the expected interest rate path affects the spot exchange rate. But if governments pursue the same policy without cooperating the announcement effects tend to offset each other and the final outcome is over-deflationary or over-expansionary. Currie, Levine and Vidalis found that for some discount parameters of the welfare function the system would become unstable. By contrast, cooperative reputational policies markedly improve welfare on all the alternatives, because they enable governments to exploit the benefits of reputation and to avoid the welfare losses deriving from the setting of mutually inconsistent targets[14]. Their main conclusion therefore

13Currie, Levine and Vidalis, (1987)
14We have already shown that in the closed economy reputational policies generally dominate non-reputational time consistent policies. The trouble with

is that benefits from coordination and reputation should be considered as mutually interdependent. Governments may exploit the benefits from reputation only if they coordinate. But substantial gains from coordination may only arise when policies are reputational. Currie and Levine also address the important issue of the sustainability of cooperative policies. Cooperative agreements may prove unsustainable because governments may find advantageous to renege on the private sector and because either government might have an incentive to renege on the other. The cost of reneging on the agreed policy obviously is the loss of reputation. Sustainability requires that the welfare loss associate to the cooperative policy is lower, for each country at each point in time than that implied by the non-cooperative policies. Currie Levine and Vidalis find that the cooperative reputational policy is generally sustainable, but that the incentive to renege may arise when the gains from the cooperative reputational policy are small. Furthermore, they show that introducing stochastic noise the incentive to renege is eliminated,

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non-cooperative reputational policies is that the mutual inconsistency of policies reduces the "gains from reputation" as the gains from switching to policies that exploit the previous commitment must be contrasted with the poorer future policy performance, deriving from the loss of reputation, in the the face of disturbances currently unknown.

Empirical evidence

The empirical evidence about the gains from cooperation is rather mixed and supports the view that gains do exist but are not large. Oudiz and Sachs (1984) estimated governments "revealed preference function" (for the U.S., Japan and Germany) by assuming that observed policy outcomes corresponded the optimal uncoordinated policies and then used policy multipliers from large scale econometric models of the world economy to assess whether coordination would increase welfare. Gains were found to be rather small, between 1% and 2% of GNP. However, the revealed preference function seemed rather implausible, since it implied that the U.S. was indifferent to a current account balance. Under this circumstance one should not be surprised of finding that the gains from cooperation are small. Since Oudiz and Sachs assumed that each country had two instruments, fiscal and monetary policy, the U.S. was in the position of achieving its targets independently, as it was supposed to have two targets only, output and inflation. Furthermore, the study did not assess the importance of the sustainability of the uncoordinated policies, which implied the accumulation of a huge external debt for the U.S.. Ishii, McKibbin and Sachs (1985) applied the results of dynamic game theory to a five region model. They used OECD projections for macroeconomic policies to generate a future baseline and found that coordinated optimization leads to substantial gains. Currie, Levine and Vidalis, (1987), found that the gains from coordination increase with the persistence of disturbances. Recent work from Hughes Hallett produced worrying evidence that the gains from coordination are asymmetrically distributed among the G5 and that attempts to alter this outcome would also reduce the overall gains. Typically, conflict arises among countries on how to share the burden of adjustment. The Hughes Hallett result implies that cooperative solutions might be difficult to find as the uneven distribution of gains becomes politically not sustainable[15].

15See Currie, Holtham and Hughes Hallett (1988)

Conclusions

Whatever the theoretical results about the gains from coordination, the call for some kind of cooperation in the design of macroeconomic policies has impressively gained consensus because of the difficulty governments are having in implementing their own policies independently.

One limit of the literature we have reviewed in this section is that one cannot contrast the desirability of sub-optimal coordinated policies against decentralized sub-optimal policy action. But non optimizing behaviour is likely to be the rule rather than the exception in the practical design of macroeconomic policies. Furthermore, fully optimizing rules are exceedingly complex. As Currie and Levine (1987a) point out, there must be considerable doubt as to whether the degree of complexity is realistic. The obvious alternative, rather than run the risk of considerable simplification at the stage of implementation, whith the risk of adverse results, is to build in the requirement of simplicity from the outset[16]. Currie, Levine and Gaines, (1989), have developed a methodology for exploring the issues of reputation and sustainability

16See Currie and Levine (1985a)

in the context of simple policy rules. Their work bears many similarities to that of Currie, Levine and Vidalis, (1987). They argue that policy-makers may substantially enhance credibility in the eyes of a skeptical private sector by adopting policy rules which are simple. In this context simplicity means[17] that rules have a simple dynamic structure and respond to a restricted range of variables. But if the policy rule is constrained to be "simple", then Currie, Levine and Gaines show that substantial gains accrue from pursuing simple coordinated reputational policies instead of simple coordinated non-reputational policies. However, this result does not seem entirely convincing, as there should be no incentive for governments to pursue a simple policy when it cannot bring any benefit in terms of reputation and credibility. Governments willing to renege on the private sector would then have an incentive to switch to fully optimal time inconsistent rules. The comparison between cooperative reputational and non-cooperative reputational simple rules is probably more relevant: the welfare loss under cooperative rules is substantially lower. Cooperative agreements appear to be sustainable when policy is

17See Currie, Holtham and Hughes Hallett (1988) restricted to the domain of simple policy rules, whereas if governments switch to non-cooperative non-reputational rules the incentive to renege becomes substantial.

Some theoretical support would therefore seem to exist for simplicity in the design of coordinated policies. It is to the discussion of proposals which involve simple coordinated policy rules that we now turn.

3.Simple rules for policy coordination

Several simple rules for policy coordination have been put forward over the last few years. In this brief review we shall focus on three proposals:

1)the McKinnon proposal for a return to a fixed exchange rate regime;

2)the target zones proposal, as it has been put forward by Williamson;

3)the simple rules separately advocated by the "Cambridge Group", working with Meade[18], by Boughton (1989), and by Genberg and Svoboda (1988). We consider these three proposals as part of the same strand of literature because, despite some non negligible differences, they share a strong emphasis on the need

18Vines et al. (1989)

for direct current account targeting and allow for temporary fluctuations of real exchange rates.

The rules reviewed in this section are designed with the obvious aim of internalizing, for each coordinating country, the externalities of individual policy actions. They differ because their proponents do not share the same view about the working of an economic system[19], or apparently imply different welfare functions[20], or attach a different "cost" to the use of the same policy instrument[21].

19Contrast for example the purchasing power parity approach followed by McKinnon with the fundamental real exchange rate approach of Miller-Williamson

20Boughton overlooks the trade distortions potentially caused by real exchange rate fluctuations, whereas this is a primary source of concern for both Williamson and McKinnon.

21Meade and his associates criticize Williamson's assignment of fiscal policy to the domestic objective for two reasons. First, they point ou that in many countries fiscal policy is not sufficiently flexible to be used for inflation control. Secondly, they argue that this assignment might cause adverse cost-push effects in the labour market.

The McKinnon proposal

McKinnon has for long advocated the return to a system of fixed exchange rates, which he regards as the necessary condition for ensuring the survival of a free trade regime. We have already discussed at some length the reasons of his dissatisfaction with a regime of unmanaged float and will not repeat them here. He points at the working of the international monetary system during the late 19th century as an example both for a reform of the international monetary system and for international policy coordination[22]. In his view, but many would probably disagree[23], that regime worked reasonably well because countries pursued coordinated policies in defence of international gold parities. Without actually returning to a gold standard, McKinnon would advocate the sort of monetary cooperation needed to ensure fixed nominal parities and roughly the same rate of inflation across countries. Following Dornbusch, we may summarize his view in a few key propositions :

22McKinnon, (1988)

23For example Eichengreen (1985) argues that Central Banks sterilized gold flows more often than intervening to reinforce their impact on the domestic market. Furthermore, interest rates tended to move together, whereas the "rules of the game" would have implied the widening of differentials.

-The doctrine predicting that variations of exchange rates may achieve current account equilibrium is a false one: gains in competitiveness trigger an increase of domestic real expenditure which offsets the initial improvement of the current account. He recommends sound fiscal policies as a mean for ensuring current account equilibrium.

-The purchasing power parity theory is a good guide to equilibrium exchange rates. This approach involves the identification of the level of nominal exchange rates that would equalize across countries the price levels of internationally tradable goods during a period of substantial equilibrium of trade flows[24].

-Currency substitution shocks are the key determinant of exchange rate instability.

Therefore nominal parities should be fixed according to Purchasing Power Parity and the aggregate monetary base of the three main industrial countries should be managed so as to ensure price stability in the world economy. Each country would then follow a domestic credit target and stabilize the exchange rate by means of symmetric, unsterilized intervention.The mechanism which should prevent diverging inflation rates among

24For a more detailed exposition see McKinnon and Ohno, (1987) countries does involve control of a domestic monetary aggregate, but a key role is played by the longer run effect on expectations formed in the face of such a currency union and by the impact on trade and employment of the temporary appreciation of terms of trade. Nominal exchange rates being fixed, inflation differentials will change real exchange rates in ways which shift demand from countries experiencing high levels of inflation to countries whose price level grows more slowly.

Criticisms of the McKinnon proposal

1)The first obvious criticism is concerned with McKinnon's belief that variations of the real exchange rate cannot achieve current account equilibrium. Meade[25] general equilibrium analysis has shown that the correct policy mix for balancing a current account deficit involves a combination of depreciated real exchange rates and a cut in domestic absorption. Our analysis in the former chapters has confirmed that a devaluation is effective in bringing the net external position of a country into equilibrium, as long as it does not excessively stimulate domestic inflation

25Meade (1951)

2)A second criticism is concerned with the reliance on the Purchasing Power Parity. Current account models of the exchange rate that follow the seminal work of Branson, which we have already discussed at some length, show that macroeconomic equilibrium may obtain at different levels of the real exchange rate. According to this approach, the real exchange rate ensures current account equilibrium for given output levels and a given net external position. An increase in net domestic holdings of foreign assets raises domestic demand for goods relatively to foreign demand and this causes a terms of trade appreciation. Furthermore, exchange rate flexibility may be needed to accomodate the differential inflation which stems from divergent rates of productivity growth[26]. Another important objection to the McKinnon approach is that if tradables in the industrial economies are imperfect substitutes it makes very little sense to look for exchange rates that ensure Purchasing Power Parity.

3)Last but not least comes the skepticism about the presumption that currency substitution is the main source of interest rate instability. In analogy with

26See Dornbusch (1988) for a clear example of how differences in productivity growth may substantially complicate the task of equalizing inflation rates across countries.

the celebrated analysis of Poole (1970), we would argue that exchange rate pegging might be heavily sub-optimal if real disturbances arise. For example, if an inflationary shock occurs which is not due to inopportune money supply expansion, an "accomodative" policy allowing for a higher price level but no permanently higher inflation might be desirable. But this policy would put a strong deflationary pressure on the trade sector under a fixed exchange rate regime[27]. Indeed some degree of managed exchange rate flexibility might be helpful in limiting the negative effects of adverse "real" shocks on output and inflation.

The Target Zones Proposal

Williamson points out two reasons of dissatisfaction with a regime of unmanaged float. The first is that it leaves room for too much exchange rate volatility, due to the inherent instability of the international financial markets. The second is that it does not place enough pressure on countries to cooperate their economic policies[28]. On the other hand Williamson, unlike McKinnon, would not advocate a return to a fixed exchange rate regime. In fact he believes that a

27Williamson (1988) raises this criticism
28We would rather take the view that a regime of unmanaged float is often the result of policy conflict.

flexible, but not unmanaged, exchange rate performs a desirable function in allowing the reconciliation of differential inflation rates. Even more important in his view is the possibility, that a flexible exchange rate does guarantee, to adjust the terms of trade when this is necessary to obtain current account equilibrium. Another reason for advocating exchange rate flexibility is that it allows a moderate degree of temporarily anticyclical policies whenever the economic conditions of each individual country should require it. Finally Williamson sees a role for a flexible exchange rate as an instrument for temporarily accomodating speculative pressures which it would be too costly to offset through exchange rate intervention. He believes that the "announcement" of the exchange rate target and the publicly known commitment of governments to cooperate to achieve it would reduce uncertainty about the formation of expectations and the short term volatility of exchange rates. In his own words:

> **"The target zones proposal envisages a limited number of the major countries negotiating a set of mutually consistent targets for their exchange rates .... The aim would be to set**

exchange rate targets at fundamental equilibrium exchange rates, that is , at the real values that on average in the medium term are expected to reconcile the internal and external balance...... The participating countries would be expected to conduct their macroeconomic policies with a view to......preventing their (real) exchange rates going outside a broad zone of.±10% around the target."[29]

As it is defined above, the target zones proposal leaves many interrogatives. An obvious weakness of the target zones proposal is the absence of a "nominal anchor" for the conduct of domestic anti-inflationary policy. This objection arises because, given the commitment of monetary policy to the protection of the target zone and the flexibility of the nominal exchange rate, some other policy instrument is needed to achieve the domestic target.

Williamson accepts such criticism and does not underestimate the importance of policy coordination for guaranteeing the sustainability of a target zones regime. As a guideline for implementing a coordinated

29Williamson, (1987)

policy he has put forward the following three propositions.

-The average level of world interest rates should be assigned the control of aggregate nominal income

-Interest rates differentials should aim at limiting currency deviations from their targets.

-National fiscal policies should be designed with the aim to achieve nominal income targets. This version of the target zones proposal has been slightly modified by Miller and Williamson, (1987), who suggest that fiscal policy in each country should be assigned to domestic demand rather than nominal income.

Boughton (1989) has strongly criticized the proposal. He points out that under a flexible exchange rate fiscal policy has a comparative advantage over monetary policy in controlling the current account, because any attempt to improve the current account by depreciating the exchange rate would cause a spur of domestic demand and suck in more imports, whereas the effect of a fiscal contraction would be unambiguously positive. On the other hand monetary policy would seem to be more effective in controlling the domestic target, because a fiscal policy shift would push the interest rate in the same direction so that the necessary exchange rate variation might in principle offset the fiscal stimulus[30]. In our view Boughton's criticism might be correct for the conduct of policy in the short term. In fact it should not be necessary to rely on monetary policy for the determination of the equilibrium target. As we shall see in the next chapter Edison, Miller and Williamson, (1987) have shown with the aid of a small two country model that control of domestic targets might be achieved assigning fiscal policy to the domestic target and leaving monetary policy with the task of equalizing interest rates across countries as long as destabilizing speculative attacks to the exchange rate do not occur. To the extent that this policy involved only temporary current account fluctuations and no permanent international redistribution of wealth, that is, no revision of the fundamental exchange rate would be necessary, Williamson would not advocate monetary control of the current account.

