ABSTRACT

This thesis discusses the macroeconomic implications of the potential full participation of the Portuguese escudo in the European Monetary System (EMS). The thesis is organized in two parts with seven main chapters. The first part - chapters 1 to 4 - makes a number of contributions. Firstly, in chapter 2, we integrate several theoretical arguments which suggest that semi-industrialized countries should not engage in extensive and simultaneous real and financial external liberalisation. This is particularly true if the economy starts from a situation of high inflation, a large fiscal deficit financed by money creation, underdeveloped financial system, high barriers to international trade and stringent capital controls, conditions which describe roughly the state of the Portuguese economy when the country joined the EC in 1986. We also extend the existing literature on balance of payments crisis to study the stabilizing effects of the announcement of a currency band. Secondly, in chapter 3 we estimate income and price elasticities in Portuguese foreign trade. Simulation exercises are carried out in order to compare some of the quantitative consequences of different choices facing the escudo (gradualist vs. immediate ERM-entry). Thirdly, in chapter 4 we measure the degree of real and financial market integration of the Portuguese economy and we advance a systematic study on the role of capital controls in the Portuguese economy. We discuss in detail the nature and extent of the risk premia on escudo denominated assets. In the second part of this thesis - chapters 5 to 7 - we assume that the current account has been successfully liberalised and that the fundamental factors behind the inflationary process (budget deficits and money printing) have been corrected. In this part our contribution is as follows. In chapter 5 we discuss the macroeconomic incentives that governments might have in "tying their hands" during a disinflationary process. We suggest that if the output costs of disinflation are to be minimized ERM-participation in itself cannot be a substitute for other measures directed at alleviating product and labour market distortions. In chapter 6 we look at the experience of disinflation in the 1980s in some selected countries. Our own analysis and the conclusions drawn from a critical survey of the literature suggest that the reputational effects of ERM-membership might be less important or at least more difficult to realise than the theoretical literature on credibility effects suggests. In chapter 7, we study the recent experience of costless disinflation in Portugal (1985-87). We find evidence that supports the idea that a decisive turn-around in expectations occurred in Portugal in 1987 and this could be the reason why the disinflation was costless. Such a change in expectations coincided with the beginning of the implementation of an incomes policy explicitly directed at breaking inertial inflation and can be seen as a measure of the success of that policy. We also argue that fundamental more than reputational factors are at the root of the interruption of the disinflationary process in Portugal (1988-89) and that an immediate entry into the ERM would only force the country to discontinue the gradualist approach to disinflation. The policy conclusions are that the soft-ERM option appears to be the second-best choice for Portugal in the early 1990s and that without a fundamental transformation of the economy a cautious approach to financial de-regulation and opening-up is necessary.

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PREFACE

When the Portuguese escudo joined the ERM on April 6, 1992 this thesis was already finished. The political timing of that decision is not surprising as Portugal holds the Presidency of the EC during the first semester of 1992. Indeed, as the Portuguese press remarked that was the only relevant political event announced by the Prime-Minister at the press conference given to assess the first three months of the Portuguese Presidency.

The escudo joined the ERM within the wide band at the ECU central rate of 178.735 (escudo/ECU) which corresponds to the bilateral central rate of 86.94 escudo/DM. As mentioned in chapter 1 of this thesis, from the beginning of 1987 until late 1989 the Portuguese escudo had "shadowed" the ERM within the wide band. After an acceleration of the rate of the crawling-peg (devaluation of the escudo against the DM) at the end of 1989, something which can be seen as equivalent to a realignment of the "shadow" central rate of the escudo, the exchange rate policy of the Portuguese authorities changed significantly. In 1990 the crawling-peg (soft-ERM) was discontinued and until April 1992, when the escudo joined the ERM, the escudo/DM rate had been managed within a narrow band in what came to be known as a period of hard-ERM simulation. Apparently the Portuguese government wanted the escudo to join the ERM from a strong position, preferably near the lower edge of the wide band. This would have limited the expected jump revaluation of the nominal exchange rate at the time of the announcement of the accession to the ERM and would have given the escudo the potential "safety net" of a gradual (12%) depreciation against the DM. However, the central rate agreed for the Portuguese escudo is lower than the rate that the Portuguese authorities had proposed, which was 180 escudos /ECU, and it turned out that the escudo entered the ERM near the central rate. This also means that the escudo has been de facto within the ERM without any realignments since January 1990. When the foreign exchange market reopened on Monday (April 6) after the Friday (April 3) announcement, the escudo came under very strong buying pressure and in spite of the 1% drop in the intervention rate (discount rate) of the Portuguese central bank, the escudo appreciated 1.4% against the DM. The Portuguese central bank had to intervene buying sterling, the weakest currency in the ERM at that time.

Portuguese economists are divided as to whether the escudo joined the ERM at the right time and at the appropriate level. In our opinion the appointment of Braga de Macedo as Minister of Finance after the general election of October 1991[1] was a clear signal that the escudo's entry into the ERM was imminent. In fact the new Minister of Finance had been advocating the escudo's full participation in the EMS since at least 1988. The main argument presented by Braga de Macedo for the escudo's immediate entry into the ERM is that it enhances the credibility of the fight against inflation and thus alleviates the costs of disinflation. This line of argument is discussed in chapters 5 and 6 of this thesis.

It should be noted that the Portuguese government is fully aware of the (potential) consequences for public finances of the decision to join the ERM. In fact, the expansion of public expenditure contemplated in the 1992 budget was accompanied by a sharp increase in VAT which suggests that the government has given its preference for "taxation" over "expenditure reduction" in trying to

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[1] - The (centre-right) Social-Democratic Party led by the Prime-Minister Cavaco Silva won the general election and retained its absolute majority in Parliament.

control the expected accumulation of public debt resulting from the loss of seigniorage, greater reliance on capital markets and increase in real interest rates which are likely to occur as a consequence of the accession into the ERM and the process of financial liberalisation under way. Braga de Macedo has stressed that joining the ERM with fiscal correction is not risky and that domestic financial stability is not threatened. This line of reasoning is discussed in chapter 2 of this thesis.

These are broadly the main arguments of those who think that the time was ripe to join and that the level of the central parity is largely irrelevant.

Before turning to the arguments of the sceptics, it should be mentioned that if the credibility bonus of ERM entry is so important and if the budget of 1992 is already "the tough budget of EMU", it is somewhat puzzling why the Portuguese government did not choose the narrow band of the ERM, a policy choice which, after all, would only be the confirmation of the policy followed after 1990. Thus, and quite paradoxically, the entry of the escudo into the ERM looks more like a relaxation of monetary policy!

The sceptics[2] say that the escudo joined at the wrong time and overvalued. The escudo joined at the wrong time because the inflation rate in Portugal (10% in 1991) is still well above the EC average (5%) and is not yet on a clear downward trend. Besides, the increase in public expenditures and VAT budgeted for 1992 will make the fight against inflation even more difficult. Thus under these circumstances the sceptics dismiss the relevance of the credibility

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[2] - We chose Alfredo Sousa's article "Escudo, mistificações e economia real", Valor, No. 23, 10/4/92, pp. 12-14, as representative of the sceptical's view. A. Sousa is currently Professor of Economics at the Faculty of Economics of the New University of Lisbon.

bonus and stress instead the sluggishness of the inflation process and the perverse policy-mix chosen by the authorities. The escudo is overvalued because of the sharp loss in competitiveness which occurred after 1990: the real appreciation of the escudo contributed to the stagnation of exports (zero growth rate in 1991) and the import boom of consumption goods (25% growth in 1991). Thus, the sceptics fear the squeeze of the tradables sector that might result from the actual level of the nominal (real) exchange rate and the expected future real appreciation of the escudo. The inevitable consequence will be a deceleration of the real growth of the Portuguese economy. This line of reasoning is discussed in chapter 3 of this thesis.

There is now great economic pressure for the total dismantling of capital controls in Portugal. The authorities want to keep nominal and real interest rates in Portugal above the EC level in order to keep the growth of aggregate demand in check and curb inflationary pressures. However, with virtually no exchange rate risk premium and with the expectation of the escudo's real exchange rate appreciation, the recent (post 1987) large short-term speculative capital flows into Portugal will continue and the escudo will remain "strong" within the ERM. Thus, there is now a renewed downward pressure on domestic interest rates even with the continuous sterilization of capital inflows and/or some form of taxation or other barriers to the free mobility of capital. Indeed, an immediate and full opening up of the capital account would speed up the convergence of domestic short-term nominal interest rates towards the EC average level. However, the convergence in nominal interest rates would tend to dry up the speculative inflows of capital. This would allow the fundamentals (inflation differentials, productivity growth, current account and foreign direct investment) to play a greater role in exchange rate determination and would almost certainly drive the escudo towards the upper edge of the band.[3]

The sceptics welcome this pressure to reduce real and nominal interest rates.[4] However they argue that by joining the ERM in April 1992, the reduction in nominal and real interest rates will prove unsustainable in the medium run. They fear that with a sharp widening of the trade deficit, flows of long-term capital (foreign direct investment) and EC transfers into Portugal will not be sufficient to sustain the central parity of the escudo. Then, with a largely overvalued escudo, only a relatively high level of real interest rates will attract the needed (equilibrating) short-term capital inflows. Furthermore, the sceptics fear that the reduction in the real growth rate of the Portuguese economy and the sharp loss in competitiveness might reduce the inflow of foreign direct investment thus increasing the potential pressure on the escudo and domestic interest rates. The sceptics say that the decline in real and nominal interest rates in Portugal is desirable and certainly feasible without an immediate ERM entry.

Those who think that the time was ripe to join either tend to dismiss the trade balance effects of the loss in competitiveness or believe that they will not occur because the fiscal correction undertaken and the credibility of the ERM commitment will generate a swift fall in the rate of inflation. The issues raised by this debate are tackled in chapters 4, 5 and 6 of this thesis. The role of capital controls and the Portuguese experience with capital

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[3] - We mean a level depreciated relative to the central rate.

[4] - When the escudo joined the ERM the domestic nominal long-term lending rate was 23% and the rate of inflation 10%.

controls is discussed in chapter 4. The path of competitiveness and real interest rates during a disinflationary process, under different disinflationary strategies, is discussed in chapters 5 and 6.

The Portuguese authorities have been emphasizing the need for a coordinated fall in the growth of wages and prices. Just before the decision to join the ERM was announced, government, trade unions and employer's syndicates agreed on a 10.5% ceiling on (contractual) nominal wage increases for 1992. This ceiling is well above the level initially proposed by the authorities which was 8% in line with the (announced) expected rate of inflation for 1992 (8%). The negotiations under the Conselho Permanente de Concertação Social (institutional framework for price and wage bargaining) were very tough and the CGTP, the most influential trade union, did not sign the agreement.[5] Some economists (sceptics and non-sceptics alike) believe that with the modest productivity growth of recent years (1-2%) a decisive and sustained fall in the rate of inflation cannot be achieved unless nominal wage growth is reduced to 4-5%. How this can be attained under full employment[6] and high levels of public expenditure and taxation is not clear. The role of incomes policy in a disinflation is discussed in chapter 5 and the recent costless disinflationary experience in Portugal (1985-1987) is discussed in chapter 7.

For the reasons discussed in this thesis we think that an early accession of the escudo into the ERM, say, for example, in 1986 or

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[5] - The most influential trade union, in particular among "blue collar" workers, is the Confederação Geral dos Trabalhadores Portugueses (CGTP) which is led by the communists. The other trade union which is led by socialists and social-democrats is the União Geral de Trabalhadores (UGT). The UGT which signed the agreement is more influential among "white collar" workers.

[6] - Full employment here means rate of unemployment below NAIRU.

1987, would have been a serious policy error. Although we would have preferred the escudo to join somewhat later (reputational factors are not at the root of the present problems of the Portuguese economy) the main question is not the timing of ERM entry but instead the policy-mix that the authorities have been following since 1990 (primary deficits, fixed exchange rates and high real interest rates). We think that the policy-mix followed during the 1987-89 period (primary surpluses, crawling-peg and moderate real interest rates) would have been preferable to the actual policy-mix. We think that a substantial deceleration of the real growth of the Portuguese economy is now almost inevitable.

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INTRODUCTION

This thesis discusses the macroeconomic implications of the potential full participation of the Portuguese escudo in the European Monetary System (EMS). Before outlining the specific contributions of this thesis, it is as well to set out briefly the nature of the institutional changes that are envisaged in the EMS with reference to the Delors plan for Economic and Monetary Union (EMU).[1]

Stage 1 of EMU, which started in July 1990, implies joining the exchange rate mechanism of the EMS (ERM) within narrow bands and the full liberalisation of capital movements. As has recently been set out, stage 2 of EMU should start in January 1994. During this stage bilateral exchange rates of the participating countries will remain within very narrow bands, like those of the first years of the Bretton-Woods era; realignments will be in practice ruled out; and monetary and exchange rate policy of the participating countries will be coordinated within the framework of a quasi-federal system of central banks. At that stage, the European single market for goods, labour and services is expected to be already fully established. Stage 3 involves full monetary union and eventually a single currency.

At the time of writing, the Portuguese escudo is not yet a full member of the EMS and Portugal has been given a transitional period, until 1995, for the total removal of capital controls and full integration in the EC. However, the escudo has been "shadowing" the ERM since 1987, and the liberalisation process implied by the completion of the European internal market has already fostered impor-

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1 - Delors, J. et al. (1989) - Report on EMU, EEC Committee for the study of EMU, Brussels.

tant structural changes in the Portuguese economy. In particular, the domestic financial system has been de-regulated in several important ways and foreign exchange controls have been relaxed.

In this thesis we attempt to explain why the challenge of joining the ERM for Portugal is a major one. The thesis is organized in two parts with seven main chapters.

In the first part - chapters 1 to 4 - we suggest caution in moving too quickly towards full liberalisation of the capital account (short-term capital) and irrevocable fixing the level of the exchange rate. We argue that "ERM-shadowing" appears to be the second-best option for Portugal in the late 1980s and early 1990s. This option has a sound theoretical basis (explained in chapters 2 and 3) and relies also on the previous 1979-89 experience of the ERM (reviewed in chapter 1) which suggests that the width of the fluctuation band, occasional realignments and capital controls played an important role in the success of the arrangement.

This part of the thesis makes a number of contributions. Firstly, in chapter 2 we integrate several theoretical arguments which suggest that semi-industrialized (or developing) countries should not engage in extensive and simultaneous real and financial external liberalisation. This is particularly true if the economy starts from a situation of high inflation, a large fiscal deficit financed by money creation, underdeveloped financial system, high barriers to international trade and stringent capital controls, conditions which describe roughly the state of the Portuguese economy when the country joined the EC in 1986. Although the existing literature on the EMS emphasizes the link between fiscal correction and the credibility of the fixed exchange rate commitment, it overlooks the arguments for the sequencing of liberalisation which we believe are most relevant for Portugal. It is also argued that under these circumstances pegging the exchange rate will bring more trouble, as the domestic currency becomes the target of speculators, and that it is preferable to announce a currency band. Here we extend the existing literature on balance of payments crisis to study the stabilizing effects of the announcement of a currency band.

Secondly, in chapter 3 we advance the first systematic study on income and price elasticities in Portuguese foreign trade. The estimation of price elasticities allow us to quantify the effects of exchange rate changes on the trade balance, including the J-curve effect. The estimation of income elasticities allows us to emphasize the need for structural change in the pattern of Portuguese external trade. Using the estimated trade model, simulation exercises are carried out in order to compare some of the quantitative consequences of different choices facing the escudo (gradualist _vs._ immediate ERM-entry).

Thirdly, in chapter 4 we measure the degree of real and financial market integration of the Portuguese economy and we advance the first systematic study on the role of capital controls in insulating the Portuguese economy from the full strength of speculative attacks. In particular, we discuss in detail the nature and extent of the risk premia on escudo denominated assets.

The analysis presented in chapters 3 and 4 shows that Portugal joined the EC in 1986 against the background of 15 years of "stop-go" policies, competitiveness targeting and political instability, and highlights a number of concerns as to the speed and to the extent of the adjustment required for the full participation of the escudo in the ERM, under the conditions set out for Stage 1 of EMU. The "structuralist" analysis presented in chapters 3 and 4 suggests caution in moving too quickly towards full liberalisation without a more fundamental transformation of the economy and, although from a different perspective, confirms the recommendations drawn from the more "public-finance" oriented analysis presented in chapter 2.

In the second part of this thesis - chapters 5 to 7 - we shift the emphasis of our analysis. Here we assume that the current account has been successfully liberalised and that the fundamental factors behind the inflationary process (budget deficits and money printing) have been corrected. In this part our contribution is as follows.

In chapter 5 we discuss the macroeconomic incentives that governments and central bankers might have in "tying their hands" during a disinflationary process. The argument most often referred to in the literature is related to the credibility problem facing a government at the outset of a disinflationary programme. By joining the ERM the government or the central bank of the entrant will benefit from the Bundesbank's reputation of being tough on inflation. The existing literature suggests that much of the incentive to join the ERM is due to the increase in the variability of the real exchange rate which results from accepting the rules of the arrangement. We suggest an alternative view of the incentives to join the ERM with full capital mobility. Firstly, in order to highlight the problem of high real interest rates and real exchange rate appreciation involved in the stabilization of inflation we use a version of Buiter and Miller's (1982) model. This is a model with perfect capital mobility under flexible exchange rates and rational expectations. A special feature of this version of Buiter-Miller's model is that it assumes rational expectations both in asset and labour markets: it turns out that with flexible exchange rates and perfect capital mobility the hypothesis of rational expectations in the labour market is largely inconsequential: disinflation is costly. Secondly, in order to highlight the role of exchange rate pegging and monetization in the stabilization of inflation we extend Buiter-Miller's model to study the transition from a floating exchange rate regime to a fixed exchange rate regime under perfect capital mobility. This is equivalent to a policy of stopping inflation: it turns out that inflation is stabilized immediately and without costs because of the large (unsterilized) capital inflow that occurs at the moment of pegging. However, in the case of pegged rates rational expectations in the labour market play a fundamental role: separate exchange rate and wage targets are incompatible. The incentive to join the ERM is understood because the output costs of disinflation are likely to be lower under an immediate-peg strategy than under a floating regime. We see the hypothesis of rational expectations in labour markets as the outcome of a deliberate incomes policy that eradicates from the economy real wage targeting, lagged indexing and slow adjustment of expectations. This suggests that if the output costs of disinflation are to be minimized ERM-participation in itself cannot be a substitute for other measures directed at alleviating product and labour market distortions.

In chapter 6 we look at the experience of disinflation in the 1980s in some selected countries. The main objective of the chapter is to confront the reputational and credibility hypothesis with the empirical evidence. Our own analysis and the conclusions drawn from a critical survey of the literature suggest that the reputational effects of ERM-membership might be less important or at least more difficult to realise than the theoretical literature on credibility effects suggests. However, the paths of the real exchange rate and real interest rates seem to have influenced the output costs of disinflation (measured by the sacrifice ratio and/or misery index) which tended to be lower under pegged rates (France/franc) than under floating (U.K./sterling). Disinflation under the monetary tightening-floating strategy (U.K./sterling) implied an initial large loss of competitiveness and a higher level of real interest rates, whereas the peg strategy (France/franc) implied a greater stability of competitiveness and a lower level of real interest rates. This could possibly be a justification for ERM participation, independent of any further credibility effects that might arise.

In chapter 7, we advance the first study on the recent experience of costless disinflation in Portugal (1985-87). We find evidence that supports the idea that a decisive turn-around in expectations occurred in Portugal in 1987 and this could be the reason why the disinflation was costless. Such a change in expectations coincided with the beginning of the implementation of an incomes policy explicitly directed at breaking inertial inflation and can be seen as a measure of the success of that policy. However, it might be the case that a virtuous combination of other factors supported the disinflation effort and enhanced the credibility of incomes policy: it can be argued that the gradualist approach to disinflation that was followed and the virtuous monetization that occurred[2] may also have contributed to the elimination of the costs of disinflation. We argue that fundamental more than reputational factors are at the root of the interruption of the disinflationary process in Portugal

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2 - This was due to the partial opening up of the capital account (long-term capital flows).

(1988-89) and that an immediate entry into the ERM would only force the country to discontinue the gradualist approach to disinflation.

Finally, although our thesis is exclusively oriented towards the discussion of the Portuguese case we think that it has a wider scope of application. Both the theoretical synthesis developed and the empirical analysis carried out can be applied and/or extended to study the cases of other countries of Southern Europe, namely Greece and Spain, and to the cases of the potential new EC-entrants of Eastern Europe.

CHAPTER 1

The Exchange Rate Mechanism of the European Monetary System: Some Features of Past Experience (1979-1989)

Introduction

The objective of this chapter is to highlight some features of the Exchange Rate Mechanism (ERM) of the European Monetary System (EMS) that we believe are most relevant in so far as the potential accession of the Portuguese escudo to the system is concerned. In the first section we review the institutional aspects and the rules of the ERM. In the second section we review the performance of the system since its inception and in section three we present some theoretical issues that are relevant to an understanding of its performance. A final section offers some conclusions.

1.1 - Institutional aspects of the EMS and the rules of the ERM

The institutional aspects and rules of the EMS and of the ERM and their evolution over time have been described comprehensively and discussed at length in the literature, by, among others, Ypersele (1985).[1] In this chapter, as in the thesis generally, we highlight only those features of the past experience of the ERM that we believe are most relevant in so far as the potential accession of the Portuguese escudo to the system is concerned.

The exchange rate mechanism of the EMS can be described as a system of adjustable bilateral exchange rates. The parity-grid is

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1 - A concise description and discussion of the main aspects can be found in Deutsche Bundesbank (1979, 1987, 1989).

jointly decided by the participants from time to time. It establishes a set of central bilateral rates that is binding, although with some flexibility: the bilateral market rates cannot exceed a margin of fluctuation of ± 2.25% around the central rate (narrow band) or in some special cases ± 6% around the central rate (wide band). When the market exchange rate of any two currencies reaches the margin, the central banks of the corresponding countries are obliged to intervene. The weak (depreciating) currency central bank sells the strong (appreciating) currency and the strong currency central bank buys the weak currency. At the margins intervention is obligatory and unlimited in amount.

Each currency has a central rate expressed in terms of a reference unit of account, the European Currency Unit (ECU). The ECU is a composite unit consisting of specified amounts of the currencies of all European Community (EC) countries. Its composition is reviewed every five years. The initial composition (March 13, 1979) was reviewed on 17 September 1984 and the Greek drachma was included in the ECU basket. In 1989 the Spanish peseta (June 19) and the Portuguese escudo (September 21) were included in the ECU basket. It is worth noting that being a member of the ERM is not a requirement for the currency to be included in the ECU basket.

For a better understanding of what is involved it is useful to formalize the main features of the system. Let $S^{c}_{ej}(t)$ be the central ECU value of currency j at time t. The price of the ECU in units of currency j is $S^{c}_{je}(t) = 1/S^{c}_{ej}(t)$. At time t0, the beginning of the system, the quantity of the currencies in the basket and the central ECU values are commonly decided. The agreement is summarized in the table below where we omit the term (t) for simplicity ($j = 1, 2, \ldots, n$).

Currency	Units of currency	Central ECU value	Weight in the basket
n	a_n	$S^c_{\bullet n}$	$\alpha_n = a_n . S^c_{\bullet n}$
.	.	.	.
.	.	.	.
.	.	.	.
1	a_1	$S^c_{\bullet 1}$	$\alpha_1 = a_1 . S^c_{\bullet 1}$

The weight of the currency (α_j) should reflect the relative importance of the country's economy in the EC in accordance with the shares in intra-European trade, national products and the quotas in the various support mechanisms to be mentioned below. The sum of the weights is unity.

$$\Sigma^n_{j=1}\alpha_j = 1 \qquad (1)$$

The table below provides information on the evolution of the weights of the currencies in the ECU.

Currencies	1979	1984	1989
Belgian and Luxembourg Franc	9.7	8.5	7.9
Danish krone	3.1	2.7	2.45
Deutsche Mark	33.0	32.0	30.1
French Franc	19.8	19.0	19.0
Greek Drachma	–	1.3	0.8
Irish Pound	1.1	1.2	1.1
Italian Lira	9.5	10.2	10.15
Netherlands Guilder	10.5	10.1	9.4
Portuguese Escudo	–	–	0.8
Pound Sterling	13.3	15.0	13.0
Spanish Peseta	–	–	5.3

Source: Deutsche Bundesbank, Monthly Report, various issues.
Discrepancies in the totals are due to rounding.