> **"A (current account) deficit of one year that is offset by a surplus one year or two later has no enduring effects on consumption, investment, inflation or any other variable of welfare**

30Indeed Boughton criticism is a combination of the well known conclusion of Fleming Mundell about the effectiveness of fiscal policy under perfect capital mobility and of the equally well known Laursen-Metzler effect.

> **significance. On the contrary, short-run variations in the current account provide a valuable shock absorber: it is only when they cumulate over the medium term that one needs to be troubled with the sustainability and optimality of borrowing from or lending to the rest of the world"**[31]

The most obvious weakness of the Williamson proposal is the perhaps excessive reliance on fiscal policy. This is in fact a rather inflexible instrument, which governments seem to find more difficult to adjust to changes of the economic climate than monetary policy. As Williamson himself has stressed[32], coordination of national fiscal policies has so far been the area where recent attempts of implementing coordination in practice has failed so far. This is not to mean that the fiscal instrument should not play a role in a policy mix aiming at macroeconomic stabilization. Indeed, this thesis stresses the importance of fiscal policy for stabilizing an open economy, but the fiscal instrument might be geared toward targets which may be regarded as a source of concern in the longer run. It is to these proposals that we now turn.

31Williamson (1989)
32Williamson, (1988)

Alternative proposals involving fiscal control of the current account.

In this section we consider the so-called "IMF view"[33] and a proposal outlined by the "Group of Cambridge" working with Meade. To some extent these two proposals might look pretty similar, but some important differences will emerge during the review.

The "IMF view has been articulated in two contributions, put forward by Genberg and Svoboda (1988) and Boughton, (1989). Both share the view that:

> **" as a general rule, expenditure changing policies have the most direct and quantitatively strong influence on the current account. Expenditure-switching policies, in contrast, affect the exchange rate significantly but have only a limited impact on the current account.......fiscal policy has a comparative advantage over monetary policy as an instrument for current account adjustment as opposed to domestic aggregate demand stabilization."[34]**

Genberg and Svoboda are mainly concerned with the correction of current account imbalances. They note, correctly in our view, that there is no predictable link between the exchange rate and the current account balance unless one takes into account the full set of relevant variables. In other words, they stress the

33We mutuate this definition from Currie et al.1989
34Genberg and Svoboda (1988)

importance of a general equilibrium analysis for the determination of the current account balance. In their view the current level of the exchange rate merely reflects the current and expected values of the relevant variables, including the policy mix. This framework is closely related to the monetary approach under the assumption of rational expectations. They implicitly assume that the correct policy mix may be sufficient for achieving current account balance and overlook the possibility that exchange rate swings may derive from shifts in portfolio preferences. In this context they argue in favour of the assignment of fiscal policy to current account control on the grounds of the comparative advantage that this instrument supposedly has over monetary policy[35]. As far as policy coordination is concerned, their main prescription is that governments should implement "sound" fiscal policies. If national fiscal policies follow diverging paths and this has undesirable consequences for the global economy as well as for each individual economy, they conclude that the best remedy is to redress such policies, instead of pursuing exchange rate adjustments by means of monetary policy. One is left to suppose

35 although different models might yield opposite results

that they simply regard the attainment of each country's internal target as a matter best tackled under decentralized policy action.

Boughton's paper is concerned with a more general "blueprint" for macroeconomic stabilization. In his view the main source of governments' concern for a balanced current account rests on the intergenerational transfers of disposable income that current account imbalances imply. He stresses that the impact of monetary policy on the current account balance is ambiguous and advocates fiscal control of the external target. This implies that governments should agree about desired external balances, which should not be necessarily zero, and assign domestic fiscal policies to this target. Given this assignment, and given that monetary policy has little or no impact on the current account, Boughton argues that each country should pursue its own internal target independently by means of monetary control This would obviously imply that exchange rate swings would become tolerable since they would not be associates with external imbalances.:

> **"the international coordination of monetary policy is neither necessary nor sufficient for attaining the targets, fiscal policy coordination, however, is necessary and, if monetary policy is aimed correctly at internal balance, sufficient as well."**

One difficulty with this proposal is that, while advocating a reasonable solution to the control of trade imbalances it would leave plenty of room for conflict arising from the international transmission of inflation (or deflation) through the exchange rate. Under this regime nothing would prevent the world economy from being locked into sub-optimal Nash equilibria of the kind discussed in Hamada. A second difficulty is that changes in the real exchange rate level re-allocate resources between tradables and non-tradables, and this has important implications too, as excessive appreciation might fuel calls for protectionism, one of the evils coordination should primarily avoid. Finally, as Vines (1989) pointed out, there is nothing in Boughton's proposal which is meant to reduce exchange rate volatility[36]

The "group of Cambridge"[37] is not directly concerned with the issue of policy coordination, as they focus on macroeconomic policy design in a single country. Nevertheless their approach is of interest here, as it bears relevant implications for the definition of targets. They point at a wealth target as

36This criticism would apply to the paper of Genberg and Svoboda, too.
37Vines et al.(1989)

an important element in policy design. We have already discussed this at some length in chapter 1, it is interesting to note here that they stress the importance of allowing for current account deficits as they enable a country to achieve its overall wealth target. For example, it might be acceptable for a country to run a current account deficit as long as it is meant to finance a build up of its productive capital, so that the expected income stream may be used to service the current deficit[38]. One major caveat is that wealth targets would have to be coordinated as long as they imply an international redistribution of wealth. In the context of this thesis, where output is assumed to be constant and no capital accumulation takes place, setting a wealth target is tantamount to setting a foreign wealth target. Also, given that output is constant in the long run, a foreign wealth target would necessarily imply a long term real exchange rate target. Thus, the position of the "Group of Cambridge" has substantially different implications from the "IMF view", because neither Genberg and Svoboda nor Boughton are too concerned with this

38This argument has been used very recently, in the face of the external deficits run by the U.S. and the UK aspect, as they simply stress the importance of achieving current account balance at whatever level of the exchange rate. Meade and his associates recommend the combined assignment of fiscal and monetary policy to both the domestic and external target, although they recognize that fiscal policy has a comparative advantage over monetary policy in controlling the current account. This might imply that, for each assignment, the relative strength in using an instrument should depend on the comparative advantage of the instrument itself. In the next chapter we shall assess the performance of a simplified version of this proposal involving "decoupled" control rules, which is spelled out as follows:

-coordinated use of monetary policy, so as to enable each country to achieve its domestic target. At the world level monetary policy is assigned to a global nominal income target, as in the Williamson proposal. Real interest rate differentials are assigned to nominal income differentials. This combined strategy ensures that countries do not pursue independent policies which might turn out to be excessively inflationary or deflationary.

-Differentials in the stance of national fiscal policies will be assigned to an internationally agreed wealth target. Countries whose current net external position is above target are required to expand, whereas countries whose current level of foreign wealth are below target are required to contract.

One might object that under this assignment the definition of the level of the exchange rate is left to "market forces" and that this might leave room for foreign exchange instability. But the announcement of a long run target for wealth and the real exchange rate might provide an "anchor" preventing the current exchange rate from drifting away. Furthermore, coordinated intervention and a limited degree of flexibility of the monetary instrument[39] might significantly reduce the danger of destabilizing speculation.

Empirical evidence

The empirical evidence on the relative performance of the alternative proposals is still scarce. A recent study by Taylor (1988) stresses the negative consequences of a regime of fixed exchange rates and provides some indirect support for the "IMF view".

39The target zones proposal shares these features, too

Taylor estimates a 7 country model where forward-looking expectations drive the exchange rate and influence the labour market as in Taylor's model of sticky wages (1980), long run output is set at the natural rate, fiscal policy is exogenous. Taylor argues that, under a wide set of disturbances, independently set interest rate rules which aim at controlling a domestic target, in the form of either a price level or a nominal income target, would perform better than a fixed exchange rate regime where monetary policy is constrained to maintain nominal parities. Under this second rule interest rates in all countries move simultaneously as average inflation raises above target and the real exchange rate fluctuations, determined only by the differential rates of inflation, avoid persistent differentials in the national rates of inflation. The reason why decentralized monetary policy performs better is quickly spelled out. Suppose that in one country inflation unexpectedly rises. Under a fixed exchange rate regime the domestic interest rate is raised only when and to the extent that world inflation goes up. The policy feedback is therefore slow and weak in the domestic country and unnecessarily affects the foreign economies. The real exchange rate swing caused by the inflation differential affects the individual economies with a delay, due to the j-curve effect. As a consequence, the proper deflationary feedback in the domestic economy operates too late. Symmetrically, the foreign economies face an unnecessary deflation in the initial phase of the cycle. Real exchange rate fluctuations are higher under the flexible exchange rate regime, but swings of trade flows are not. This is very much in line with Boughton's argument that monetary policy has negligible effects on the current account, although it does influence profitability in the traded goods sector. Taylor's study seems open to an important criticism: it does not account for the wealth redistribution which takes place through current account imbalances[40]. In fact these effects might prove quite important. In the next chapter we shall simulate a small theoretical model which is analytically very similar to Taylor's model, as both are derived from Carlozzi and Taylor, (1985). It will be shown that decentralized monetary policy as advocated by Taylor may cause huge current account swings and even overall instability.

40but the majority of large scale econometric models shares this shortcoming

Frenkel Goldstein and Masson (1988) simulate a model where exchange rate expectations correctly anticipate the policy stance. They first try to assess whether decentralized policy action without sharp shifts would have improved the macroeconomic performance. To do this they simply "smooth" over time the paths of policy variables[41]. The outcome is that smoothness of targets would have actually increased. Frenkel, Goldstein and Masson argue that this should not surprise, as actual policies were indeed not exogenous during the simulation period but responded to such exogenous shocks as the oil price rise, therefore smoothing was already embedded in the historical data. They find that the target zones proposal is effective in limiting current account imbalances as fiscal policy stabilizes domestic targets, but at the cost of large budget deficits. By contrast, the exchange rate paths are smoothed only to a limited extent and at the cost of strong interest rate swings. But this result might be due to an unconvincing feature of their simulation approach: Frenkel, Goldstein and Masson assume that future shocks are correctly anticipated, and so is the policy feedback. Perhaps their results would have been

41They simply consider five-year moving averages for each policy instrument.

markedly different if it had been assumed that foreign exchange markets may anticipate the state contingent policy response but not the shock. Another criticism comes from Williamson, who has pointed out that, despite the introduction of rational expectations, the model fails to account for the beneficial role of exchange rate targeting on "bubbles" and "fads", despite the fact that this is one of the main goals of the target zones proposal. Furthermore, they do not discuss the evolution of the global economy, but we have theoretical reasons to believe that the coordinated world monetary policy advocated by Williamson is likely to improve on the actual path of the global economy, as it reflects non-cooperative policy decisions. Also it is not entirely clear how the monetary policy rule is applied. They state that uncovered interest parity holds among the industrialized countries, but that a fiscal expansion appreciates the exchange rate[42]. It is only at this stage that monetary policy is activated to keep the exchange rate close to the target. But this is not the kind of policy that advocates of the target zone proposal have suggested. In fact, Edison, Miller and

42Frenkel Goldstein and Masson (1988) page 33

Williamson (1987) simulate a small theoretical model where uncovered interest parity holds and real interest rates are equalized across countries in the face of changes of the fiscal policy stance, so that no exchange rate dynamics occur in absence of "fads"[43]. One would expect this result to be replicated in the simulations carried out by Frenkel, Goldstein and Masson.

Currie and Wren-Lewis (1989) investigated two alternative rules, the target zones proposal and the "Boughton" assignment by simulating the GEM model for the 7 major countries. They define a welfare function which includes output, inflation, fiscal policy and the exchange rate. They then optimize the values of the parameters to be included in the feed-back rules. One major criticisms of this procedure is that it selects the strength of the policy feedback under the assumption that shocks are known[44]. This is likely to introduce a bias in favour of the feedback policies over the historical paths, but should not affect the comparison between alternative assignments. The target zones rule turned out to perform better than the

43In the next chapter we will discuss the Edison Miller Williamson paper at great length
44see Williamson, 1988

Boughton assignment. One major difficulty with the latter assignment was that the exchange rate flexibility induced by monetary control of the domestic target affected the current account with considerable delay, due to the J-curve effect. The delayed response of fiscal policy to exchange rate swings would then influence the domestic target in a way that would complicate the task of monetary policy and introduce greater overall variability of the targets. But one might argue that if the fiscal policy feedback had been calibrated more carefully in order to account for the J-curve effect the Boughton assignment might have performed significantly better. Currie and Wren-Lewis point out that the preferable outcome associated with the Target zones proposal depends crucially on the arguments of the welfare function, which includes the exchange rate but does not consider the current account. When the current account is an argument of the welfare function the Boughton assignment performs better at least for a few countries. Williamson's counterargument is that in principle there are no strong reasons for assigning a welfare cost to current account swings, as long as they are temporary[45],

45This might not be true when these swings are large and their correction becomes very difficult, so that because they will be easily accomodated by the financial markets. What the Currie and Wren-Lewis experiment fails to tell us is whether the target zones proposal is able to prevent undesired wealth transfers across countries, as the GEM model does not account for wealth effects. If target zones implied this outcome, at least under a certain range of shocks, then the balance might shift in favour of the Boughton rule, whose design prevents wealth redistribution. This issue will be investigated in the next chapter.

4. Conclusions

In this chapter we have been concerned with several issues which have emerged in the debate on policy coordination. In the context of a growing interdependence of national economies it may be advantageous for governments to pursue their goals cooperatively instead of acting independently, as decentralized policy action may yield outcomes which lay out the set of Pareto-efficient outcomes. The game-theoretic approach has stressed the potential gains from coordination, but has also emphasized the importance of reputation if cooperation is to actually improve welfare. Time inconsistent coordinated optimal

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the incentive to renege on previous commitments increases.

policies without pre-commitment are likely to be counterproductive in a context where the private sector is forward-looking. This conclusion has given support to advocates of simple policy rules, which are easily understood and monitored. Several proposals have been put forward over the last few years. To some extent, an empirical evaluation of the performance of these rules has already been carried out, with the aid of large econometric models. This pragmatic approach may be illuminating, but often it falls short of pinpointing the theoretical determinants of the behavior of the economy and of the reasons why one proposal should be preferred. Furthermore, wealth effects are often neglected, despite their importance for determining long run equilibria, both in large econometric models and in the simpler models which aim to provide an analytical discussion of the issue. In the next chapter we will simulate a small theoretical model where international transfers of wealth occurring through the balance of payments are explicitly modelled. In this framework we shall assess the performance of alternative simple rules for policy coordination.