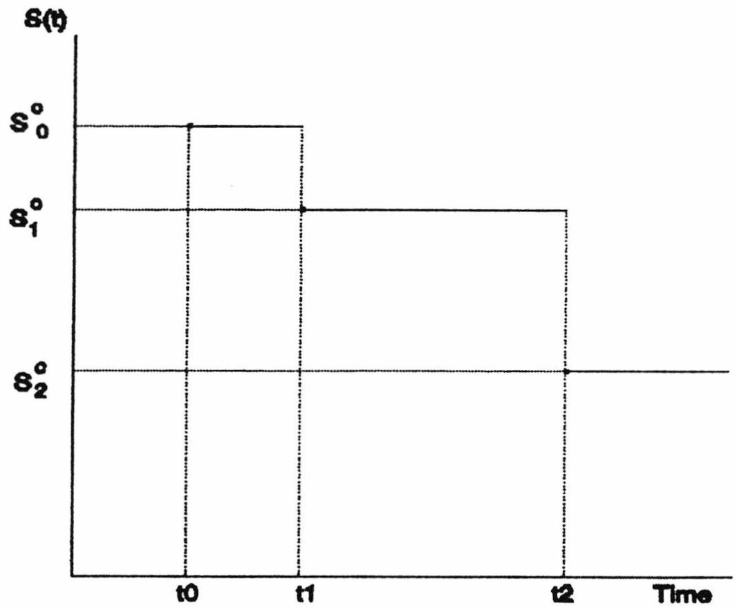
Once $S^c_{\bullet i}(t)$ and $S^c_{\bullet j}(t)$ are decided we must have for any pair of currencies (i,j) :

$$S^c_{ij}(t) = S^c_{\bullet j}(t)/S^c_{\bullet i}(t) \qquad (2)$$

where $S^c_{ij}(t)$ is the bilateral central rate of currency j in units of currency i at time t, which is an ECU cross-rate. We obtain the parity-grid of central rates calculating $S^c_{ij}(t)$ for each pair of currencies in the system. For currencies of EC countries not participating in the ERM a fictitious value is given.[2] The figures below summarize the main elements of the ERM.

In figure 1 we measure on the vertical axis the bilateral central exchange rate for any pair of (i,j) currencies. S^c_0, S^c_1, and S^c_2 are the bilateral central rates decided at time t0, t1 and t2, respectively. The beginning of the system is at t0 and t1 and t2 are realignment moments. Decisions about the magnitude of the change in central rates are commonly agreed which means that the country foresakes some of its policy autonomy.

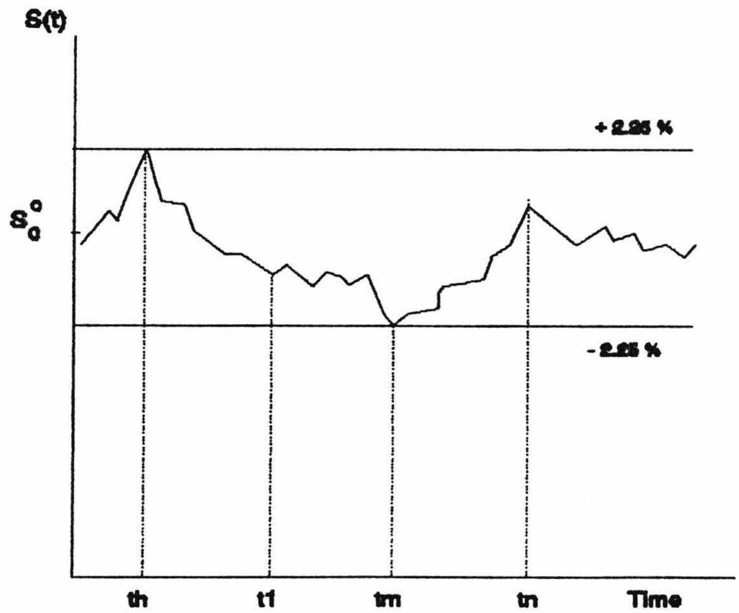
Figure 1 - Bilateral exchange rates, timing and magnitude of realignments in the ERM



2 - For EC currencies not participating in the ERM, ECU central rates and implicit bilateral central parities are given; however, these rates are not genuine because they have not to be defended.

In figure 2 we measure on the vertical axis the market exchange rate for the (i,j) pair of currencies. The market exchange rate is allowed to move within a band around the central bilateral rate - the narrow band if the fluctuation margin is ±2.25% or the wide band if the fluctuation margin is ±6%. At times th and tm the central banks responsable for managing currencies i and j (bank I and bank J respectively) are obliged to intervene in a coordinated way: as already explained, at th, bank I must sell currency j (which is appreciating) and bank J must buy currency i (which is depreciating). The converse occurs at tm. Intramarginal interventions are carried out at tl and tn. These interventions are made, in general, in third currencies and are not coordinated among central banks. Intra-marginal interventions in partner currencies require the partner's consent.

Figure 2 - Fluctuation margins, market exchange rates and intervention points in the ERM



Central banks participating in the ERM may hold partners currencies only as working balances. Thus, to make possible the use of Community currencies for compulsory and unlimited intervention at the margins the countries participating in the ERM arrange mutual credits - Very Short Term Financing Facilities (VSTF). The other financing facilities in the EMS are the Short Term Monetary Support (STMS) and the Medium Term Financial Assistance (MTFA) which are designed to provide finance for transitory and longer term balance of payments needs respectively.

Central banks of EC countries create a stock of ECUs through revolving swap arrangements: they obtain ECUs in exchange for the deposit of 20% of their gold and dollar reserves with the European Monetary Cooperation Fund (EMCF). Dollar and gold holdings are valued at market-related rates.

Spot sales and purchases of ERM participating currencies arising from interventions are debited or credited to central bank's ECU accounts with the EMCF. In this way net creditor and net debtor positions are created. To illustrate how the VSTF works, and how marginal interventions affect the money supplies in the two countries whose currencies have reached the bilateral margin we have adapted an example given by Giavazzi and Giovannini (1989). Consider the situation at time th in figure 2, that is when currency i is weak and j is strong. Bank I, which has to sell currency j, draws on its credit line with bank J resulting in an increase in the liabilities of bank J and in the assets of the bank I. The transaction is recorded in the accounts of the EMCF, which show a liability in relation to bank J and an asset in relation to bank I. Therefore, the transactions produce a monetary expansion in country J and a monetary contraction in country I. These operations can be summarized as follows.

The opening of the credit line by bank J:

Bank I		EMCF		Bank J	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
+x(J) -x(EMCF)		+x (I)	+x (J)	+x(EMCF)	+x (I)

The foreign exchange intervention of bank I:

Bank I

Assets	Liabilities
-x (of i)	-x (counterpart)

Claims and debts arising from such interventions are settled according to certain rules specifying the time and the means of payment as well as the interest rate paid on ECU debtor positions. According to the original rules set up in March 1979 the VSTF balances expire 45 days after the end of the month in which the intervention led to actual payment but may be extended automatically for a period of three months, up to the level of the debtor quota of the respective central bank under the STMS. Liabilities in excess of this ceiling can be renewed but only with the consent of the creditor central bank. The interest rate paid on the balances outstanding is a weighted average of the official discount rates of all Community central banks with the weights of the corresponding currencies included in the ECU basket. For the settlement of balances the debtor central bank must use first balances in the creditor currency which exceed the ceilings laid down for working balances;

second, ECU balances with the EMCF arising from the contribution of official reserves, the creditor central bank not being obliged to accept settlement in ECUs of an amount exceeding 50% of its claim; and third, other foreign exchange reserves (excluding gold). These rules were changed in March 1985 and in September 1987. The direction of change was two-fold: to facilitate the use of the ECU as means of official payment as well as to increase its attractiveness and to allow VSTF of intramarginal interventions, subject to some restrictions.

The changes relating to the ECU can be seen as steps towards the creation of a truly international reserve asset. In particular, under the new arrangements, creditor central banks should accept full repayments in ECUs. However, because interest rates paid on debtor positions in ECUs are in general higher than the level of interest rates in the country of the creditor currency there is still an inducement to settle debtor positions in ECUs by raising the currency of the creditor. This topic and others relating to the development of the official and private use of the ECU will not be discussed in this thesis.[3]

Under the new arrangements the period for settlement of the intervention balances was extended to 75 days and the limit to which it automatically applies was raised up to the double of the debtor's quota. These conditions apply also to the financing of intramarginal interventions, which can now be undertaken via VSTF except when the creditor central bank explicitly objects to it.

The changes relating to the VSTF of intramarginal interventions

3 - A reference for further research in this area is Masera (1987).

have several interesting consequences. Firstly, intramarginal interventions will be increasingly done in ERM currencies rather than in third currencies (i.e. in DM instead of US dollars). Secondly, they will affect directly the monetary conditions of creditor currencies, in particular Germany. Thirdly, they may reduce the incentive to use the short-term flexibility allowed by the fluctuation bands.

The ERM is not a fixed exchange rate arrangement. We may distinguish two kinds of flexibility allowed by the system. In the short-run some flexibility is allowed by the fluctuation margins: a relatively small interest rate differential combined with the width of the band can be used to accommodate a temporary and moderate exchange market pressure. To see why let us consider the implications of uncovered interest rate parity. With risk-neutrality, asset substitutability and perfect capital mobility we must have: $i_I = i_J$ with fixed exchange rates or $i_I - i_J = (\Delta S/S)^e$ with flexible exchange rates, where i_I and i_J are the nominal interest rates in countries I and J respectively, and $(\Delta S/S)^e$ is the expected rate of change (%) of the market exchange rate expressed as the price of j in units of currency i.[4] Suppose that the nominal interest rate in country I (i_I) is above the nominal interest rate in country J (i_J), this difference being consistent, for example, with an expected small and temporary inflation differential between the two countries, $(\Delta S/S)^e = (\pi_I - \pi_J)^e > 0$, lower than the width of the band, where π_I and π_J are the inflation rates in countries I and J respectively. If the market exchange rate slides down towards the lower

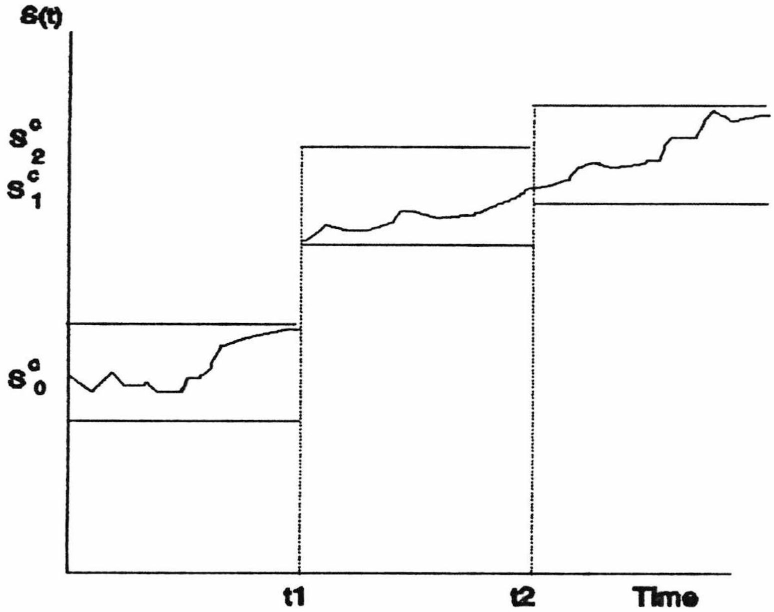
4 - We discuss this further in chapter 4.

intervention margin, as illustrated by the movement from time th to tm in figure 2, this will generate (at tm) the expectation of a future appreciation of currency j keeping asset markets in equilibrium ($i_i - i_j = (\Delta S/S)^e > 0$). The interesting conclusion is that under these circunstances and because of the working of the ERM, the currency of country I, which has a higher inflation rate will appear to be the strong currency, at least in the short-run. However, if the inflation differential is relatively large and/or is expected to persist, the situation described above is unlikely to remain. This brings us to the second kind of flexibility allowed by the system.

In the long-run some flexibility is allowed by the fluctuation margins and realignments, as illustrated in figure 3. There we measure on the vertical axis the market exchange rate for the (i,j) pair of currencies which is allowed to move within the narrow band around the central rate, as explained above. S^c_0, S^c_1, and S^c_2 are the bilateral central rates decided at time t0, t1 and t2, respectively. The beginning of the system is at t0 and t1 and t2 are realignment moments. At t1 the bilateral central rate is readjusted such that the fluctuation bands before and after the realignment do not overlap. We call it a jump realignment, that is when $(\Delta S/S)^c_1 = (S^c_1 - S^c_0)/S^c_0 > 4.5\%$ (12%). At t2 the bilateral central rate is readjusted such that the fluctuation bands before and after the realignment overlap. We call it a crawling-peg realignment, that is when $(\Delta S/S)^c_2 = (S^c_2 - S^c_1)/S^c_1 < 4.5\%$ (12%).

Let us assume that even a relatively small inflation differential between countries I and J generates the expectation that the nominal market exchange rate $S_{ij}(t)$ will follow a long-run upward trend. This could be the case if the market and/or the authorities think that the inflation differential is likely to persist and if continuing deviations from relative purchasing power parity (PPP) are seen as unsustainable or undesirable (misalignments). In that

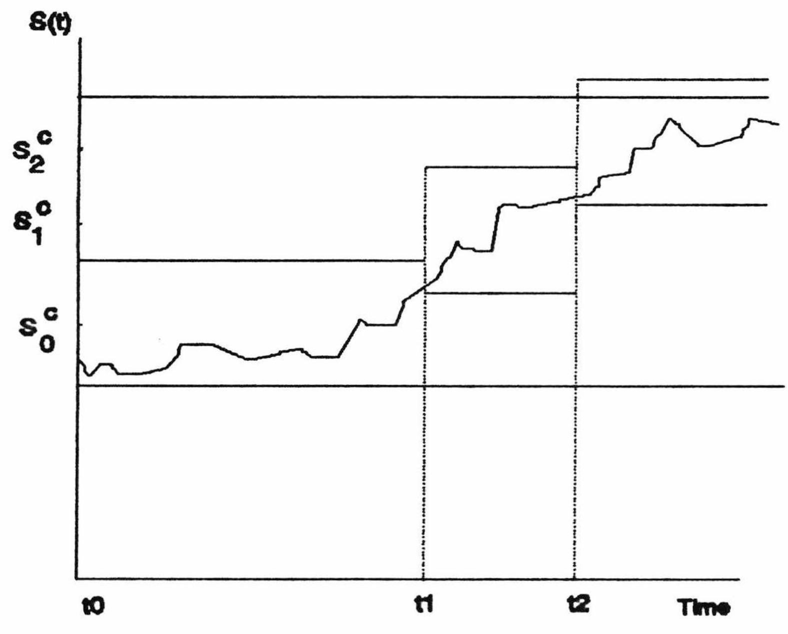
Figure 3 – Patterns of realignments and long-run flexibility in the ERM



case the trend, which will be considered as approximately given by $(\Delta S/S)^{*} \approx (\pi_i - \pi_j)^{*}$ (yearly rate), can be accommodated within the ERM rules if occasional parity realignments are allowed in order to restore (at least partially) relative PPP. For small inflation differentials the pattern of realignments is likely to be one of the crawling-peg type which, by avoiding any discontinuity in the path of the market exchange rate may contibute to avert giving speculators a profitable one-way option.

The same reasoning can be applied to the case of persistent inflation differentials, as long as they are not too large and the currency is allowed to slide within the wide band. The advantage of keeping the currency within a wider band when the yearly inflation differential is larger than 4.5% and realignments are costly, is illustrated in figure 4. On the vertical axis we measure the market exchange rate and we suppose that the inflation differential is 6% (p.a.). If the currency is kept within the wide band it can follow the expected long-run trend for two years without any realignment [$(\Delta S/S)^{e} = (\pi_i - \pi_j)^{e} =$ 12% in 2 years]. However, if it is kept within the narrow band the same path would have to involve at least two crawling-peg realignments within the two years.

Figure 4 - Wide band and narrow band with realignments in the long-run flexibility of the ERM



For large (relative to the width of the band) and persistent inflation differentials between countries, the pattern of realignments is likely to be one of the jump kind unless they are very frequent - this situation is not considered here because too frequent realignments would undermine the discipline feature of the ERM (see chapter 5). Thus even with some uncertainty about the timing and magnitude of realignments the currencies of the high inflation countries within the ERM must be under strong speculative pressure, from time to time and often for substantial periods of time. This topic is discussed further below.

In the ERM there is no explicit integration of economic policies and, as shown by Rogoff (1985), policy coordination has not played any major role in stabilising the exchange rates of the participating currencies. However the grid of bilateral central parities and intervention limits is supplemented by the divergence indicator which is supposed to be a trigger for policy coordination. It is straightforward to show that:[5]

$$\Delta S_{n\bullet}/S_{n\bullet}(t) = \sum_{k=1}^{n-1} \alpha_k(t).\Delta S_{nk}/S_{nk}(t) \qquad (3)$$

where $\Delta S_{n\bullet}/S_{n\bullet}(t)$ is the rate of change (%) of the price of the ECU expressed in currency n; $\alpha_k(t)$ is the weight of currency k in the ECU basket; and $\Delta S_{nk}/S_{nk}(t)$ is the rate of change (%) of the price of currency k expressed in currency n. If all (n-1) currencies move in the same direction and by the same amount against currency n we may re-write (3) as:

$$\Delta S_{n\bullet}/S_{n\bullet}(t) = s.[1-\alpha_n(t)] \qquad (4)$$

where $s = \Delta S_{nk}/S_{nk}(t)$ for all k, (k=1,2,...,n-1).

According to ERM rules if all currencies were at the central ECU rates at time t and all (n-1) move in the same direction against currency n, s cannot be greater than 2.25% in absolute value. Using this condition in (4) we obtain the range within which $S_{n\bullet}(t)$ can

5 - By definition we have

$$an.Sen + \sum_{k=1}^{n-1} ak.Sek = 1 \text{ and } Sek = Snk.Sen.$$

Thus

$$Sen=1/(an + \sum_{k=1}^{n-1} ak.Snk)$$

By differentiation and using $\alpha k = ak.Sek$ we get equation (3).

vary given the above assumptions:

$$-0.025.[1-\alpha_n(t)] \leq \Delta S_{n\bullet}/S_{n\bullet}(t) \leq +0.025.[1-\alpha_n(t)] \quad (5)$$

The divergence indicator of currency n (ID_n) is defined as:

$$-1 \leq ID_n(t) = [\Delta S_{n\bullet}/S_{n\bullet}(t)]/\{0.025.[1-\alpha_n(t)]\} \leq +1 \quad (6)$$

If a currency crosses its threshold of divergence set at $ID_n = \pm 0.75$ this leads to a presumption that the authorities concerned will correct the situation by adequate measures such as diversified intervention, monetary policy changes, changes in central rates or other economic policy measures.

The indicator of divergence has several technical imperfections.[6] Firstly, the divergence indicator does not differentiate between high-inflation and low-inflation averages and therefore it cannot be used to promote a lower level of inflation or monetary stability, which is one of the main objectives of the EMS.

Secondly, it is possible for one or more currencies to reach their intervention points without having passed the divergence threshold. Thus the indicator of divergence cannot work properly as an early warning system.

Thirdly, the indicator is not symmetrical because when two currencies move in opposite directions it will "ring" earlier for the currency with the smaller weight.

Fourthly, the crossing of the threshold results only in a presumption that the respective central bank takes measures: it does not involve any obligation. Thus, there might be an incentive for the respective central bank not to act in order to let the currency

6 - The technical imperfections of the divergence indicator are exhaustively examined by different authors, namely, Salop (1981) and Spaventa (1982). Fels (1987) provides a good summary of the main drawbacks of the indicator which prevent it from being an important factor in promoting policy coordination.

reach the margins which will then force the burden-sharing of obligatory interventions with the other central bank.

Finally, even if the indicator worked as a warning signal this could lead to currency and/or monetary instability because the rules of the game do not specify what kind of policy measures will be taken namelly interest rate changes or changes in the central rate.

1.2 - Exchange rate developments

Most empirical studies on exchange rate developments within the ERM[7] have found evidence that the arrangement has brought a reduction in both the conditional and unconditional variance of exchange rate changes (bilateral and effective, nominal and real). Intuitively, this means that the exchange rate path of the participating currencies has become less difficult to foresee, that is, the (currency) risk attached to each of these currencies has been reduced.

There is some controversy over whether the volatility of exchange rates has any significant negative effect on the growth of international trade (see IMF (1984)). Moreover it seems that there are no conclusive arguments based on microeconomic theory to support that idea (see De Grauwe (1988)). Furthermore, when evidence is found to support the hypothesis that the low exchange rate variability contributed positively to intra-ERM trade, it is clouded by the unresolved issue that the arrangement might have also induced low growth of output (and therefore low growth of trade) which may have occurred if the participating countries were forced to follow a

7 - Like those of Ungerer et al. (1983) and (1986), Rogoff (1985) and Artis and Taylor (1988).

more deflationary demand policy than in a different exchange rate arrangement (see De Grauwe and Verfaille (1988)).

In this section we look at exchange rate developments within the ERM from a different perspective, taking for granted that the system has contributed to exchange rate stability.[8]

During the 11-year period under analysis (1979-89) seven EC currencies participated in the ERM from the beginning: six within the narrow band and one within the wide band. The former are the Belgiam and Luxemburg Franc (BLFR), the Danish Krone (DKR), the Deutschmark (DM), the French Franc (FF), the Dutch Guilder (HFL), the Irish Pound (IRL), and the latter is the Italian Lira (LIT). On the 19th of June 1989 the Spanish Peseta joined the ERM within the wide band.

From its inception until December 1989 the exchange rates of ERM participants were realigned eleven times as shown in table 1. As it can be seen the frequency of the realignments varied significantly. There are years without realignments (1980, 1984 and 1988-89), years with one realignment (1983, 1985 and 1987) and years with two realignments (1979, 1981, 1982 and 1986). The number of months between realignments varies from two (between the first and the second) to twenty eight (between the seventh and the eight) and, after the realignment of January 1987 follows a period of three years (35 months) without any realignment.

Table 2 shows the direction and magnitude of each realignment. We can say that in the first two years of the existence of the ERM

8 - The macroeconomic incentives to participate in the arrangement are discussed in chapter 5. Further inquiry on the microeconomic impact of exchange rate instability is beyond the scope of this thesis. A reference for future work on this topic is Krugman (1989).

(1979/80) the DKR and the LIT were the weak currencies and the DM the strong currency. In the following two years (1981/83) all currencies were involved in the realignments. The DM followed by the HFL were the strong currencies, the FF, the LIT and the IRL were the weak currencies. Thereafter the ERM entered two years of tranquility without any realignment (1984/85) followed by a period (1986/87) where the LIT first and the FF and the IRL later were again in a weak position. Since January, 1987 until the end of the 1980s there was not any further realignment.[9] To analyse the magnitude of the realignments it is more convenient to look at the bilateral exchange rate changes against the DM shown in table 3.

Table 1 - ERM realignment dates during the 1979-89 period

Year	Realignment	Date
1979	Beginning	13/March
	1st	24/September
	2nd	30/November
1980	none	
1981	3rd	23/March
	4th	5/October
1982	5th	22/February
	6th	14/June
1983	7th	21/March
1984	none	
1985	8th	22/July
1986	9th	7/April
	10th	11/August
1987	11th	12/January
1988	none	
1989	none	

Source: European Economy

9 - On the 1st of January 1990 the Italian lira narrowed the fluctuation band and its ECU central rate was devalued (3 %). However, the upper limit of fluctuation against the DM was not affected by these changes.

Table 2 - ERM realignments: change in bilateral central rates (%)

	1	2	3	4	5	6	7	8	9	10	11
BLFR	-	-	-	-	-8.5	-	+4	-	+1	-	+2
DKR	-2.9	-4.8	-	-	-3	-	+5	-	+1	-	-
DM	+2	-	-	+5.5	-	+4.25	+7	-	+3	-	+3
FF	-	-	-	-3	-	-5.75	-	-	-3	-	-
HFL	-	-	-	+5.5	-	+4.25	+6	-	+3	-	+3
IRL	-	-	-	-	-	-	-1	-	-	-8	-
LIT	-	-	-6	-3	-	-2.75	-	-8	-	-	-

Note: changes calculated a the % change against the group of currencies whose bilateral parities remained unchanged in the re-alignment. Calculations are our own.