CHAPTER 6
TARGET ZONES AND WEALTH EFFECTS: CURRENT ACCOUNT IMPLICATIONS OF ALTERNATIVE POLICY ASSIGNMENTS

1. INTRODUCTION.

Since the breakdown of the Bretton Woods exchange rate system, currencies of the most advanced world economies have more or less freely fluctuated. But floating has been accompanied by large swings of real exchange rates and trade flows. As a result there have been calls for some sort of policy coordination.

One of the most influential policy coordination proposals is that of a system of target zones (Williamson, 1987): the proposal has been presented as a device for avoiding real exchange rate "misalignments", which are defined (Williamson, 1985) as "persistent departures of the exchange rate from its long run equilibrium level". It has been claimed (Edison, Miller, Williamson, 1987, henceforth EMW) that such real exchange rate targeting also requires some degree of coordination of fiscal policy if control of inflation is to be achieved at the same time. In this system <u>monetary policy</u> in each country is assigned to the <u>real exchange rate target</u>, and <u>coordinated fiscal policy</u> is assigned to reducing the <u>inflationary imbalance among</u>

countries. EMW have examined their proposals by means of simulating a small theoretical model.

However their work suffers from a serious shortcoming: although their exchange rate target is stated to be determined with the aim of achieving balance of payments equilibrium (Williamson and Miller, 1987), no account is in fact given in their model of the way in which the current account would evolve as a consequence of the policies they advocate. In this chapter we study that question and show that such current account behaviour has potentially worrying implications for their scheme. We do this by analyzing an extended version of the EMW simulation experiment, in which we explicitly model the current account equation and introduce wealth effects in the aggregate demand function.

The second objective of this chapter is to focus on another problematic aspect of the EMW proposal which has so far received scant attention. They assign monetary policy to the control of average world inflation. Under this regime average world interest rates would be raised if global inflation rose above its global target. Skepticism has already been expressed about the possibility of enforcing this uniformity (Fischer, 1987), but there is another potentially very serious problem: this policy rule has implications for the reduction of national imbalances which have probably been greatly underestimated. EMW regard control of world and national targets as two problems to be solved independently. In fact this may no longer be possible when the behaviour of the current account is brought into the picture. It is well known that fluctuating interest rates redistribute wealth among debtor and creditor countries and cause current account disequilibrium. But the EMW global anti-inflation policy would do just this and would, we argue, probably make the task of reducing national divergence far more complicated, if foreign investment were to be considered a source of active concern for national governments.(Louvre agreement,1987)

The chapter has a third objective, since it is our intention not merely to criticize. An alternative set of rules for control of national imbalances is also presented. In this scheme <u>interest rate differentials</u> are assigned to <u>inflation divergences</u> and <u>coordinated fiscal policy stances</u> are assigned to control of an <u>agreed international distribution of financial wealth</u>. In this second framework <u>surplus countries</u> would be required to carry out a <u>fiscal expansion</u> whereas countries running a <u>deficit</u> would be required to carry out a <u>fiscal contraction</u>. This policy assignment is not entirely novel, it bears some resemblance to the work of Boughton (1988) and to a proposal by Vines et al. (1989). But this is the first time it has been fully spelled out. The reason we do this is that we are sympathetic to the general thrust of EMW policy coordination proposals, but wish to find a way to overcome the potentially rather severe problems associated with the particular details of their proposals.

The rest of the chapter is laid out as follows. In section 2 we describe the technical details of the model. In sections 3,4 and 5 we present the results obtained simulating three alternative policy assignments.

<u>2. THE MODEL.</u>

Model structure and parameter values entirely correspond to those of EMW, who follow Carlozzi and Taylor (1985) except that wealth effects in aggregate demand and the current account. On the other hand the model is a straightforward extension in a two country setting of the model set out in chapter 4[1].

It is assumed that the world economy is composed of two national units, the home and foreign economy, identical in size and structure. Since the two economies are isomorfic, it becomes possible and analytically convenient to split the model into two blocks, (Aoki,1981), referred to as "world averages" and "national differences".

$x_a = (x_h+x_f)/2$; $x_d = x_h-x_f$;

where the subscripts h,f,a,d are meant to relate variable x respectively to the home economy, the world averages, the national differences. This split highlights the two conceptual tasks inherent with international policy coordination: a) targets definition for the world economy, which is not affected by exchange rates or current account imbalances; b) control of national imbalances, with the transmission of disturbances operating through the exchange rate and the current account. Furthermore, the

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1Two differences exist. The first is that, for reasons which are to be made clear later, we do not consider the wealth effects of exchange rate changes. The second is that variables are now defined in logs, in order to enable a direct comparison with the model set out in Edison Miller Williamson (1987).

definition of world averages and national differences enables one to greatly simplify the analysis by solving for the two blocks independently. However, as we shall see, this is possible only up to a certain degree of model complexity: it will become necessary to solve for the two blocks jointly once a proper treatment of the current account is introduced.

TABLE 1: THE MODEL

1.The Home Economy

$$y_h = -\mu r_h + s_h + \pi y_f + \delta c + \theta F;$$
$$dp_h = \Phi y_h + z_h + dx_h \;;$$
$$z_h = \epsilon(dp_h - z_h) \;;$$
$$dx_h = \Sigma E\{dc\} + \beta(\Sigma c - x_h) \;;$$

2.The Foreign Economy

$$y_f = -\mu r_f + s_f + \pi y_h - \delta c - \theta F;$$
$$dp_f = \Phi y_f + z_f + dx_f \;;$$
$$dz_f = \epsilon(dp_f - z_f) \;;$$
$$dx_f = -\Sigma E\{dc\} + \beta(-\Sigma c - x_f) \;;$$

3.Exchange Rate and Wealth Dynamics

$$E\{dc\} = dc \;;$$
$$E\{dc\} = r_h - r_f \;;$$
$$dF = T + r^*F + F^*r_f \;;$$
$$T = 2\tau_1 c - \tau_2(y_h - y_f) \;;$$

TABLE 2: THE MODEL SPLIT INTO BLOCKS

1.Block 1: World Averages

1a) $y_a = -\mu r_a + s_a + \pi y_a$;

2a) $dp_a = \Phi y_a + z_a$;

3a) $dz_a = \epsilon(dp_a - z_a)$;

2.Block 2: World Differences

1d) $y_d = -\mu r_d + s_d - \pi y_d + 2\delta c + 2\theta F$;

2d) $dp_d = \Phi y_d + z_d + dx$;

3d) $dz_d = \epsilon(dp_d - z_d)$;

4d) $dx = 2\Sigma E\{dc\} + \beta(2\Sigma c - x)$;

5) $E\{dc\} = \{dc\}$;

6) $E\{dc\} = r_d$;

7) $dF = T + r^f * F + F * r_f$;

8) $r_f = r_a - 0.5 r_d$;

9) $T = 2\tau_1 c - \tau_2 y_d$;

Dynamic paths for the Target variables

11a) $dm_a = \sigma_1 z_a - \sigma_2 y_a$;

11b) $dm_d = \sigma_1 z_d - \sigma_2 y_d$;

TABLE 3: THREE ALTERNATIVE POLICY ASSIGNMENTS

The EMW assignment

12) $dr_a = \alpha_1[dm_a - dp_a - dy_a] + \alpha_2[m_a - p_a - y_a]$;

13) $ds_d = \Omega_1[dm_d - dp_d - dy_d] + \Omega_2[m_d - p_d - y_d]$;

The "monetarist" assignment

14) $dr_a = \alpha_1[dm_a - dp_a - dy_a] + \alpha_2[m_a - p_a - y_a]$;

15) $dr_d = \Omega_3[dm_d - dp_d - dy_d] + \Omega_4[m_d - p_d - y_d]$;

The "Meade" assignment

16) $dr_a = \alpha_1[dm_a - dp_a - dy_a] + \alpha_2[m_a - p_a - y_a]$;

17) $dr_d = \Omega_3[dm_d - dp_d - dy_d] + \Omega_4[m_d - p_d' - y_d]$;

18) $ds_d = \Omega_5 dF$;

DEFINITION OF VARIABLES (DEVIATIONS FROM EQUILIBRIUM)

y = real output, measured relative to the "natural rate" (in logs)
r = short term real interest rate ;
c = real exchange rate ;
s = index of fiscal stance (scaled to have a unit effect on y)
p = consumer price index (logs)
z = core inflation (a moving average of p) ;
x = the markup of prices on wages (equivalent to the cost of foreign inputs for a unit of domestic output);
m = nominal income target ;
F = net domestic holdings of foreign assets, defined in foreign currency ;
T = trade balance ;
d = differential operator ;

PARAMETER VALUES

$\mu = 1.2$; $\sigma = 0.25$; $\epsilon = \beta = 1$; $\Phi = 0.25$;
$\theta = 0.08$;
$\sigma_1 = -0.25$; $\sigma_2 = 0.5$; $\alpha_1 = -0.83$; $\alpha_2 = -0.42$;
$\Omega_1 = 1$;
$\Omega_2 = 0.5$; $\Omega_3 = -0.83$; $\Omega_4 = -0.42$; $\Omega_5 = 1$;
$\Sigma = 0.25$
$r_f{}^* = 0.05$;

	low interdependence	high interdependence
π =	0.1	0.3
δ =	0.1	0.3
τ_1 =	0.06	0.224
τ_2 =	0.048	0.188

τ_1 and τ_2 have been derived from δ and π assuming:

$\tau_1=\delta[1-b(1-t)+\tau_2]$ and $\tau_2=\pi[1-b(1-t)]/(1-\pi)$,

where b=0.8 is the marginal propensity to consume out of income and t=0.3 is the tax rate.

In the block relating to world averages output is driven by demand, namely monetary and fiscal policy (eq.1_a). Consumer price inflation (eq.2_a) corresponds to wage inflation, which depends on current output deviations from the natural rate and on core inflation. Core inflation dynamics (eq.3_a), driven by a partial adjustment mechanism, is linked with current consumer price inflation. National divergences differ from world averages because of wealth effects and exchange rates, defined as the amount of domestic currency for a unit of foreign currency. Following Smith (1988) and Currie (1986), we have excluded revaluation effects caused by real exchange rates on financial wealth by assuming that it is held in foreign currency by domestic residents. Agents in the financial markets are assumed to form expectations rationally and to have full access to the relevant information. Therefore the expected variation of the exchange rate corresponds to its actual rate of change.(eq.5_d)

Due to the assumption of perfect substitutability between assets denominated in different currencies, the rate of change of the real exchange rate is set equal to the difference between home and foreign real interest rates(eq.6_d). As in EMW, the dynamic equations of national consumer price divergences (eq.3_d and 4_d) account for the gradual adjustment of prices to exchange rate "surprises".

Wealth redistribution between the two countries takes place through the current account flow.(eq.7_d) This was not present in the original EMW model and therefore it needs to described in more detail. We do not consider alternative forms of wealth as we wish to emphasize the link existing between wealth effects and current account imbalances. We assume that the two countries exchange assets denominated in foreign currency, F, whose rate of return corresponds, as in Currie et al. (1986), to the foreign real interest rate. The real instead of the nominal interest rate is included because account is made of changes in the real value of wealth due to inflation abroad. As both r_f and F are endogenous variables we have linearized the term $r_f F$, with r^{f*} and F^* being the initial levels of the foreign real interest rate and of foreign wealth. The initial stock of wealth outstanding will be of crucial importance for the results, so we will consider various cases in the range $-0.5<F^*<+0.5$.Note that F is normalized as a fraction of equilibrium output. Following Carlozzi and Taylor r_f^* has been set at 0.05.

It is important to note that when disequilibrium occurs at the world level and monetary policy is activated the two blocks of the model cannot be solved independently. This is because, unless $F^*=0$, world real interest rate changes will redistribute wealth among countries and activate the national differences block.[2]

Following EMW again the trade balance depends on relative deviations of national outputs from the natural rate and on the real exchange rate.(eq.9_d) For obvious reasons of similarity with F in the current

2This problem is of course a consequence of the crucial difference between the present model and that of EMW.

account flow it is assumed, as in Currie (1986), that the trade balance is expressed in terms of foreign currency unit. As in EMW the dynamic path of the real exchange rate is connected with the rest of the block by means of its effect on aggregate demand. (eq. 1_d)

Financial wealth is an argument of aggregate demand: a current account surplus stimulates domestic demand and symmetrically depresses foreign demand. As a consequence, output differentials are enhanced. This is another new feature of the present model; the numerical value of the coefficient corresponds to that used in Currie (1986).

<u>Money</u> <u>GDP</u>[3] levels, world averages and national differences, are set as the intermediate target for inflation control. (eq.4 and eq. 11_d) We also follow the procedure of EMW, in defining a path for both targets which is <u>not</u> independent from inflation and output dynamics. The reason that they do this is to dampen cyclical fluctuations: 25% of core inflation is "accomodated" and 50% of the output cycle is resisted. (eq. 4_a, eq. 11_d)

3Elsewhere, Miller and Williamson (1987) point at domestic demand as the intermediate target for inflation control. We do not explore that possible alternative here for sake of simplicity.

In all the experiments which follow, the model is shocked by assuming a 10% surge of world inflation, with national differences also being 10%. This implies that the initial rate of inflation is 15% in the home economy and 5% in the foreign economy.

The model allows for four policy instruments. Two are related to the world averages block, the average real interest rate and the average fiscal policy stance. Two refer to national differences: real interest rates differentials and divergences of national fiscal policy stances. It is assumed that policy tools gradually adjust to deviations of targets from their desired values: the policy experiments differ in the nature of these gradual adjustments.

RESULTS

3.THE EMW ASSIGNMENT

EMW make use of two instruments only. They assign "average" monetary policy to the control of world money GDP(eq.12) dispensing with "average" fiscal policy altogether. Reduction of national differences in the rate of inflation is caused by the asymmetric stance of national fiscal policies: the country whose rate of inflation is above average contracts, whereas the country whose inflation rate is below average expands. Monetary policy is used to hold down the exchange rate at its "target zones" level. In this model, with perfect capital mobility real interest rates must be always equalized across countries, since, as shown in eq.6), anything else would cause exchange rate fluctuations. According to the EMW proposal neither real interest rate differentials nor real exchange rate dynamics ever occur. Implicitly, monetary policy is left as a short run "reserve" weapon against exchange rate "bubbles" not accounted for in the model. The real exchange rate target stays constant throughout the adjustment period and is set with reference to external equilibrium, although the current account does not appear in the model, so that there is no way one can assess the current account implications of their proposal. The aim of this section is to do exactly this.

In order to facilitate a better understanding of the model we undertake our analysis in stages. At first, as it is sometimes assumed in the literature (Bandhari et al. 1987), we shall ignore the debt service in the current account and consider the trade balance only. Secondly, we shall simulate a model where the debt service appears in the current account. This substantially complicates the picture, but as a preliminary step we shall assume that no shock occurs at the world level, so that world interest rates stay constant[4]. Finally, by simulating the full model, involving the reduction of world average inflation as well as control of national differences, we will assess the implications that the assignment of world monetary policy to average inflation has in terms of wealth redistribution and current account disequilibrium as part of the overall adjustment process.