Source: European Economy

Table 3 - ERM realignments: change in bilateral central rates against the DM (%)

	1	2	3	4	5	6	7	8	9	10	11	Total
BLFR	2	-	-	5.5	9.3	4.3	3	-	2	-	1	27
DKR	5	5	-	5.5	3.1	4.3	2	-	2	-	3	30
FF	2	-	-	8.8	-	10.6	7	-	6.2	-	3	38
HFL	2	-	-	-	-	-	1	-	-	-	-	3
IRL	2	-	-	5.5	-	4.3	8	-	3	8.7	3	35
LIT	2	-	6.4	8.8	-	7.2	7	8.5	3	-	3	46

Note: calculated from table 2.

From tables 1 to 3 we can draw two main conclusions. First, although the timing of the realignments does not appear to follow any regular pattern, the direction of the realignments does. The DM followed by the HFL are the strong currencies, the FF, the IRL and the LIT are the weak currencies. The DKR and the BLFR, having started from a weak position are now in an intermediate position. Second, we can say that, perhaps with the exception of the HFL, the ERM currencies did not follow a fixed DM peg. The system has been flexible enough to accommodate long-run parity changes of considerable and uneven magnitude.

In table 4 we show only the weak currencies. Of these, only the LIT has persistently followed crawling-peg realignments in the sense defined above. This is not surprising as the wide band accommodates larger parity changes. As far as the other currencies are concerned the FF has had jump realignments more frequently than the other currencies in the ERM. This differing pattern of realignments is further illustrated for the FF and the LIT in figures 5 and 6.

Table 4 - ERM realignments: number of changes in bilateral central rates against the DM by range (%)

Currency	$\Delta \leq 4.5\%$	$\Delta > 4.5\%$
BLFR	5	2
DKR	5	3
FF	2	4
HFL	2	0
IRL	4	3
LIT (*)	8	0

(*) - For the LIT the relevant range limit is 12%

From the above we can conclude that the survival of the ERM seems somewhat puzzling. Consider for example a 7% change in the bilateral central rate of the FF against the DM, like the change in the 7th ERM realignment of 21/3/1983 - the minimum jump in the market exchange rate is 2.5% (7%-4.5%). Supose that the timing of the change is anticipated with some uncertainty (for tomorrow) and that the (subjective) probability of the 2.5% jump in the market rate is 10%. Ignoring compounding we have an expected yearly gain of 90% and without uncertainty the expected yearly gain is 900%!

On Saturday, March 19 1983 after a week of daily headings hinting an eminent ERM realignment the heading of the Financial Times was "Finance Ministers plan weekend EMS talks". On Monday, March 21 1983 the DM was revalued 7% against the FF. The general conclusion is that within the 11 years of ERM experience under

Figure 5 FF/DM nominal exchange rate 1979(1)-1989(12)

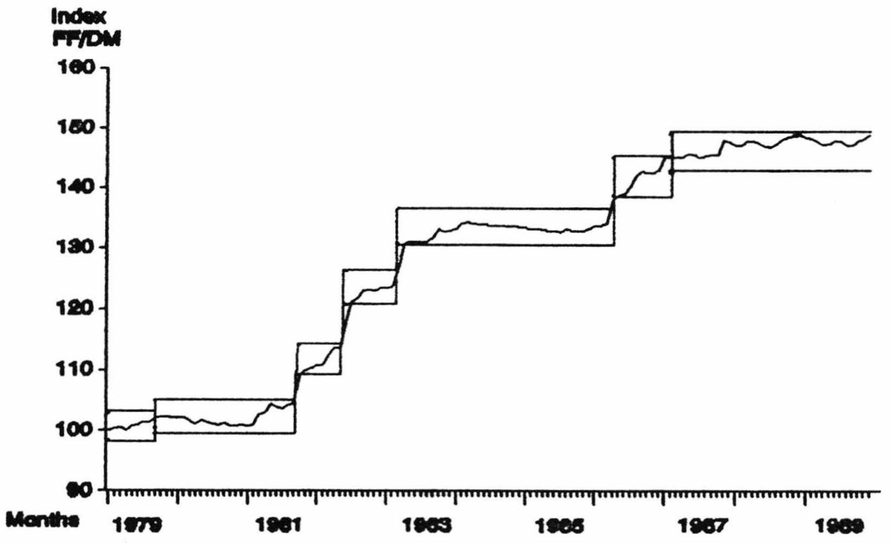
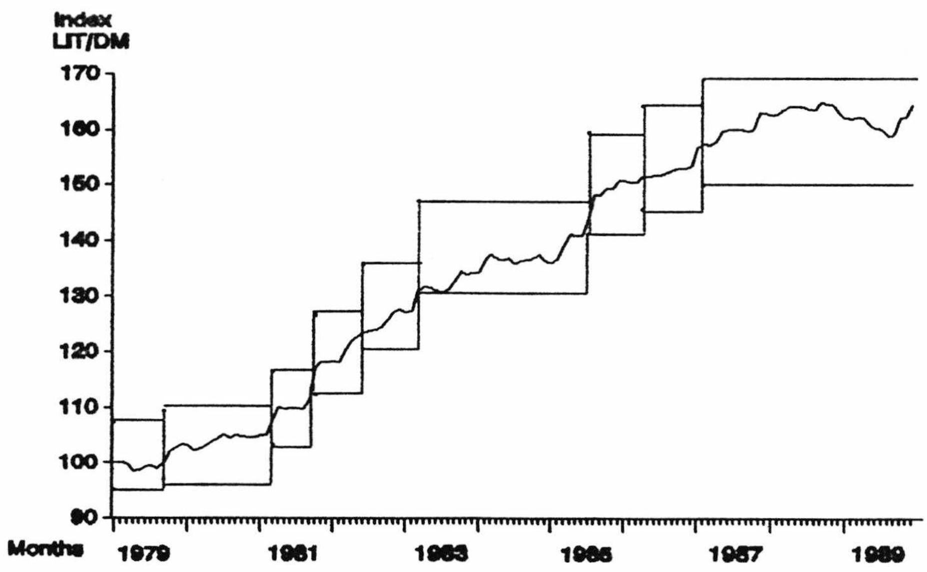


Figure 6 LIT/DM nominal exchange rate 1979(1)-1989(12)



review the weak currencies must have been under strong speculative pressures from time to time.

1.3 - Speculative runs, collapsing exchange rate regimes and the role of capital controls

In the previous section we have seen that in spite of recurrent speculative pressures the ERM did not collapse. Among the factors that might have contributed to the survival of the system we have emphasized the role played by the width and flexibility (periodic realignments) of the fluctuation band. In this section we look at the role of capital controls and ask whether (and how) they help to explain the sustainability of the ERM.

It is worthwhile considering whether a regime of fixed exchange rates can be maintained when divergent economic policies pursued in the different countries imply periodic parity adjustments.

Recent literature on the theory of balance of payments crisis, following Krugman (1979), argues that this is impossible. When a currency is devalued those agents who possess assets denominated in that currency suffer a capital loss. If agents foresee such an outcome they will attempt to sell off all their assets denominated in the weak currency. Such massive sales create a crisis situation and, if they are potentially unbounded, the fixed exchange rate regime must collapse and the currency float. Capital controls are one possible way of limiting the potential volume of speculative transactions and thus prevent, at least temporarily, the collapse of the regime.

In a recent contribution to the literature in this area Wyplosz

(1986) develops a simple model that captures the key ingredients of a balance of payments crisis when capital controls limit the volume of speculative funds available.[10]

Consider that the two countries I and J, with currencies i and j, respectively, have decided to peg their currencies rigidly at the central rate, that is, that we have $S_{ij}(t)=S^c_{ij}(t0)$ for t>t0. Central banks are committed to defending the parity using foreign exchange reserves. Now assume that currency i faces the prospect of a devaluation for reasons to be explained below. Capital controls are stylized as follows: residents in country I are not allowed to hold foreign currency or to grant domestic currency loans to residents in country J; residents in country J are free from any restrictions and hold a certain volume of currency i which is considered as working balances essentially used to finance trade settlements. When the exchange rate is pegged at a credible level the expected rate of devaluation is zero and residents in J hold a positive amount of currency i. If the level of the exchange rate appears to be impossible to defend the expected rate of devaluation tends to infinite and residents in country J sell off all their holdings of currency i in an attempt to avoid capital losses.

To create a crisis situation an inflation differential between countries I and J is introduced. With a higher inflation rate, country's I currency will appreciate in real terms. The real exchange rate in this model ($RER_i(t)$) is the nominal exchange rate divided by the ratio of consumer price indexes. With the nominal exchange rate fixed and with the foreign price index constant, for

10 - Other contributions to the theory of balance of payments crisis are reviewed in chapter 2.

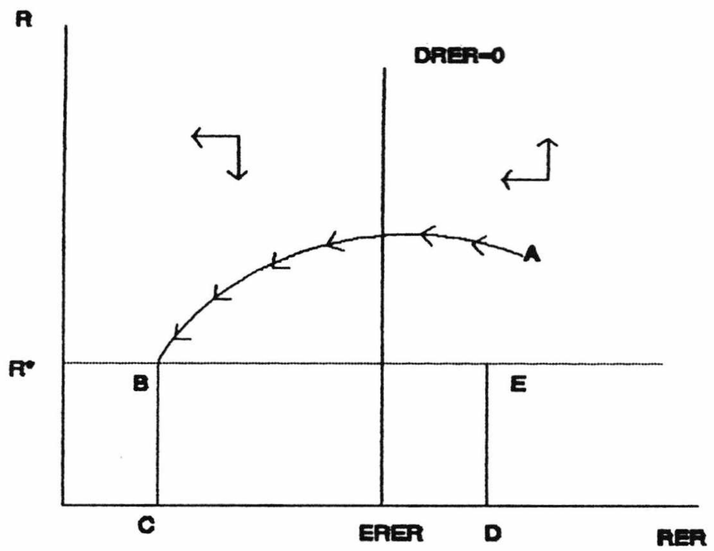
simplicity, the rate of real appreciation is given by the rate of inflation in country I that is we have $(\Delta RER/RER) = (\Delta S/S) - (\pi_i - \pi_j) = = -\pi_i$. A decrease in RER means real appreciation and thus a loss in competitiveness affecting the trade balance. Suppose that there exists a value of the real exchange rate that balances trade. Let it be the equilibrium real exchange rate (ERER). If the fixed exchange rate agreement starts from a situation where currency i is undervalued, that is, from a situation where the real exchange rate is higher than the equilibrium rate, $RER_i(t0) > ERER$, the trade balance will be positive and country I will accumulate foreign exchange reserves. Under these circumstances the level of the nominal exchange rate will be credible. The continuing real appreciation of currency i will eliminate its initial undervaluation and eventually will cause currency i's overvaluation and trade deficits. Then, after a certain time, country I's foreign exchange reserves will start to shrink.

Residents in country J are supposed to monitor country I's foreign exchange reserves and thus will trigger a crisis when the level of those reserves drop below the volume of their trade-related working balances. Then at a certain point in time the nominal exchange rate level will loose its credibility, the expectation of a capital loss will become infinite and a speculative run will occur. However, the speculative supply of funds is bounded because the maximum amount available is the level of working balances held. That is the reason why, with capital controls, the fixed exchange rate regime can survive. With reserves being exhausted a devaluation is engineered. If the new level of the peg is such that the RER becomes undervalued, country I will have again a trade surplus and reserves will start growing. The nominal devaluation is therefore credible and an immediate gain in reserves will follow as residents in J replenish their working balances of currency i.

Figure 7 below (taken from Wyplosz's article) illustrates the dynamics of the real exchange rate and foreign exchange reserves, just described. The vertical axis measures the level of reserves and the horizontal axis the level of the real exchange rate. R* is the level of J residents' working balances of currency i and ERER is the unique level of the real exchange rate that balances trade. Thus, foreign exchange reserves are invariant along points on the vertical line that passes trough ERER, that is we must have DRER = dRER/dt = 0 along that line. With a persistent inflation differential the real exchange is appreciating at a constant rate given by $(\Delta RER/RER)=-\pi_i$. This is indicated in figure 7 by the horizontal arrows. If the real exchange rate is above the level given by ERER (undervaluation) the country will accumulate reserves. If the real exchange rate is overvalued (below ERER) the country will loose reserves. This is shown in figure 7 by the vertical arrows. Starting at point A the economy follows the path indicated by the arrows towards point B. When it reaches that point a speculative run occurs and reserves are exhausted - there is a jump to point C. Then the authorities engineer a credible devaluation and there is a jump to D followed by another jump to E as reserves accumulate.