3.1. A MODEL WHERE THE TRADE BALANCE IS THE ONLY SOURCE OF WEALTH TRANSFER

The current account equation becomes:

$dF = T;$

Real interest rates differences being constrained to zero, curbing inflation differentials requires a fiscal contraction in the home economy and a symmetric expansion abroad. Obviously, each country's demand for foreign goods depends, coeteris paribus, on its own

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4Alternatively, we might have assumed that fiscal policy is assigned to control average inflation.

rate of growth. As a consequence of the asymmetric fiscal policy stance the home economy runs current account surpluses throughout the adjustment period. This leads to a permanent wealth redistribution from the foreign economy to the home economy. The change in domestic holdings of foreign assets is related to the accumulated divergence of national outputs:

$$F_{\infty}-F^{*} = -\tau_{2}\int_{0}^{\infty} y_{d}$$

with

$$\int_{0}^{\infty} y_{d} = (z_{d\infty} - z_{d0})/\epsilon\Phi = -40\%,$$

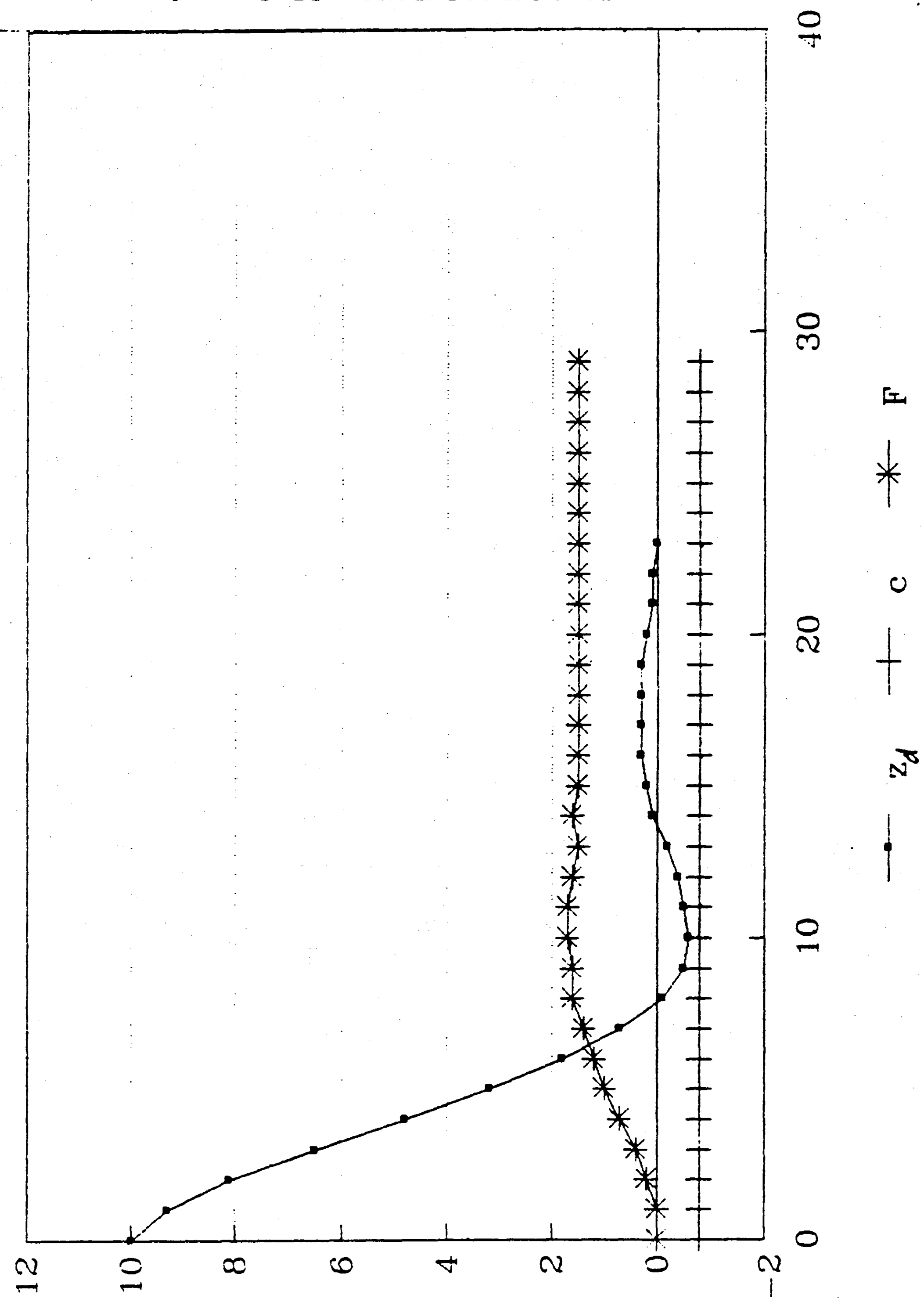
given the values of Φ and ϵ.(see eq.3d)

If the two economies exhibit a low degree of interdependence, the increase of F is about 2% of real GDP. If the degree of interdependence is higher, international wealth redistribution amounts to about 8% of GDP. Long run equilibrium requires that the permanent deviation of F from its initial value be compensated by a permanent bias of fiscal policy stance. Wealth effects do not seem to significantly alter the dynamic path of output and inflation with respect to the original EMW results.

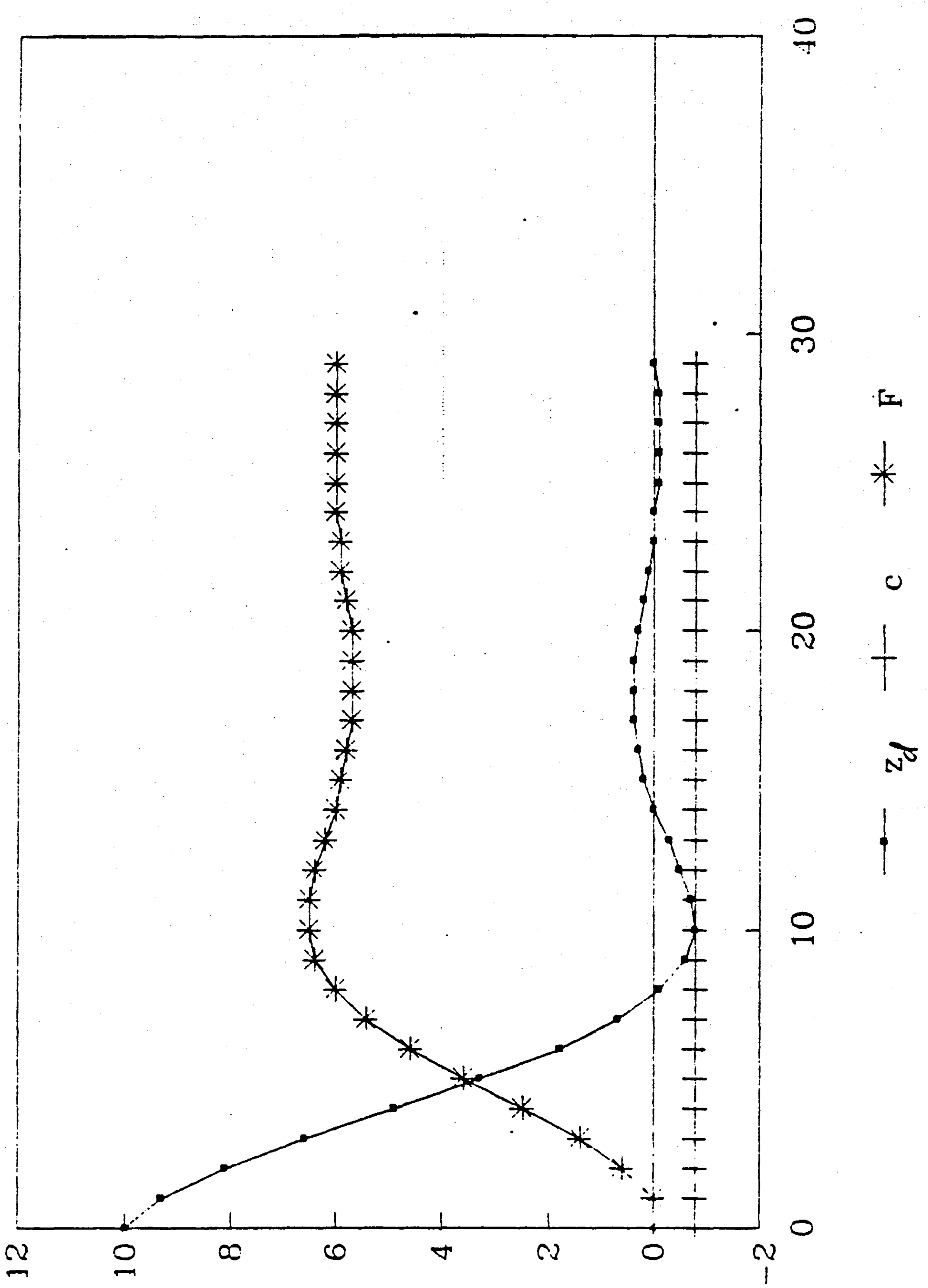
3.2. REDUCTION OF NATIONAL IMBALANCES WHEN THE DEBT SERVICE IS TAKEN INTO ACCOUNT AND WORLD MONETARY POLICY IS NOT ACTIVATED.

At this stage the simulation exercise involves block 2 only. It is intuitively clear that once national differences have died out permanent changes of domestic holdings of foreign assets will have to be offset by real exchange rate variations of opposite sign, if the current account is to be in equilibrium. This point has been repeatedly made in the literature on exchange rate determination.(Branson, 1978, Dornbusch,1986) Still, it is worth recalling because it enables one to affirm that under the set of rules for international policy coordination proposed by EMW the exchange rate cannot be regarded as exogenous and set independently from the policy exercise being carried out. Given that divergences of national real interest rates are ruled out, no real exchange rate dynamics can take place, the adjustment must occur once and for all. Technically, the model becomes saddlepath: stability requires an immediate jump of c onto its new equilibrium value. Note that the inclusion of the foreign investment service introduces an unstable root as a consequence of the chosen policy mix and quite

EMW POLICY ASSIGNMENT
F* = 0 LOW INTERDEPENDENCE



EMW POLICY ASSIGNMENT
F* = 0 HIGH INTERDEPENDENCE



independently from the values of the structural parameters. It has been noted elsewhere (Vines et al.,1989) that if $r_f>\tau_2\theta$ an increase in F will raise foreign interest payments more than depress imports through the fall of domestic expenditure, therefore leading to the destabilizing outcome of cumulative current account surpluses. In this case potential instability arises irrespectively of $r_f \gtrless \tau_2\theta$. If the inflationary gap between the two economies is to be driven down a negative differential must arise in the rates of real GDP growth. As a consequence, the home economy must run current account surpluses and accumulate foreign assets. The expansionary stimulus to domestic expenditure deriving from wealth accumulation will have to be matched by a permanent fiscal contraction. Eventually, with $y_d = 0$ the increased stock of foreign investment will still exert a positive pressure on the current account, to be compensated for by a real exchange rate appreciation.(tab.4) $F_\infty - F_0$ turns out to be lower when foreign investment service is included in the current account equation. This for two reasons. First, the initial real exchange rate appreciation worsens the home economy's competitiveness, thereby reducing the positive impact of lower domestic growth on the current account. Secondly, the terms of trade permanent appreciation reduces the amplitude of the required output divergence between the two economies.(see eq.3d)

$$\epsilon\Phi\int^{\infty} y_d = z_{d\infty} - z_{do} - 2\epsilon\Sigma(c_{\infty}-c_o) ;$$

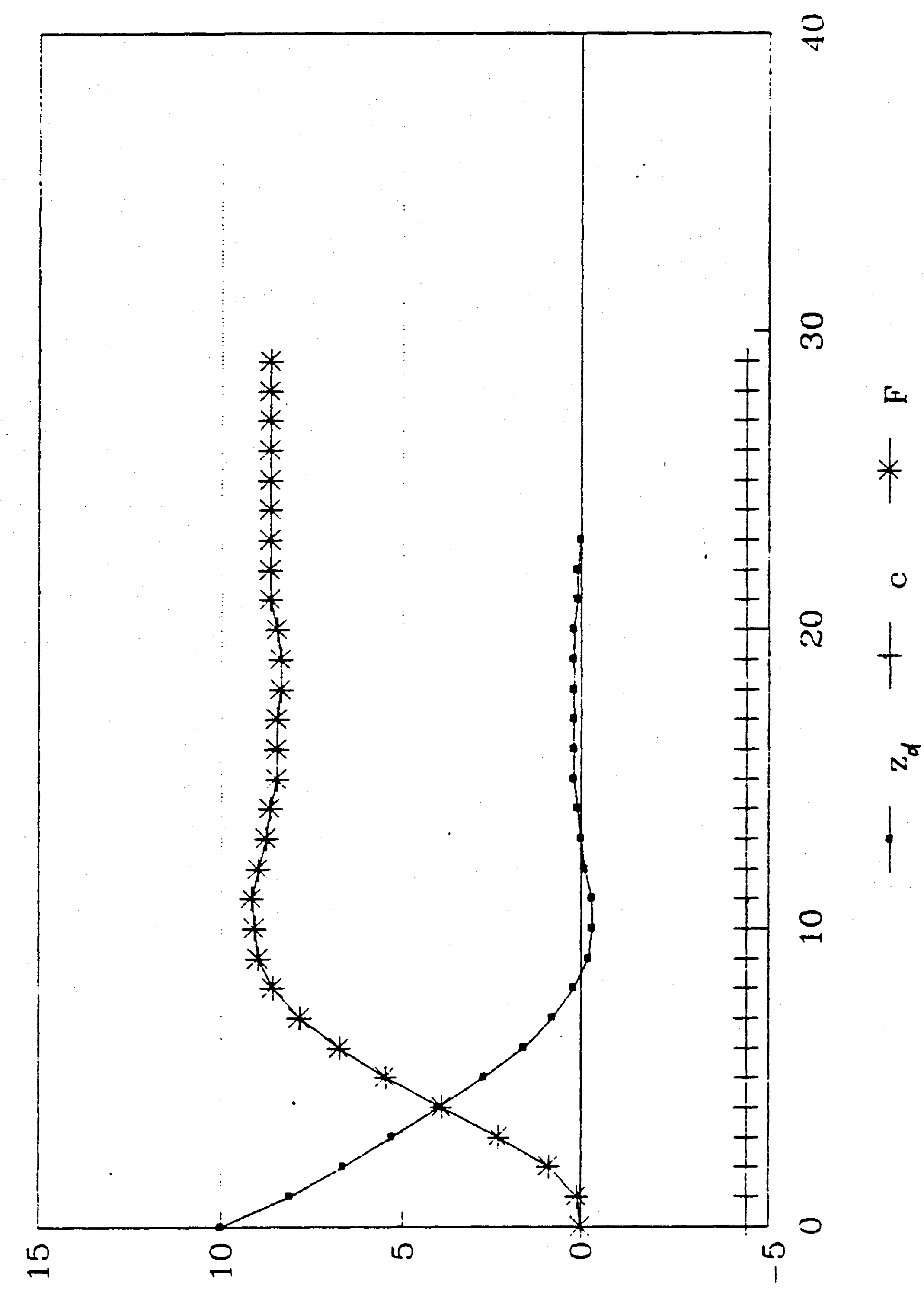
Table 4: permanent real exchange rate and foreign wealth changes and relative output loss necessary when foreign investment service is included in the current account but monetary policy does not influence national differences.