This model has some obvious shortcomings. One is the neutral role played by residents in I. Capital controls are unlikely to be as effective as is suggested and some crisis might be triggered off by residents in I. A second shortcoming is that the model does not take into account the international borrowing facilities at the

Figure 7 - Speculative run and credible devaluation with capital controls



disposal of the central bank. An obvious extension of the model is the inclusion of interest yielding assets which are not considered in Wyplosz's model. For its simplicity and suggestive empirical content we have chosen this model to illustrate the role that capital controls have played in the sustainability of the ERM, during the 1979-1989 period.

Exchange rate developments reviewed in the previous section suggest that the 1981/83 period, which included the 4th, 5th, 6th, and 7th ERM realignments, was the most critical period of the ERM particularly for the DM/FF relationship. A formal test of Wyplosz's model is beyond the scope of this thesis. Nevertheless, some interesting insights can be gained by looking at the empirical evidence on French-German inflation differentials (figure 8), French and German current accounts (figure 9), FF/DM real exchange rate and French foreign exchange reserves (figure 10) and short-term capital

Figure 8 French-German inflation differential

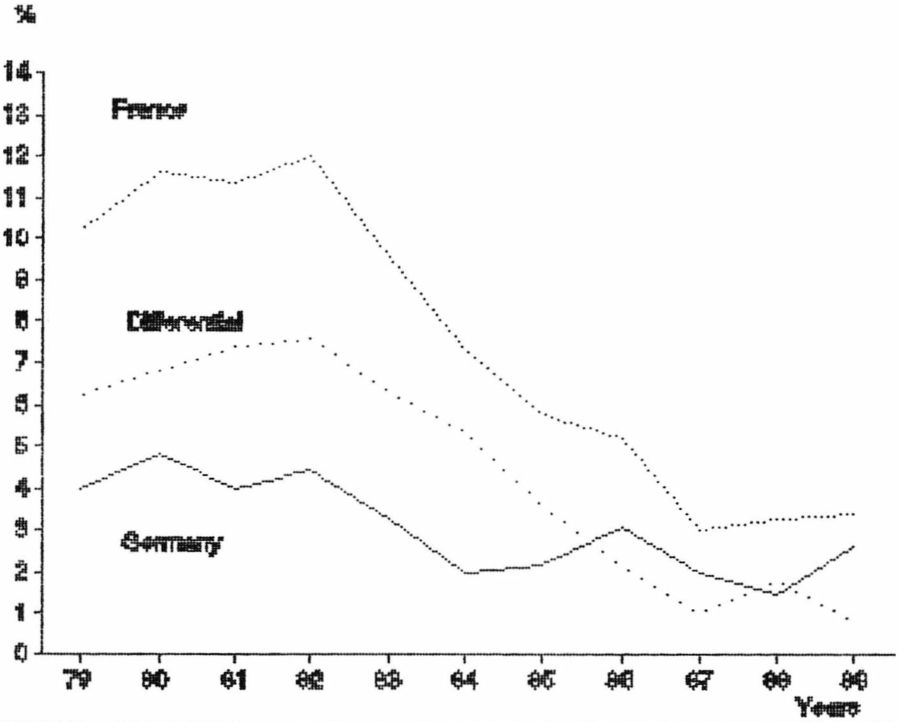


Figure 9 French and German current accounts (as % GDP)

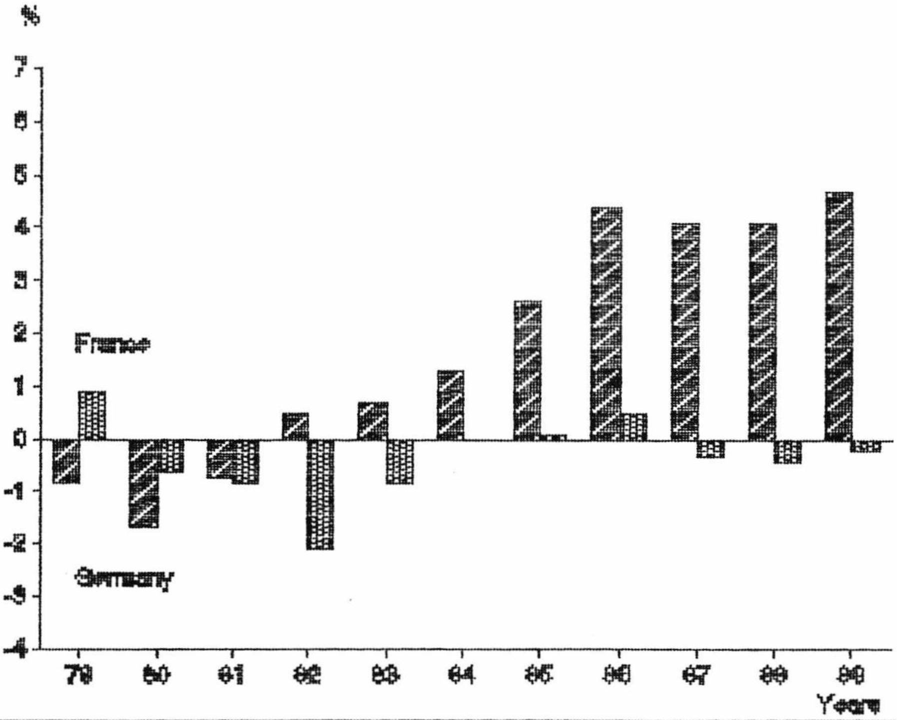


Figure 10 FF/DM real exchange rate and French reserves

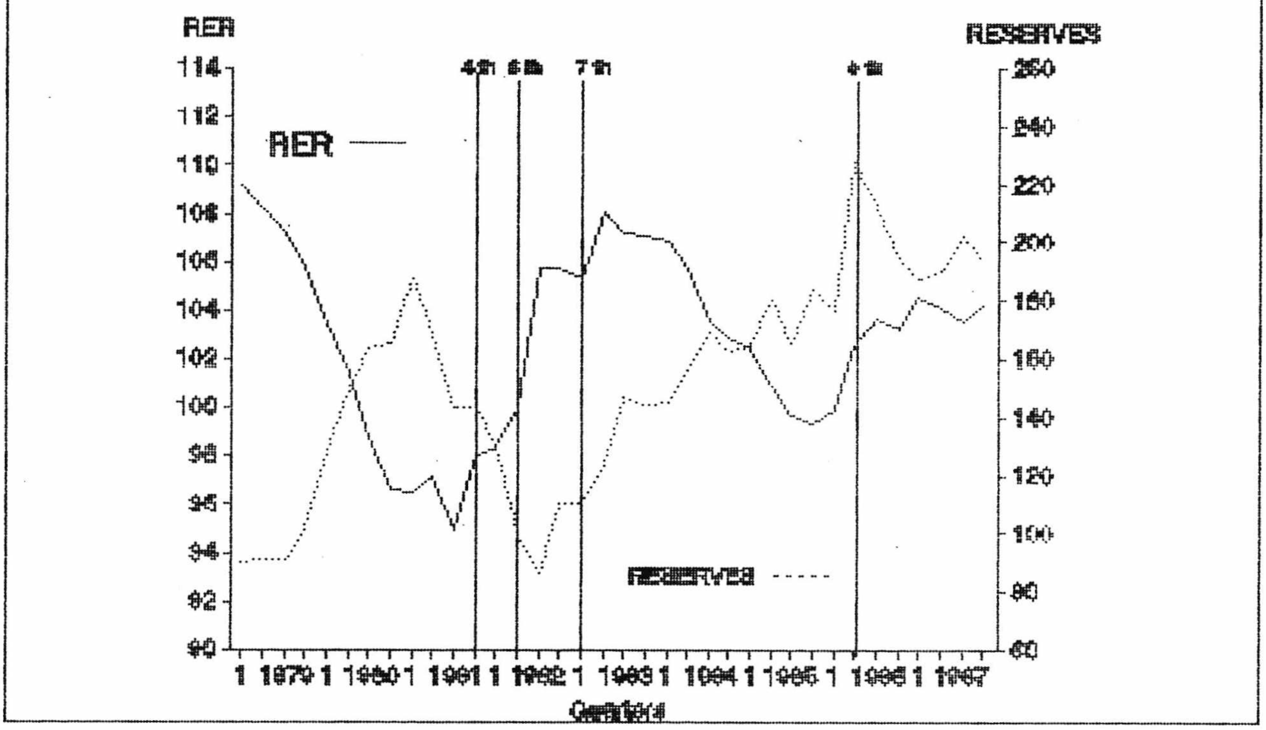


Figure 11 ERM realignments and capital flight from France

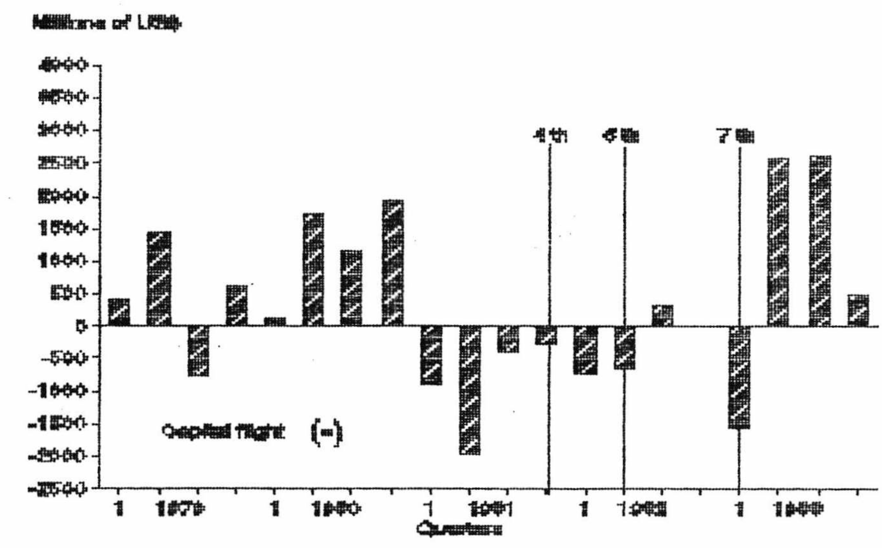
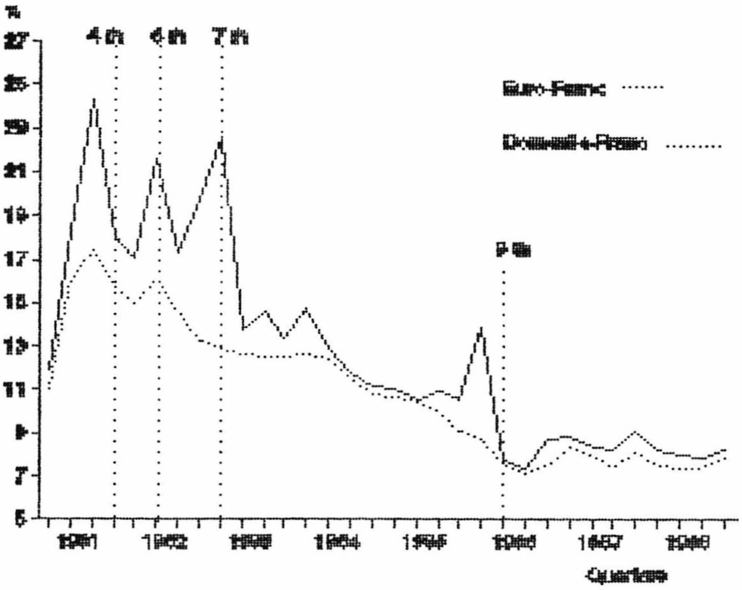


Figure 12 Euro and domestic interest rates on FF deposits



<u>Source Figures 8-12</u> : IMF, <u>International Financial Statistics</u>.
<u>Note</u>: In figure 11 capital flight is measured by the sum of short-term capital flows and error and omissions in the balance of payments.

flows (figure 11), ERM central banks' interventions in DM (table 5) and Euro and Domestic FF interest rates (figure 12).

Table 5 - Net DM interventions in the ERM (billions of DM - yearly data)

	1979	1980	1981	1982	1983	1984	1985	1986	1987
Total	+9	-10.8	+19.7	+6.4	-14.5	-17.9	+1.5	+27.6	+29.7
Afecting liquidity in Germany	+9	-10.5	+15	+3.7	- 7.8	+ 3.6	-0.2	-8.4	+18.1
Obligatory	+3.6	-5.9	+15	+3	-8.4	+4.7	+0.4	-14.8	+15
Intramarginal	+5.4	-4.9	+ 4.7	+3.4	-6.2	-22.7	+1.2	+42.4	+14.7

Source: BIS (1987).
Discrepancies are due to rounding.
+ = DM sales or expansionary impact on liquidity in Germany.
- = DM purchases or contractionary impact on liquidity in Germany.

The main conclusions to be drawn from the empirical evidence are as follows. First, the 1979/83 period is marked by a large and persistent inflation differential between the two countries. It is only after 1983 that the French rate of inflation converges gradually towards the German level. Second, without any significant realignment in the first two years of the ERM, the FF appreciated by 15% in real terms against the DM. Third, in the early years of the ERM (1979/80) Germany had current account deficits whereas France roughly achieved current account balance. In the subsequent years (1981/83) Germany steadily moved into surplus whereas France moved into in deficit. Fourth, the jump realignments of the FF during the 1981/83 period brought the FF/DM real exchange rate up to its 1979 level by 1983. The same period is also marked by a sustained decline in French foreign exchange reserves and capital flight from

France.[11] Note that after the realignment of the 21st of March 1983, foreign exchange reserves recovered and, in particular, note also the reversal of the direction of the capital flows from the 1st to the 2nd and 3rd quarters of 1983 (presumably capital returning to the country) suggesting that at last the level of the real exchange rate had become credible. Fifth, in spite of the capital flight there is evidence that capital controls were binding. Before the realignments the FF euro-domestic interest rate differential widens sharply. Throughout the critical years of 1981/83 the interest rate spread was very large; yet French domestic interest rates were also raised suggesting that controls were not totally effective. Sixth, ERM central banks' net sales of DM in 1981/82 amounted to 26.1 Billion of DM, 70% of which under VSTF affecting monetary conditions in Germany; in contrast net sales of DM in 1986 were financed mainly by intramarginal interventions and did not affect or at least had less effect on German monetary conditions.

In conclusion, the counterclockwise crisis cycle suggested by Wyplosz's model is supported by the data in particular for the 1979/83 cycle. There is a period (1979/81) of real appreciation with initially an increase in reserves and after a decrease. This was followed by a period (1982/83) of real depreciation that brings the economy back to its point of departure with reserves eventually recovered. The 1984/87 cycle is less apparent: real appreciation and reserve losses are smaller and the recuperation of reserves is

11 - As suggested by Cuddington (1986) capital flight is measured by the sum of short-term capital flows and errors and omissions in the balance of payments. For a comprehensive discussion of alternative measures and for further references of the literature on capital flight see Lessard and Williamson (1987). For an application to European countries see Gibson and Tsakalotos (1990).

faster. This is not surprising: the second cycle is smoother because the inflation differential was narrowing and already below the width of the (narrow) band (4.5%). In addition the French current account had moved into surplus and capital controls were still binding.

From the analysis presented in this section we may conclude that the survival of the ERM and thus the resulting exchange rate stability owes much or is exclusively due to the existence of capital controls. However, we may note the substantial amounts of marginal and intramarginal (DM) foreign exchange market interventions made by ERM participating central banks (table 5). And we may also recall that some of the changes in the operating procedures of the arrangement (made in September 1987) were in particular directed at facilitating the financing of intramarginal foreign exchange market interventions. Therefore, foreign exchange market interventions may also have contributed to the stability of the system and it is possible that their role will become more relevant and apparent within an ERM without any capital controls.

In fact, Radaelli (1988) presents some econometric evidence which makes two basic points supporting the role of intervention. First, he found evidence which is consistent with the presence, on the major ERM currency markets, of risk premium whose main determinant is the relative supply of assets. From portfolio theory based on mean-variance optimization this is a necessary condition for the effectiveness of sterilized intervention.[12] Second, the author found that the actual behaviour of exchange rates within the ERM has

12 - See Annex 3 to chapter 4, for a brief exposition of the theory and references to the literature.

been consistent with a simple rule of thumb that is compatible with the idea that central bank's behaviour has structurally changed after 1979 in order to take into account the constraints of the system.

Taken together these results led the author to the conclusion that capital controls were not the single factor contributing to exchange rate stability and to point out the importance of intervention.

It should be mentioned that according to portfolio theory based on mean-variance optimization, risk-averse international investors seek not only higher returns but also negative covariances between real returns in order to reduce the total risk of their portfolios. As shown, by, for example, Frankel (1986) returns on US dollar and DM assets have the propriety of being negatively correlated. Thus, they tend to be held together, although in time-varying proportions, in a well diversified portfolio. Or, to put it differently, US dollar and DM assets tend to be complements. On the other hand, essentially due to the fact that the returns on DM and FF assets are positively correlated, the FF and the US dollar-DM pair tend to be substitutes.

An important theoretical conclusion that follows is that a depreciation of the dollar should not be accompanied by appreciation of the DM against the FF. Yet, there is a broad agreement that some periods of strain in the ERM have been caused by movements out of the dollar as shown, among other, by Artis (1987) and Giavazzi and Giovannini (1986; 1989). As Frankel points out, French capital controls and the absence of substantial capital controls in Germany and in the U.S.A. have made marks and dollars closer substitutes than the dollar is for the FF, portfolio optimization notwithstanding. It would then follow that a portfolio shift out of dollars would tend to be a portfolio shift into DM assets, and would cause the mark to appreciate against the other ERM currencies.

These considerations caution us against the use of the portfolio framework to test propositions about the past experience of the ERM unless the role of capital controls is explicitly taken into account. For example, Giavazzi and Giovannini have modelled capital controls as transaction costs within a capital-asset pricing model. They show that such costs limit the size of the financial markets in the currency involved and make it less substitutable, with the important consequence that foreign exchange market operations tend to be more effective in the presence of capital controls.

Conclusions

We have seen in this chapter that one of the most important features of the ERM is (was?) its flexibility. In fact, the experience of the last decade has shown that, with periodic realignments, even countries with substantial inflation differentials could tie their currencies for some time. Whilst not allowing any major real exchange-rate misalignment to develop, high inflation countries could still enjoy some of the discipline imposed by the "hard currency" peg. However, around the time of the realignments large onshore-offshore interest rate differentials emerged suggesting that capital controls or dual exchange-rates insulated the domestic financial systems of the high inflation countries from full scale speculative pressures. We have also seen that the width of the fluctuation band and marginal and intra-marginal foreign exchange market interventions have also been important for the stability of the ERM. Meanwhile, the participating countries either reduced (gradually) their inflation rates towards the "German standard" or substantially narrowed their inflation differentials, a topic to be discussed at length in chapters 5 and 6.

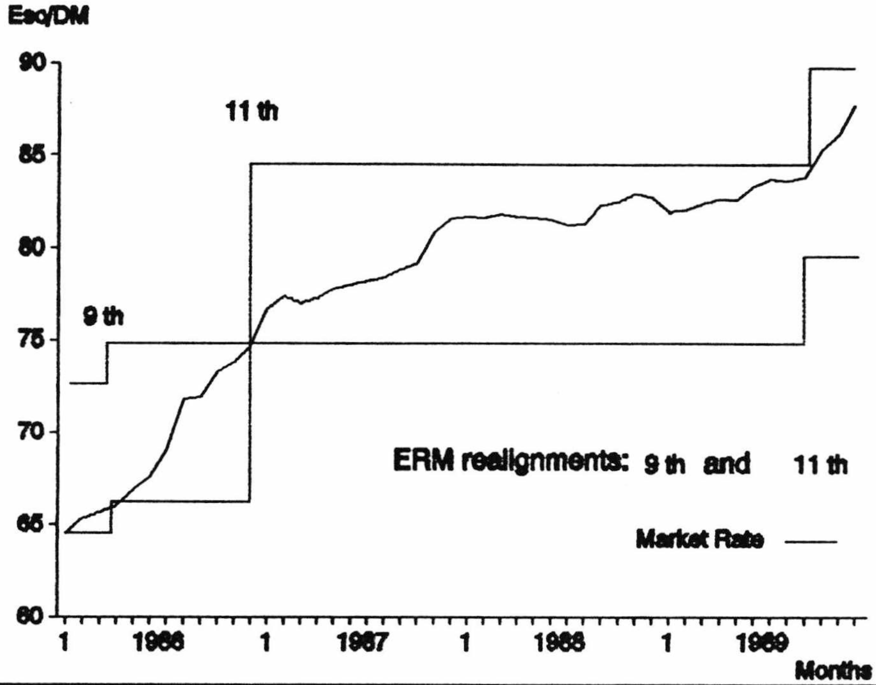
Since 1977 the escudo has been following a crawling-peg regime. The rate of monthly depreciation against a basket of currencies has always been announced by the central bank, and the composition of the currency basket and the weights of each currency in the basket are also known. In addition, the escudo was devalued five times: in February 1977, against the dollar (15%), and against the basket of currencies in May 1978 (7%), June 1982 (9.4%), and July 1983 (12%). A "technical" devaluation against the basket of currencies (2%) followed the ERM realignment of March 1983. During this period the Portuguese economy underwent two major IMF Adjustment Programmes (1978 and 1983). Of the four major devaluations mentioned, two anticipated the "letters of intent" and the other two were part of IMF's packages. Since 1977, exchange-rate policy has been oriented mainly towards maintaining or improving price competitiveness with two exceptions. The first is the revaluation of the escudo against the basket of currencies (6%), in February 1980, as part of an anti-inflationary package implemented by Prof. Cavaco Silva when he was Minister of Finance in the government of the right-wing coalition Aliança Democrática (AD) led by the late Sá Carneiro (1979-80). The second is the recent (1987-89) "shadowing" of the ERM, as part of the disinflationary strategy followed by the government of the Social-Democratic Party, led by Prof. Cavaco Silva.

Though not being a formal participant in the ERM, the escudo has in practice been "shadowing" the DM within a wide fluctuation band (±6%) in a way that looks very much like the path of the Italian lira during the experience of the EMS between 1979 and 1989. For example, the escudo/DM bilateral exchange-rate remained virtually fixed during most of 1988 and, in general, the crawling-peg has less than fully accommodated inflation differentials allowing for a (moderate) real effective appreciation of the escudo (see chapters 3, 4 and 7).

Figure 13 illustrates the recent path of the ESC/DM nominal exchange rate, ignoring the constraints imposed by the evolution of the bilateral rates of the DM against the strongest and the weaker currencies within the ERM. After Portugal joined the EC, in January 1986, the escudo has followed a path that is broadly consistent with a soft-ERM, in particular because it stayed within the wide band against the DM for nearly three years, from January 1987 until October 1989.

Thus, whilst we may say that for most of the recent past the exchange-rate policy followed by the various Portuguese governments is the kind of policy that invites self-fulfilling speculative attacks (see chapter 2), the recent change in the way the escudo is managed is a step in the right direction, if financial liberalisation is to proceed. The medium-term credibility of this move can be questioned as long as the escudo remains an ERM outsider. But Prof. Cavaco Silva's reputation of being an "inflation fighter", built when he was first in office in 1979-80 and reinforced by the sharp fall of the inflation rate in the first two years of his office as Prime-Minister, might very well be a close substitute for full par-

Figure 13 Portuguese escudo and the soft-ERM: the ESC/DM within the wide band



Source: Banco de Portugal, Annual Report ticipation in the ERM (see chapters 5 and 7).

The very pragmatic approach to exchange rate management followed by the Portuguese authorities is a step in the right direction (though not sufficient) in order to establish a "new" reputation for the escudo, as it plays an important part in any credible commitment to greater exchange rate fixity. One possible reason why this has not been done inside the ERM is related to the new stage of policy coordination in Europe which aims at achieving the near fixity of exchange rates. It seems clear that, from now on, participants in the ERM have to show the markets that they are determined to live without realignments and one way to send the message to foreign exchange markets is not to realign now. That is possibly why there has not been any realignments since 1987, and, perhaps even more significantly, why the Italian lira narrowed the fluctuation band (in 1990) without changing its upper limit against the DM and the FF is being managed within a very narrow margin against the DM (±1%). However, for reasons to be discussed in the following chapters the commitment to a definite upper limit of the escudo against the deutchmark seems premature.