interdependence	Dc	DF	$\int^{\infty} y_d$
low	-0.8%	+1.5%	-38.4
high	-0.8	+6,0%	-38.4

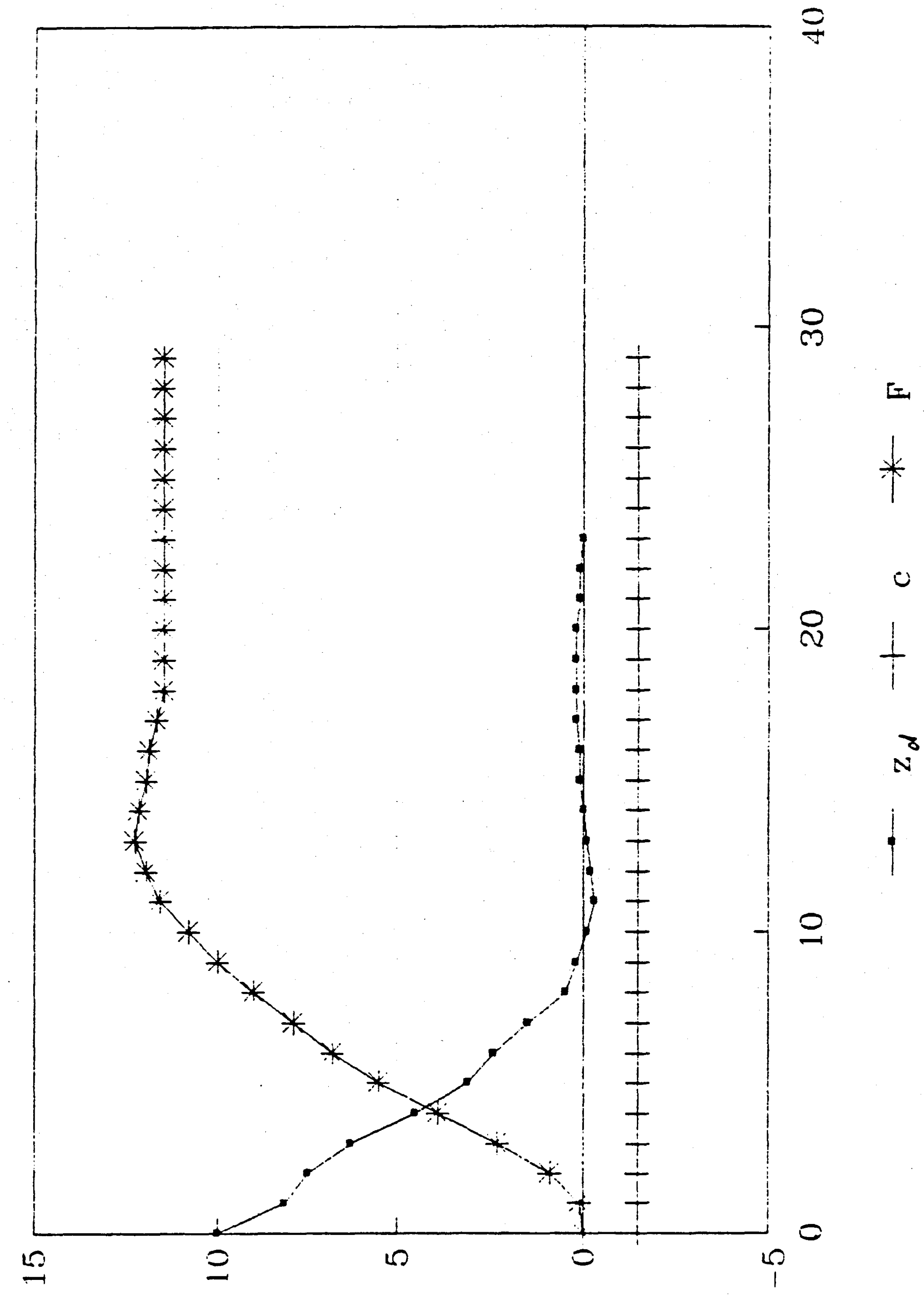
3.3. SIMULATING THE FULL MODEL

Permanent changes of F and c are significantly affected by the sign and value of F*. To a lesser extent dynamics of national inflationary divergences are altered as well. When the home economy is a net creditor accumulation of foreign assets is enhanced by higher world interest rates. This addition can be quite substantial when foreign investment is a significant proportion of real GDP. At the same time, the higher the income elasticity of the trade balance

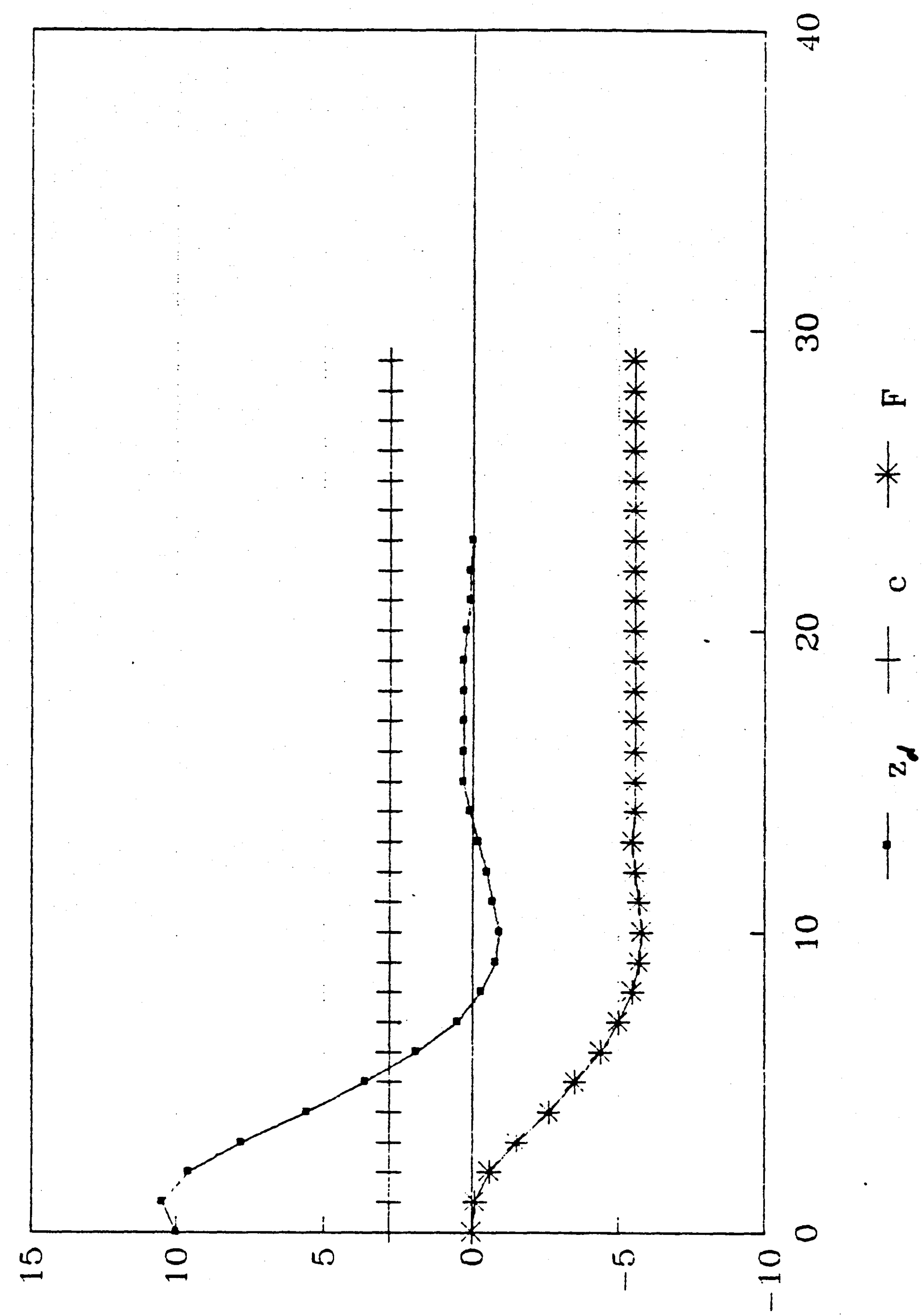
EMW POLICY ASSIGNMENT
F* = 0.3 LOW INTERDEPENDENCE



EMW POLICY ASSIGNMENT
F* = 0.3 HIGH INTERDEPENDENCE



EMW POLICY ASSIGNMENT
F* = -0.3 LOW INTERDEPENDENCE



the <u>stronger</u> the increase of F_{∞}; the <u>lower</u> the price elasticity of the trade balance the bigger the real exchange rate appreciation, the <u>smaller</u> the output loss for the home economy. If the home economy is a net <u>debtor</u> the final outcome may turn out to be quite different. World antiinflationary policy raises real interest rates and worsens the current account.If the starting level of foreign debt is sufficiently high the foreign assets loss determined by restrictive world monetary policy dominates the accumulation of F associated with the reduction of national differences. As a consequence, current account equilibrium requires a permanent real exchange rate <u>depreciation</u>. This spurs inflation at home and curbs it abroad. Correspondingly, the total output loss associated with the reduction of national imbalances must be <u>higher</u>. Also, the terms of trade depreciation initially exerts a positive impact on inflation differentials, but this perverse effect dies out rather quickly.

Tab.5: Permanent wealth, exchange rate changes and output loss required when world monetary policy affects the current account.(percentage changes)

Interd.		F*=-0.5;	F*=-0.3;	F*=-0.1;	F*=0.1;	F*=0.3;	F*=0.5;
low	DF =	-10,3;	-5.6;	-0.8;	+3.9;	+8.7;	+13.4;
	Dc =	+5.3;	+2.8;	+0.4;	-2;	-4.4;	-6.9;
	$\int^{\infty} y_d$ =	-50.6;	-45.6;	-40.8;	-36;	-31.2;	-26.2;
high	DF=	-3.3;	+0.4;	+4.1;	+7.8;	+11.5;	+15.2;
	Dc=	+0.4;	-0.1;	-0.5;	-1;	-1.5;	-2.4;
	$\int^{\infty} y_d$=	-40.8;	-39.8;	-39;	-38;	-37;	-35.2;

3.4.CONCLUDING REMARKS ON THE EMW PROPOSAL

The previous sections have shown that antiinflationary policy under a target zones regime might have consequences that countries might find undesirable.

a) Correction of national differences implies a permanent redistribution of wealth and a permanent terms of trade change. The size of the wealth transfer substantially increases when the income elasticity of the trade balance is higher.

b) For each country the total output cost of reducing inflation is affected by the sign and amplitude of the terms of trade change. A permanent depreciation will add to the required output loss whilst a permanent appreciation will lower it.

c) If the initial stock of foreign wealth/debt is not "small" in terms of real GDP world monetary policy significantly <u>interferes</u> with the reduction of national imbalances. Furthermore, the <u>sign and magnitude</u> of wealth transfers strongly depend on the <u>initial distribution</u> of wealth between countries. Alternatively, <u>fiscal policy</u> might be assigned to the control of <u>average Money GDP.</u> Advocates of the target zones proposal did not explicitly state the reasons for preferring the choice of monetary policy. Fiscal targeting might look undesirable to many in the economic profession (and to governments as well) as a renaissance of old fashioned keynesian "fine tuning". But now it should be clear that if policy coordination is to be implemented and exchange rate fluctuations are too costly, some sort of fiscal intervention is necessary anyway for reducing national imbalances.

EXPLORING ALTERNATIVE POLICY RULES

Policy coordination under rules alternative to the EMW proposal involves active use of real interest rate differentials and activation of real exchange rate dynamics. Obviously this might reproduce those real exchange rate misalignments that the EMW proposal aims to avoid. Having shown that real exchange rate stability cannot be achieved without cost and that this cost might turn out to be quite substantial, in this section we shall try to find out to what extent misalignments are inevitable if countries coordinate and yet allow real interest rates differentials occur.

4. THE "MONETARIST" ALTERNATIVE

The standard alternative to a target zones approach is the assignment of real interest rate differentials to differences of the growth rate of national money GDP. We label it as "monetarist" (although it departs from the standard monetarist orthodoxy by setting a closed loop rule) because it is restricted to the use of <u>monetary policy</u> only and completely overlooks fiscal policy as a viable instrument for stabilization purpose. EMW discuss this case and show that real exchange rate misalignments occur. Also, early gains in inflation control, brought in by the initial exchange rate appreciation, are reversed later, when the terms of trade move back into equilibrium. We have replicated the EMW experiment appending the current account equation to the model. Our results show that when the two countries exhibit a <u>low</u> degree of interdependence world interest rates fluctuations actually cause the global system to become <u>completely unstable</u>. If interdependence is <u>high</u> the model regains stability but exhibits <u>prolonged persistence.</u> Due to the stronger terms of trade effect on aggregate demand, exchange rate fluctuations are greatly dampened if compared with the EMW experiment, but <u>huge swings</u> occur in the stock of foreign wealth, fluctuating in a range of <u>±15% when F* is different from 0</u>. After 60 periods wealth is still significantly away from equilibrium. It is well known (Kouri,1976, Dornbusch e Fischer,1981) that wealth effects in domestic expenditure provide an endogenous correction mechanism for disequilibrium in the international distribution of foreign wealth; unfortunately they seem to be too <u>weak</u> to effectively dampen current account fluctuations. This raises the issue, long debated in the past, of the need for active fiscal policy as part of a system which ensures external equilibrium. It is to that issue which we now turn.

5. POLICIES FOR INTERNAL AND EXTERNAL EQUILIBRIUM

Under this set of rules, defined in table 3 as the "Meade" assignment, active use is made of monetary policy in controlling money GDP differences, while national fiscal policy stances control international wealth distribution.(eq.16,17,18) Fiscal policy gradually adjusts over time to current account deviations from equilibrium. This implies that at any point in time s is targeted on F.

Although we do not impose integral control of foreign wealth, no permanent change of F can occur. In equilibrium $y_d = 0$; $dc = 0$; $dF = 0$. For exchange rate dynamics to be nil $r_d = 0$. Since s_d is a linear function of F, $c = F = 0$ is the only combination of wealth and the exchange rate which ensures current account equilibrium when output is at the "natural rate" in both countries.

Intuitively, the working of this policy assignment can be described as follows. Reduction of national differences in the inflation rate requires a positive differential between domestic and foreign real interest rates. This, in turn, triggers an immediate appreciation of the real exchange rate. Inflation differentials are affected in two ways. The terms of trade appreciation brings in early gains, to be reversed later when the exchange rate depreciates moving back towards equilibrium. Higher interest rates and a worsened level of competitiveness depress demand for domestic goods and slow down the pace of wage inflation. Abstracting from the effect of world interest rates fluctuations on wealth accumulation, as long as the loss of competitiveness cuts down net exports more than the higher real interest rates reduce imports the current account turns into a deficit.[5] This triggers a contractionary fiscal policy stance, thereby causing further downward pressure on wage inflation.

5The plausible parameter values which we use imply this outcome

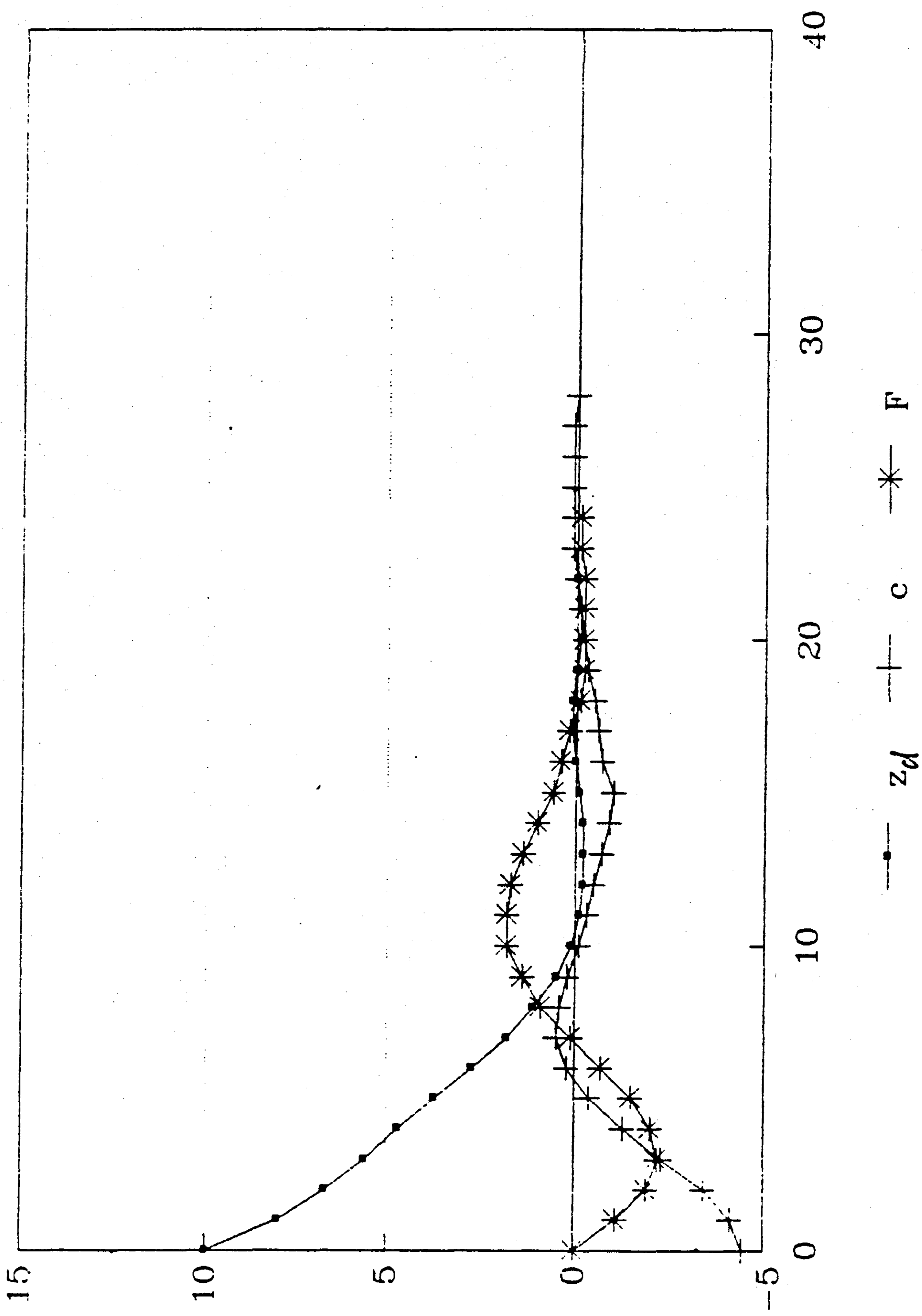
5.1. CONTROL OF NATIONAL DIFFERENCES

We begin with analysis analogous to that in section 3.2, so as to explore our results in stages. Thus we first assume that a shock affects inflation differences only, so that world monetary policy is not activated. The current account equation becomes:

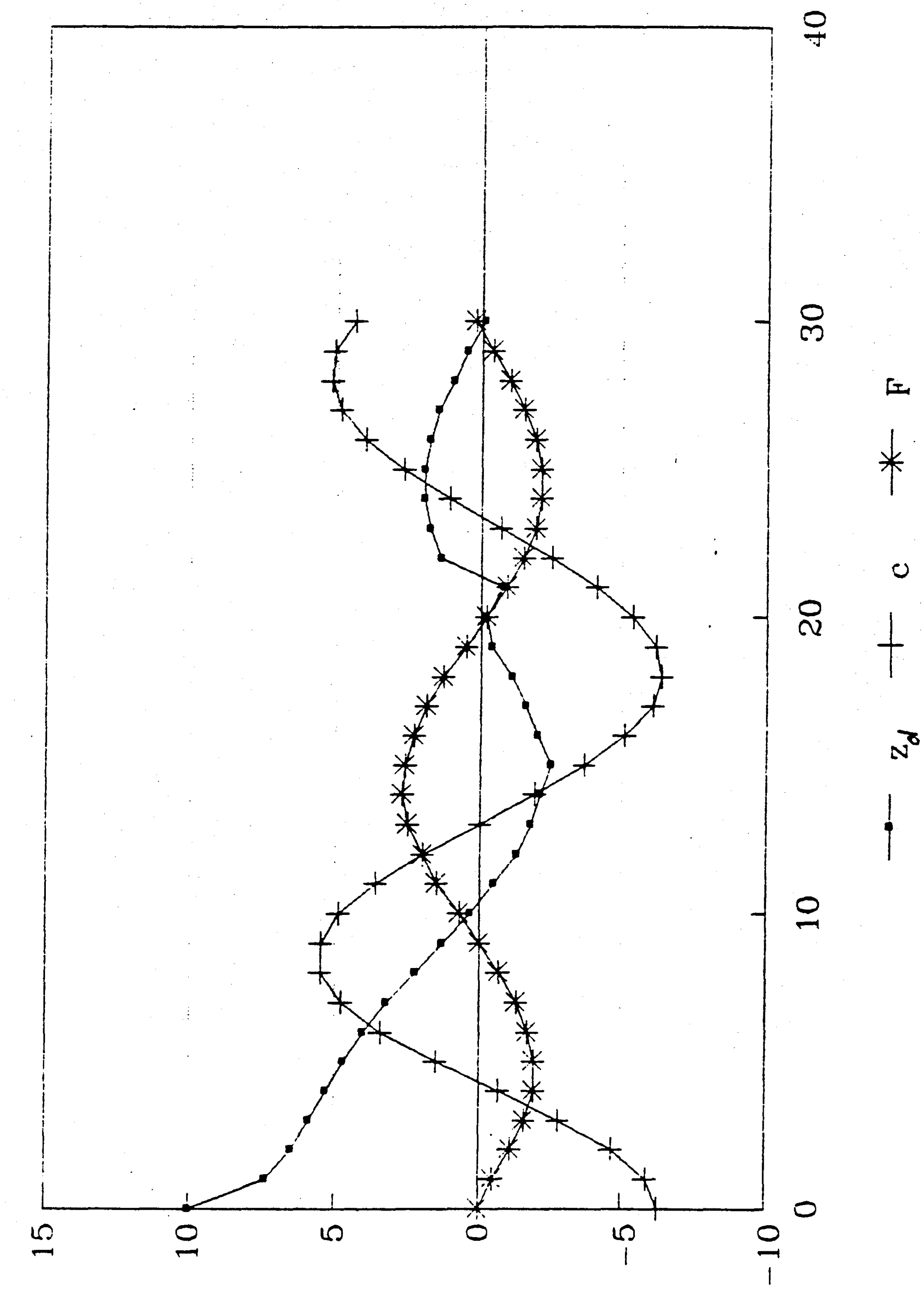
$$dF = 2\tau_1 c - \tau_2 y_d - F^* 0.5 r_d + r^* F$$

$-0.5r_d$ represents the change in the foreign real interest rate required for control of money GDP targets. With low interdependence and $-0.5 \le F^* \le 0$ the real exchange rate jump is about -7% to be absorbed rather quickly.(tab.6) After 7 periods deviation from equilibrium is below 1%, since then c fluctuates in a band of approximately ±2%. The initial terms of trade appreciation has a favourable impact on inflation at the cost of slightly higher persistence later on. The output cycle is dampened if compared with the corresponding results obtained in section 3.2. Domestic holdings of foreign assets fluctuate in a band whose maximum range is ±1.5%. When $0 < F^* \le +0.5$ the initial exchange rate path keeps a lower profile at the cost of wider positive deviations from equilibrium

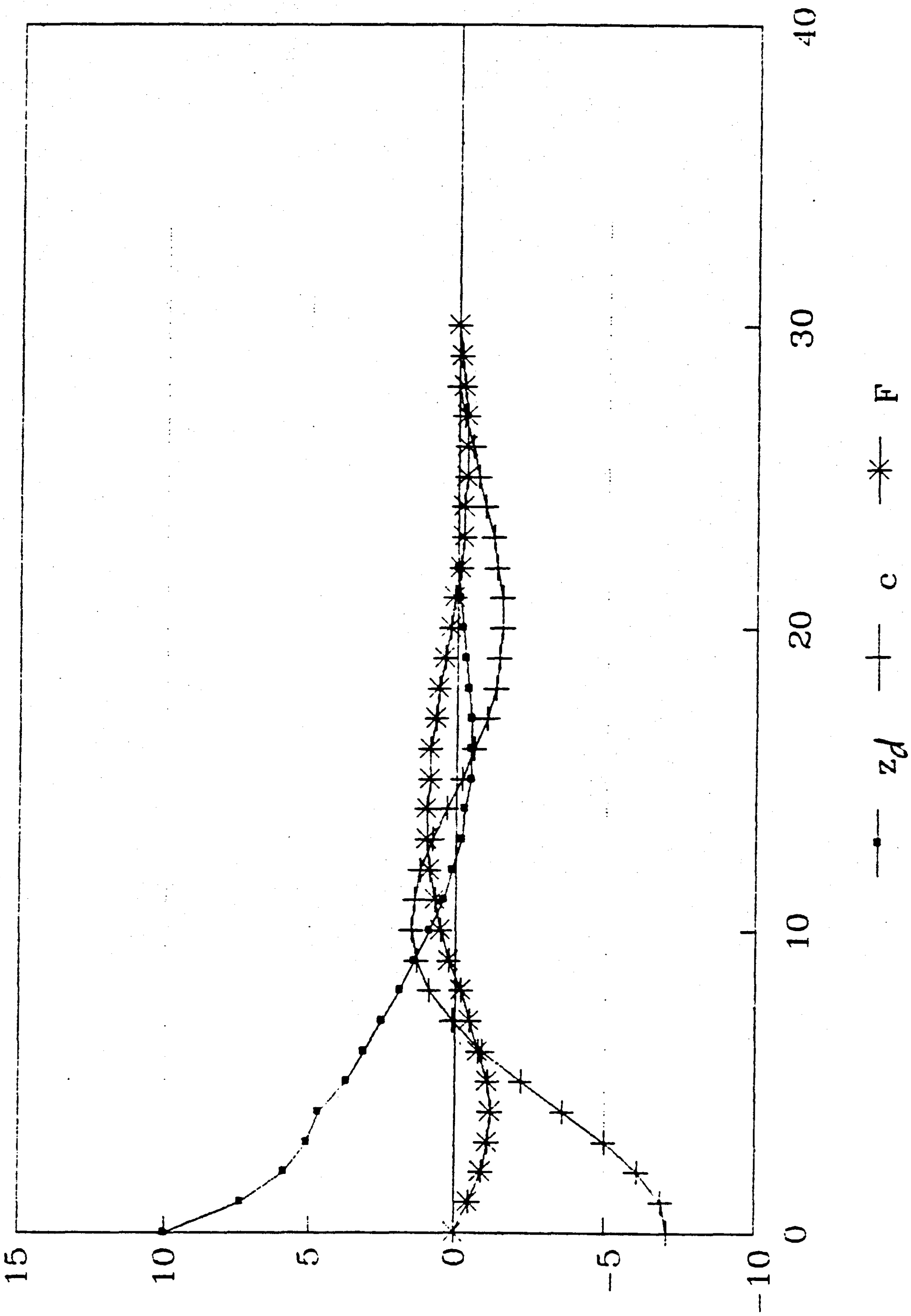
"MEADE" POLICY ASSIGNMENT
F* = 0.3 HIGH INTERD., DIFFERENCES ONLY



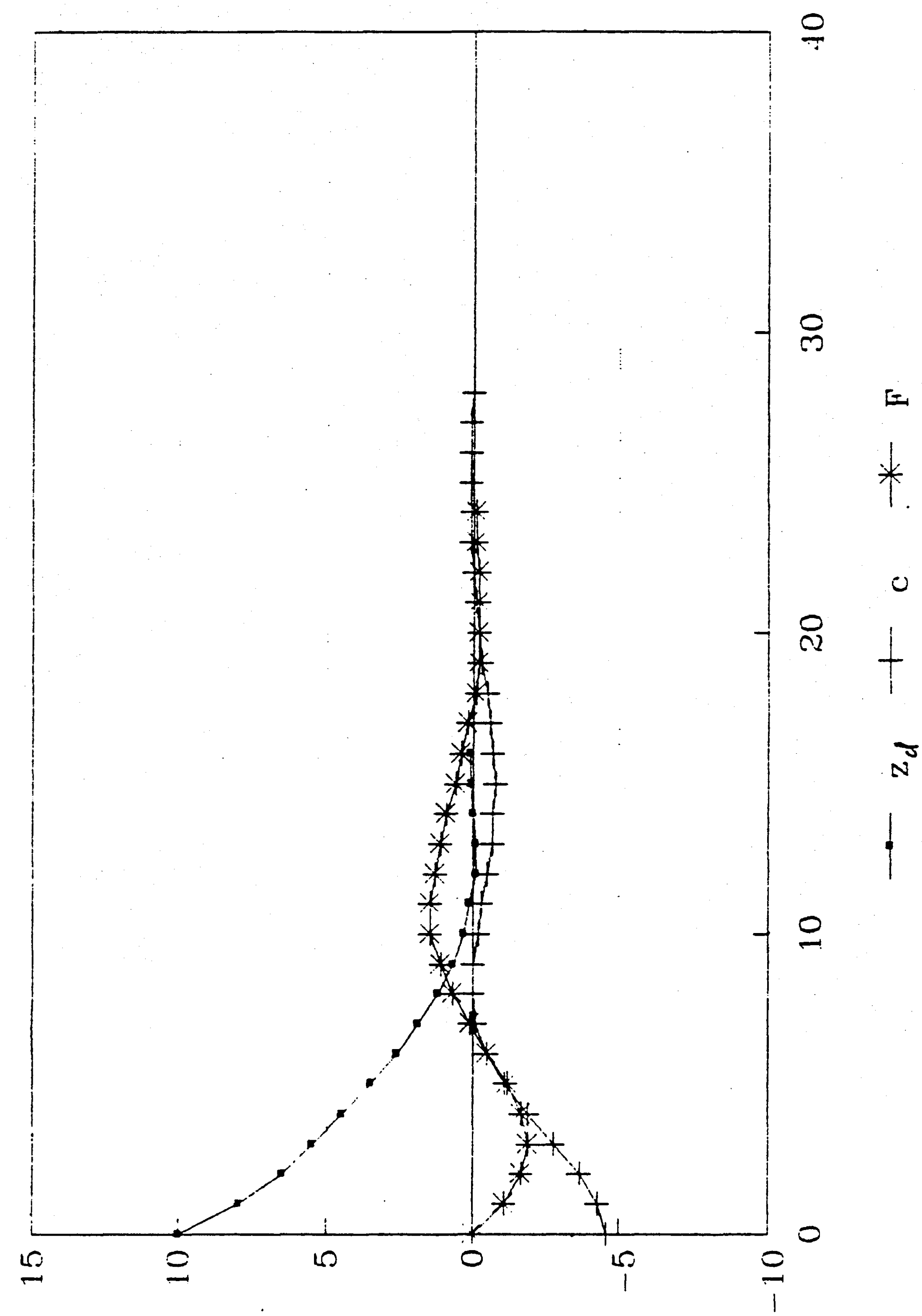
"MEADE" POLICY ASSIGNMENT
F* = +0.3 LOW INTERD., DIFFERENCES ONLY



"MEADE" POLICY ASSIGNMENT
F* =-0.3 LOW INTERD., DIFFERENCES ONLY



"MEADE" POLICY ASSIGNMENT
F* =-0.3 HIGH INTERD., DIFFERENCES ONLY



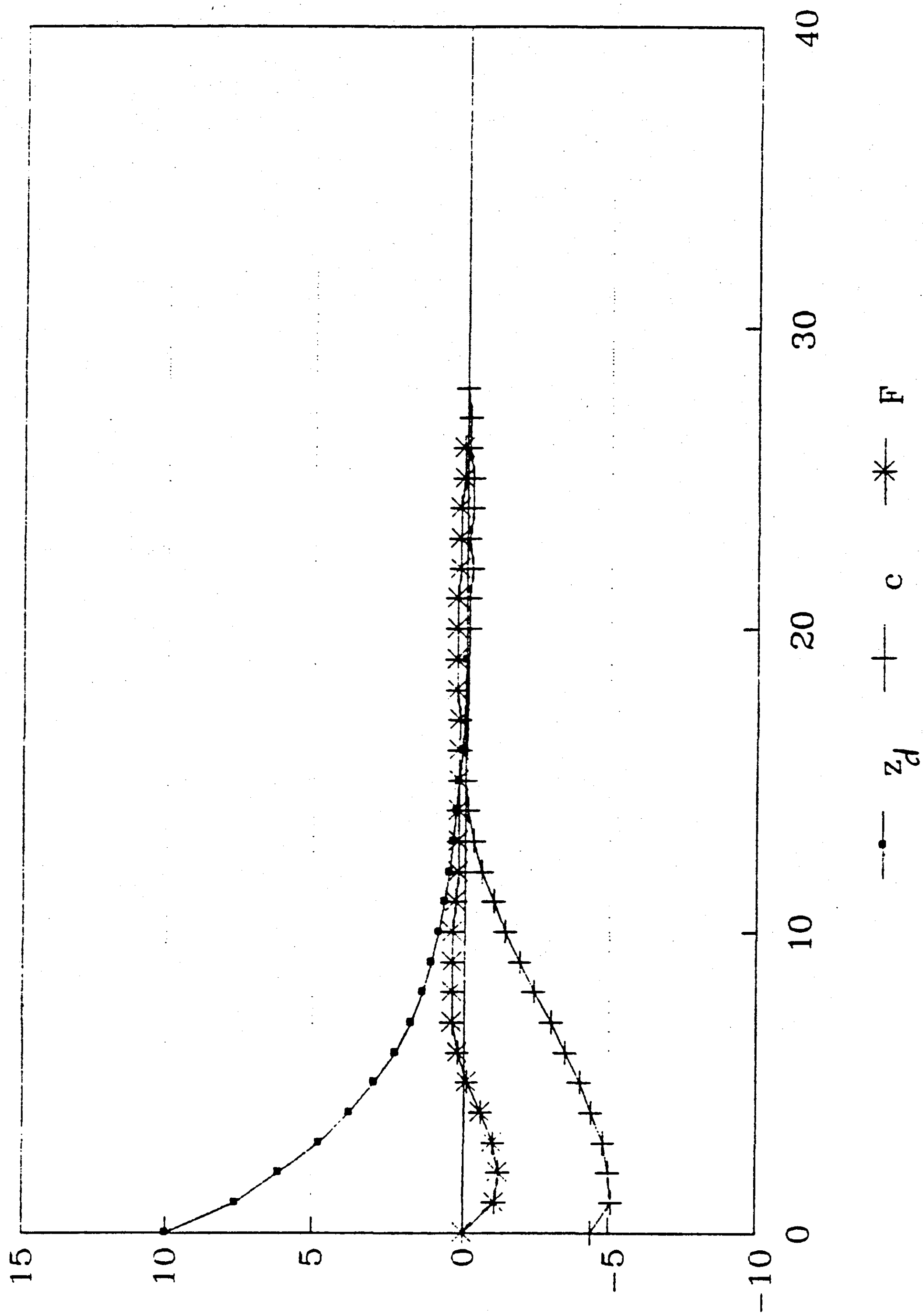
later on. If F* is positive the fall of foreign real interest rates worsens the current account and requires a stronger fiscal contraction, which will have to be more prolonged the weaker the income elasticity of the trade balance. At the later stage of the cycle the stronger fiscal control will exert an excessively contractionary effect on money GDP growth, to be compensated by a negative interest rate differential, which triggers a real exchange rate depreciation. Obviously, the <u>less effective</u> is fiscal policy on the current account the more <u>prolonged and complex</u> the output cycle. In fact simulations of the "high" interdependence model show that if $\tau_2\theta$ is strong enough the effect of r_f on the current account has a very limited influence on the overall dynamic performance of the model. In this case the initial exchange rate appreciation is substantially reduced and terms of trade fluctuations occur in a much narrower band. Also, <u>the pattern of the exchange rate cycle does not seem to be significantly affected by the sign and magnitude of F*.</u>

5.2. SIMULATING THE FULL MODEL

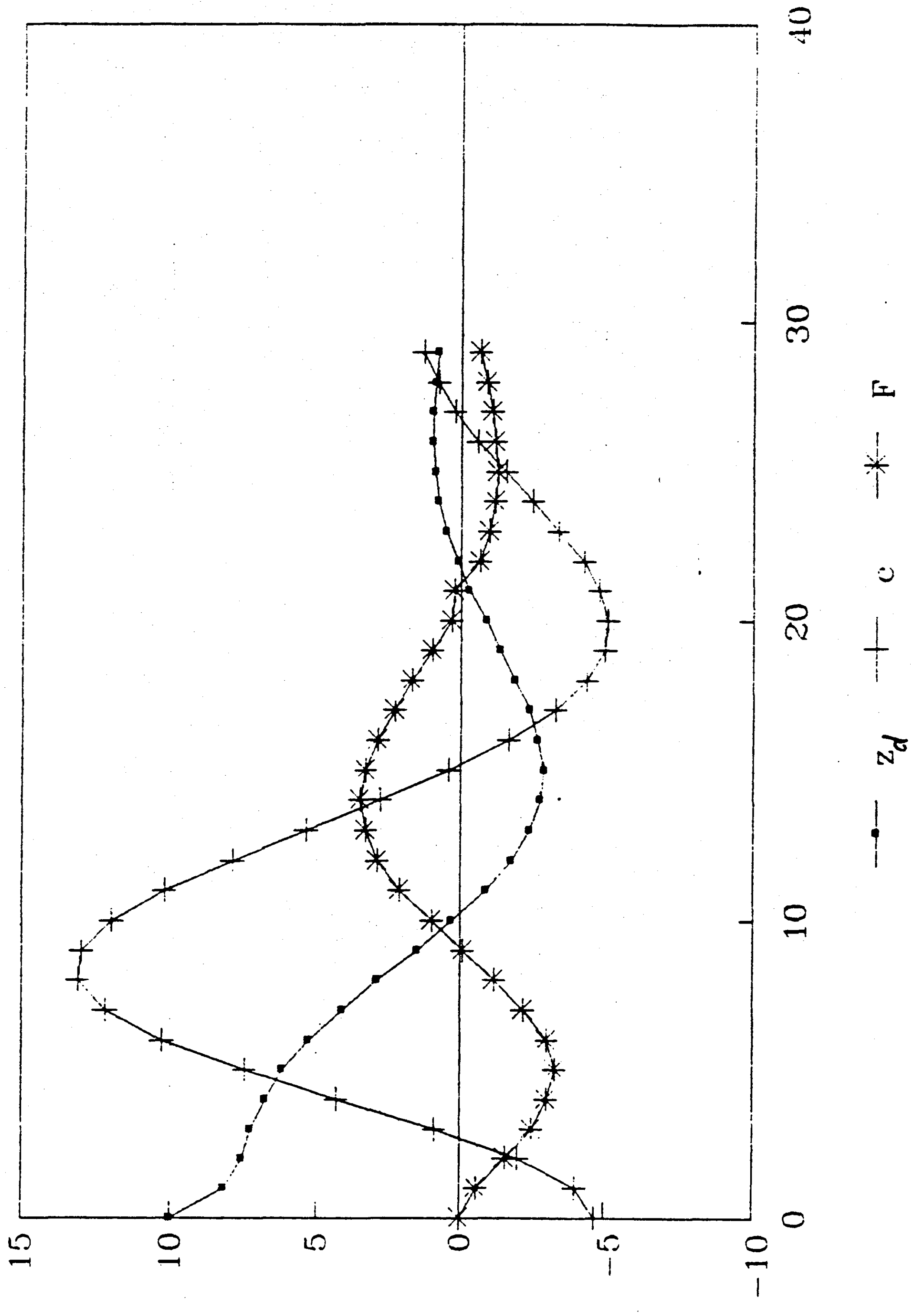
Now we turn to a full analysis of the model, considering the implications of monetary control of average inflation. As in section 3.3 we assume that both average and differential inflation are initially set at 10%. Once the effect of world monetary policy on the current account is brought into the picture and interdependence between countries is low fluctuations become much wider than those analyzed in section 5.1. Wealth control by means of fiscal policy avoids the danger of instability[5] but is not very effective in limiting fluctuations[6]. Both the exchange rate and foreign wealth exhibit huge swings. When $-0,5<F^*\leq-0.1$ higher world interest rates during the first eight years cause a redistribution of wealth from the home to the foreign economy ranging between 9% and 2%. The loss of foreign wealth requires a prolonged fiscal contraction that will affect the current account only gradually over time, complicating the task of monetary policy: the restrictive fiscal policy will have to be compensated by negative interest rates differentials and exchange rate depreciation in order to keep money

6Except that for a very large value of F

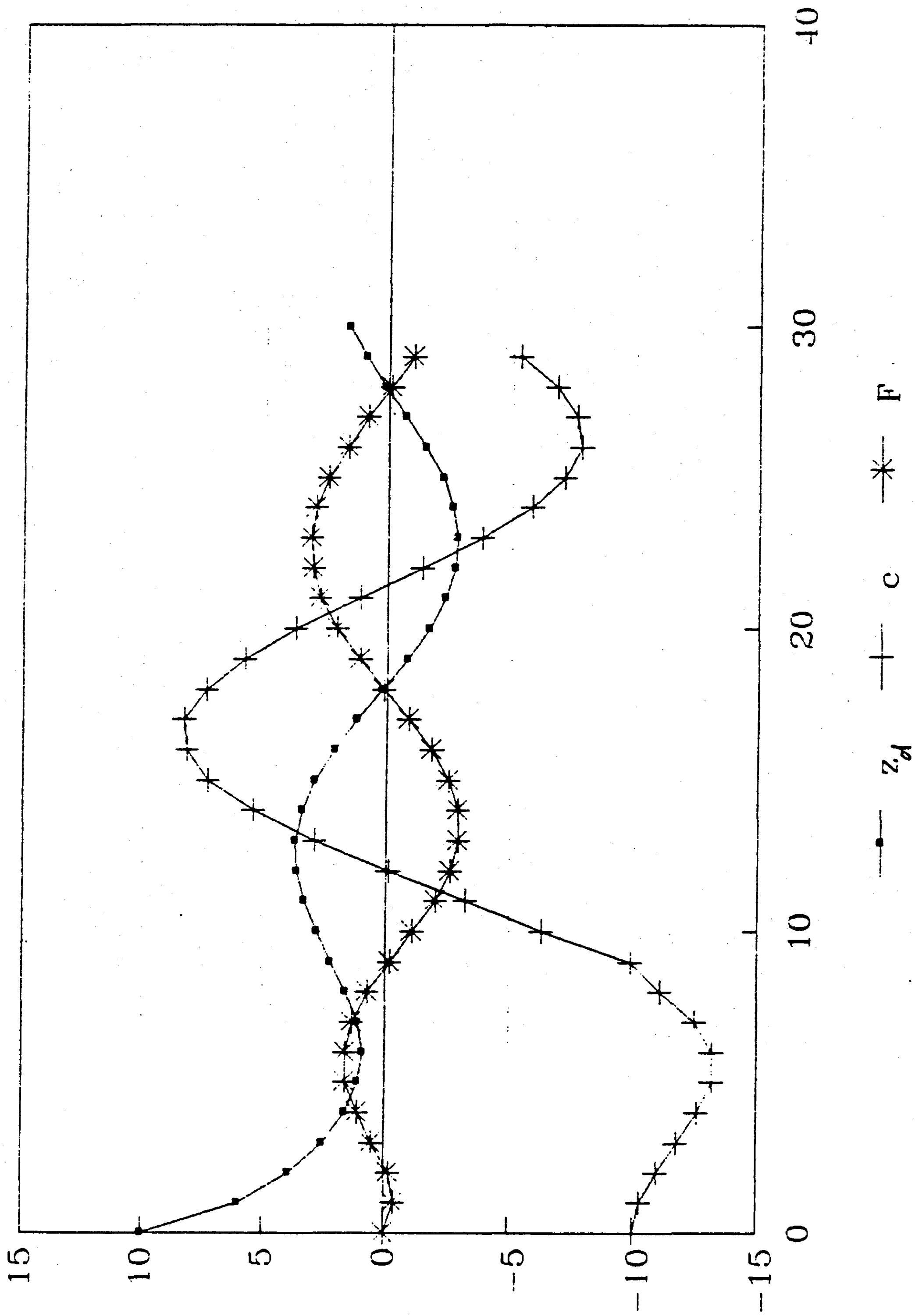
"MEADE" POLICY ASSIGNMENT
F* = 0.3 HIGH INTERD., FULL MODEL



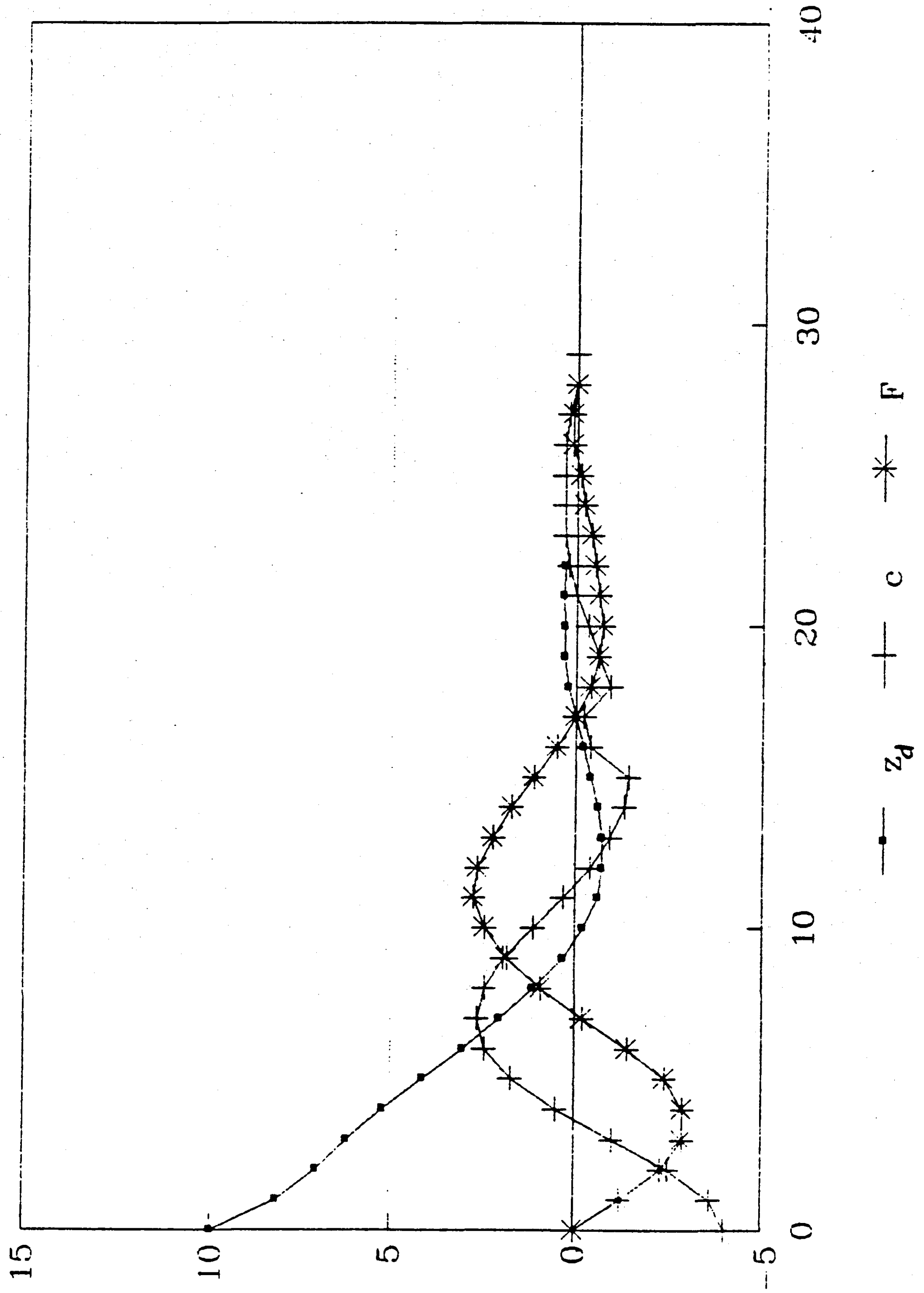
"MEADE" POLICY ASSIGNMENT
F* = 0.3 LOW INTERD., FULL MODEL



"MEADE" POLICY ASSIGNMENT
F* = -0.3 LOW INTERD., FULL MODEL



"MEADE" POLICY ASSIGNMENT
F* = -0.3 HIGH INTERD., FULL MODEL



GDP close to its target. Dynamics follows the pattern discussed above, when the effects of world monetary policy were not taken into account, but fluctuations at the later stage of the cycle are much wider. When $0.1<F^*\leq 0.5$ the surge of world real interest rates has a strong positive effect on the home economy's current account. In spite of the strong initial loss of competitiveness the current account is driven into a surplus, forcing fiscal stance to be expansionary. Terms of trade must depreciate further before reverting into equilibrium. For a higher degree of interdependence, exchange rate fluctuations are far less wide. Although similar in the pattern, the terms of trade cycle is substantially dampened. This partly because relative prices exert a more powerful influence on the trade balance, partly because fiscal policy stance is more effective in controlling financial wealth. Therefore world real interest rates fluctuations have a lower impact on the current account: dynamic adjustment becomes far more satisfactory.

5.3. SUMMARIZING REMARKS

The policy assignment presented in this section exhibits a dynamic pattern for output and inflation which only marginally differs from the results obtained under the target zones regime. And yet both permanent wealth transfers between the two economies and permanent real exchange rate adjustments are completely avoided. By contrast with EMW, the model exhibits something of an exchange rate cycle. And although permanent redistribution of wealth is avoided, something of a cycle appears necessary in wealth, too, as the model converges towards the long run. One can say something whether these cycles are likely to be large or small.

When world monetary policy is not activated, as in section 5.1, the amplitude of current account swings is rather limited whatever the degree of interdependence between the two countries. Also, if the price and income elasticities of the trade balance are high the real exchange rate cycle is substantially dampened, in this case for another reason.

When world monetary policy is activated, as in section 5.2, then this interferes with the reduction of national imbalances by redistributing financial wealth (a point already familiar from our analysis of EMW). If the degree of interdependence is low, huge current account and real exchange rate fluctuations can now occur. Also, the pattern of these swings varies according to the initial distribution of foreign wealth. If the degree of interdependence is high, these world real interest rate fluctuations have a limited extra effect on wealth and terms of trade cycles.

6. CONCLUSIONS

This chapter stresses the consequences that the policy assignment generally associated with the target zones proposal has in terms of international wealth redistribution. In section 3.2 it has been shown, by appending the current account identity to the EMW model, that in their policy assignment the equilibrium exchange rate can no longer be considered exogenous to the disinflationary process. If policy is concerned with a reduction of the underlying core inflation trend, then, in their policy system, a permanent redistribution of wealth between countries must occur. As a consequence, if the current account is to end up in equilibrium, the real exchange rate must adjust in the opposite direction. Another worrying feature of the EMW proposal is that the <u>higher</u> the income elasticity of the trade balance the <u>bigger</u> becomes the necessary wealth redistribution between the two economies. In section 3.3 it has been shown that world interest rates fluctuations may substantially affect the amplitude and the direction of wealth redistribution.

The chapter has constructively tried to suggest an alternative to EMW. As reviewed in section 5, it is possible for disinflation to be achieved <u>without</u> consequential redistribution of wealth. It does however appear difficult to avoid exchange rate and wealth cycles. By considering alternative sets of structural parameters we were able to tell what factors might influence the likely size of these cycles.

More generally, our analysis suggests that the performance of this alternative regime turns out to be quite enhanced if countries are <u>highly interdependent.</u> This is important because in the corresponding case the EMW policy assignment imposes a particularly large redistribution of wealth.

Finally, we turn to the issue of the instability supposedly inherent to international financial markets and to the possibility that speculative "bubbles" occur. The EMW proposal seems designed fundamentally to protect the world against such instabilities and "bubbles". If the risk of "bubbles" is to be considered serious then this might suggest the need for yet another sort of policy coordination which combines the virtues of EMW's exchange rate targeting with the virtues of the new proposals presented in section 5. This would require explicit modelling of some kind of "irrational" behaviour in the formation of exchange rate expectations and explicit targeting of the exchange rate. It is to an analysis of that which I will turn for future work.

CHAPTER 7

CONCLUDING REMARKS

This final chapter briefly reviews the main results of the thesis and outlines future research.

Our original results are presented in chapters 3, 4 and 6. Chapter 3 has presented a model of exchange rate determination which allows for sticky prices, wealth effects and imperfect capital mobility. Our analysis has stressed the danger of instability inherent to an open economy under a monetarist rule. Such risk of instability is shown to occur because the process of wealth accumulation, operating through the current account, is deliberately not controlled under a monetarist regime.

In chapter 4 we have assessed the relative performance of 4 alternative policy assignments which involve simple feedback rules. This is done by means of both algebraic analysis and numerical simulations of a small theoretical model. The rules considered can be described as follows.

Rule 1, a "monetarist" rule, assignes a real interest rate feedback to a nominal income target. Rule 2, which originates from the "Group of Cambridge", working with

Meade, and from Boughton (1989), adds fiscal control of a foreign wealth target to the monetary control of the internal objective. Rule 3 simply reverses the Meade assignment, as it sets fiscal control of domestic nominal income and monetary control of the foreign wealth target. Finally, rule 4 applies in a small country context the kind of assignment advocated in the Target Zones proposal by Williamson: the government is supposed to dispense with monetary policy altogether and to assign fiscal policy to the domestic target. Here, we briefly sketch once more our main original results.

-Rule 1 appears to be prone to the same instability risk highlighted in chapter 3. Furthermore, "real" demand shocks necessarily involve permanent transfers of foreign wealth, whose accumulation/decumulation is deliberately not controlled.

-Rule 4 is effective in controlling the domestic objective and obviously achieves exchange rate stability. By contrast it requires a high degree of fiscal interventism, which governments might find hard to adhere to. Furthermore, we discovered that the reduction of inflation is necessarily associated to a permanent change of the equilibrium real exchange rate and to a permanent transfer of foreign wealth from abroad, so that the home economy improves its net external position at the end of the deflationary process. This appears to be a key difference between a Target zones assignment and the other rules.

-Rule 3 does not seem to perform much better than assignment 4 in controlling the domestic and foreign targets, but at the cost of nonnegligible exchange rate volatility. This might seem counterintuitive, as it involves one additional instrument, monetary policy. This can be easily explained by the limited influence of the monetary instrument on the external position of a country[1].

-Finally, rule two avoids the risk of dynamic instability inherent to a "monetarist" assignment and is very effective in controlling the foreign wealth target. It enjoys the desirable property of requiring a relatively limited degree of fiscal intervention if compared to rule 4. On the other hand it does not avoid exchange rate swings.

Rules 2 and 4 emerge as the most suitable candidates for macroeconomic stabilization policy, and the choice

1This point was forcefully raised by Boughton (1989) and is obviously discussed in great detail in chapter4.

between the two should obviously depend on the relative costs associated to the deviations from equilibrium of the exchange rate and of the fiscal instrument.

In part two of the thesis chapter 6 is the substantive contribution of the thesis to the debate on simple rules and policy coordination. In a two-country setting we have considered a disinflation experiment and we have assessed the relative performance of three alternative proposals, which assign the same instrument to the control of global, or average, inflation, but differ in their strategies of reduction of intercountry inflation differentials. The first rule is the well known Williamson's Target Zones proposal. The second is a standard "monetarist" rule. The third is a two-country version of the Meade assignment.

The "monetarist" rule appears to be prone to instability or at least, in the more favourable case, to wide swings of foreign wealth and the exchange rate. Under the Target Zones regime the interesting result obtained in chapter 4 is confirmed. The reduction of inflation differentials requires a permanent wealth transfer in favour of the "high inflation" country. This wealth transfer may be increased or partially offset according to the external position of the home economy prevailing at the beginning of the policy experiment. This is the obvious consequence of the monetary contraction necessary to curb global inflation: as world real interet rates are increased wealth is transferred from the debtor to the creditor country.

Under the Meade assignment disinflation requires less fiscal intervention than under the former rule. Also, no permanent change of foreign wealth and of the real exchange rate is necessary. But exchange rate fluctuations do occur. Indeed the performance of the rule is highly sensitive to the strength of the trade balance elasticities: it definitely improves when interdependence is higher. The policy performance is unambiguously complicated by the wealth redistribution caused by the fluctuation of world interest rates.

Future research should extend the work done so far in two directions. The first is the assessment of the performance of the simple rules considered here in the context of a model where a broader definition of wealth is taken into account. This will involve the inclusion in the model of both the government budget constraint and of accumulation of "real" capital. An illuminating example of how such a research programme might be carried out has beeen provided by Vines et al. (1989). The second avenue of research I shall be concerned with is the analysis of simple rules in the context of a monetary union, as the ongoing process of european economic integration has brought this issue at the "core" of the debate on stabilization policies for open economies.

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