CHAPTER 2

Debts, Deficits and Financial Liberalisation

Introduction

Phase 1 of European Economic and Monetary Union (EMU), which started in July 1990, implies, among other things, joining the exchange rate mechanism of the EMS (ERM) within narrow bands and the full liberalisation of capital movements. As has recently been set out, stage 2 of EMU should start in January 1994. During this stage, according to the Delors Report, bilateral exchange-rates of the participating countries will remain within very narrow bands (like those of the first years of the Bretton-Woods era), realignments will be ruled out in practice, and monetary and exchange-rate policy of the participating countries will be coordinated within the framework of a quasi-federal system of central banks. At that stage, the European single market for goods, labour and services is expected to be already fully established.

At the time of writing, the Portuguese escudo is not yet a full member of the EMS and Portugal was given a transitional period, until 1995, for the total removal of capital controls and full integration in the EC. If the timing for EMU is to be respected, phases 1 and 2 will tend to overlap in the case of the Portuguese escudo, and Portugal will not have had what seems to be the very important experience of the transitional phase, where participating countries "learn to live" with a much greater fixity of bilateral exchange-rates, requiring a very close policy coordination and the convergence of policy objectives, control methods and economic performance.

CHAPTER 2

The Portuguese government of the Social-Democratic Party, led by Prof. Cavaco Silva, has repeatedly affirmed its commitment to EMU, without any apparent reservations, but seems to hesitate as to the timing of the escudo's full participation in the exchange-rate mechanism of the EMS. However, as mentioned in chapter 1, the escudo has been "shadowing" the ERM since 1987, and the liberalisation process implied by the completion of the European internal market has already fostered important structural changes in the Portuguese economy. In particular, the domestic financial system has been de-regulated in several important ways and foreign exchange controls have been relaxed.[1]

Meanwhile, since Portugal joined the European Communities (EC) in 1986, the macroeconomic performance of the Portuguese economy has been marked by sustained growth, decreasing unemployment, a consumption and investment boom with record levels of foreign direct investment and large inflows of other long-term and short-term foreign capital.

Despite the buoyancy of domestic demand, the current account remained in surplus for three consecutive years (1985-87), mainly as the result of the previous macroeconomic adjustment (1983-1985) and of the exceptional terms of trade gain due to the collapse of oil prices and the devaluation of the dollar that occurred in that period. As a consequence, the large accumulation of foreign exchange reserves of the recent past permitted a substantial reduction in the level of foreign indebtedness and relaxed what has been, since 1974, one of the most important constraints on growth and

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1 - The Portuguese experience with capital controls is discussed in chapter 4.

development of the Portuguese economy.

However, the persistence of inflation and high budget deficits and government indebtedness are two major areas of concern, which might help to explain the hesitation of the Portuguese government over full participation in the EMS.

The first area of concern relates to the disinflationary process which, having started in 1985 was interrupted in 1988. Inflation fell from 30% to 9%, in just three years (1985-87), allowing for a substantial reduction of the inflation differential between Portugal and EC average, but is now well above the 6% target for 1988 (13.5% in 1989). We should bear in mind that this recent surge of inflationary pressure is a world-wide phenomenon and even the "German standard" which was nil in 1986 is now over 3%. However, the widening of the inflation differential between Portugal and EC average is a matter of concern, particularly because the reversal of the trend occurred in spite of the apparently non-accommodating exchange-rate and incomes policies followed by the Portuguese authorities in recent years.[2]

The second area of concern relates to government deficits and debt, as the continuous deficits of the general government raise the question of the medium-term sustainability of the debt/GDP ratio. Budget deficits in Portugal have been mainly financed either by printing money or by debt, serviced at negative real interest rates. The latter reflects the result of the implicit taxation imposed upon the banking system by the Treasury and made possible by the existence of capital controls. In spite of this, the debt/GDP ratio has

2 - The recent (dis)inflationary process in Portugal is discussed in chapter 7.

been on an increasing trend since 1974, reflecting the accumulation of large and continuous fiscal deficits that successive governments, irrespective of their "colour", seem to have been unable (or unwilling) to contain.

There are no rigid limits either in theory or in practice as to the maximum debt/GDP ratio a government can endure. But the risks are that the switch from money financing to debt financing of a largely unchanged deficit may jeopardize the government's medium-term commitment to the "hard currency" peg and financial liberalisation process implied by full participation in the EMS.[3]

To give an idea of the scale of the potential public debt problem that the full accession of the Portuguese escudo to the EMS involves, we present in table 1 the recent evolution of the public debt-income ratio in Portugal.

Table 1 - Public Debt Accumulation in Portugal (%)

	1974-82	83	84	85	86	87	88	89
Public Debt/GDP (b)	35	56	61	70	68	72	74	72
Real Interest Rate (r)	-5.2	-5.4	-3.2	-0.9	-5	3.8	2.2	2.2
Real Growth Rate (x)	3	-0.2	-1.9	2.8	4.1	5.3	3.9	5.4
Seigniorage (s)	5	2.7	0.6	1.1	1.6	2.8	2.2	na

Note: the real interest rate is the government bond yield deflated by the GDP deflator; seigniorage is the change in reserve money as a % of GDP.
Source: IMF, International Financial Statistics, and European Economy

As the table reveals, in the 1980s, the debt income-ratio increased substantially and, in particular, note that the doubling

3 - The problems raised by the Portuguese government deficits and public debt accumulation in relation to escudo's full participation in the EMS are discussed at length in Braga de Macedo (1990). See also Braga de Macedo and Sebastião (1989).

of the ratio occurred in spite of the favorable evolution of its main determinants:[4] the real interest rate-real growth rate difference has been negative ($r - x < 0$) and the contribution of seigniorage revenue to the financing of the deficit has been considerable. This evolution uncovers an apparent lack of control over public finances in Portugal.

Recently, however, some progress has been made in this area as the Portuguese government ran primary surpluses for three consecutive years (1986-88) and relied more on capital markets to finance the deficit. This improvement on the public finances side reflects, mainly, the recent increase of taxation and the enlargement of the tax base due to the comprehensive reform of the taxation system which followed the introduction of the VAT in 1986. In spite of this improvement, it is not yet clear whether the debt/GDP ratio has been stabilized (at around 70 %) or larger primary surpluses are still required. However, the complete utilization of EC funds during the transitional period to full integration in the EC (which lasts until 1996), is likely to put some expansionary pressure on the budget, particularly on the capital expenditures side.[5] In addition, any further increase in taxes could have negative supply-side effects, could conflict with the attempt at disinflation and

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4 - The main determinants of the dynamics of public debt accumulation, discussed in section 2.1, are the level of the debt-income ratio, the real interest rate, the real growth rate, seigniorage and the primary deficit (see equation (1)). Negative real interest rates, high and positive growth rates and seigniorage tend to dampen the rate of debt accumulation. Primary deficits have the opposite effect.

5 - For example, EC structural and specific funds for industrial development are given on the principle of additionality and often require Portuguese government expenditure.

also contribute to social and political distress.[6] It is true, of course, that if real growth rates remain as high as they have been in the recent past the real interest rate paid on servicing the public debt can rise quite substantially without jeopardizing the final objective of the stabilization of the debt/GDP ratio. But in this case, a gradualist approach to budgetary correction seems preferable because a sharp reduction in public expenditures would have the effect of reducing the real growth rate without affecting (reducing) the real interest rate and, apart from delaying fundamental investments in infrastructures, would perhaps have the perverse effect of worsening even further the state of public finances.

Another reason for gradualism in budgetary correction is related to the privatization programme which has barely started in Portugal. There is now a broad political agreement, involving the major political parties and expressed in the new constitutional law approved in 1989, for the partial sale of the assets of the (large) public sector.[7] This process should allow the government to collect a substantial amount of funds which can be used for a once-for-all improvement of the state of public finances. However, the development of the stock market which is still very thin and volatile and has not yet recovered from the October 1987 crash is fundamental for the success of the venture. A sharp reduction in public spending would almost certainly cause a recession and depress the

6 - Before the reform of the taxation system, which followed the introduction of the VAT in 1986, marginal tax rates in Portugal were already relatively high. An international comparison with other OECD countries can be found in OECD, OECD Economic Surveys: Portugal, Paris, 1985/86.

7 - In fact, the privatization process already started in 1988 with the sale of 49% of the equity capital of the Totta e Açores bank and of the Unicer brewery, but had to wait for the approval of the new constitution to proceed further.

stock market, making it more difficult to raise the needed capital.

In this chapter we look, from a theoretical perspective, at the macroeconomic problems raised by extensive real and financial external liberalisation and the change from a flexible into a fixed exchange rate regime. The analysis is relevant for middle-income countries which, starting from a situation of high inflation, large fiscal deficits financed by money creation, very limited domestic securities markets and controlled interest rates, high barriers to international trade, and stringent controls on international capital movements, then engage in opening up their economies. The chapter is divided in three main parts. In section 2.1 we review the arguments for sequencing economic liberalisation. In section 2.2 we look at the implications for debt accumulation and inflation of different expectations about the future prospects for fiscal reform. A country where the government relies heavily on seigniorage revenues to finance the budget is prone to balance of payments crisis if it opens up the capital account, pegs the exchange rate, and does not engage in major fiscal reform. In section 2.3 we review several contributions to the theory of balance of payments crisis which we integrate within a common framework. Conclusions are presented at the end of the chapter. In summary, we can say that, having in mind the situation of public finances in Portugal, the theoretical arguments reviewed in this chapter set Dornbusch's (1988) call for a crawling-peg EMS into a broader perspective.

CHAPTER 2

2.1 - On Sequencing Financial Liberalisation

In the early 1970s some Latin American countries, namely Chile and Argentina, embarked on major programmes of real and financial economic liberalisation, the latter aimed at ending financial repression, as defined by McKinnon (1973) and Shaw (1973). In a very swift move, state-owned enterprises were privatized, quantitative barriers to trade were removed, tariff levels were substantially reduced, banking and finance were de-regulated, domestic capital markets were developed, and restrictions on international capital movements were lifted. A decade after the evidence showed that these reforms were to a large extent failures and, according to Diaz-Alejandro (1985), resulted by 1983 in domestic financial sectors characterized by widespread bankruptcies, massive government interventions or nationalizations of private institutions, and low domestic savings.

According to Edwards (1984) the timing and the speed of the reforms and the macroeconomic policies that were being pursued alongside interacted perversely and were the main causes for the failure of the liberalisations. His arguments apply to middle-income countries with the characteristics outlined above, which then engage in extensive real and financial external liberalisation. To facilitate the exposition of the theoretical arguments let us consider the economy divided into four sectors: the real domestic sector (1), the financial domestic sector (2), the real external sector (3), and the financial external sector (4).

The theoretical approach developed by Edwards combines insights from several models and deals with the question of the preferred sequencing of the liberalisation of the current and capital accounts of the balance of payments.

2.1.1 - Public debt and the sequencing of internal and external financial liberalisation

Let us begin with the question of sequencing the liberalisation of the financial sectors of the economy. Suppose that the capital account of the balance of payments is opened up before the liberalisation of the domestic financial sector. The sequencing would then be from 4 to 2 (4 -> 2). The economy starts from a steady-state of financial repression, such as the situation analyzed by McKinnon and Mathieson (1981). In the steady-state there are interest rate subsidies to certain preferred borrowers[8] and non-interest bearing reserve requirements against term deposits. McKinnon and Mathieson show that even if all usury restrictions had been lifted (i.e. there are no interest rate ceilings) and the banking system is competitive (makes no profits) the high non-interest reserve requirements on term deposits drive a wedge between the open capital-market determined interest rate on deposits and that on loans. In addition, in the steady-state, a substantial part of the public sector deficit is assumed to be financed by an inflation tax. In general, this leads to a situation of low domestic deposit real interest rates, which tend to be below the world level. If the capital account is fully liberalised, under these circumstances, financial intermediation will move to off-shore centres (in order to escape the high reserve

8 - This means that the government gives subsidies to preferred borrowers without such subsidies appearing in the official Treasury accounts. Accordingly, there is an implicit deficit of the government that exceeds the explicit deficit.

requirements) and domestic residents will reshuffle their portfolios resulting in currency substitution and capital flight. That is, if the capital account is liberalised before the domestic financial sector is liberalised a massive outflow of capital will result. Thus, the correct sequencing of financial liberalisation must be from 2 to 4 (2 -> 4).

As a consequence of the liberalisation of the domestic financial system there will be a rise in the general level of domestic real interest rates and the ability to impose reserve requirements on financial institutions will be severely impaired. This will have important implications for fiscal policy.

As mentioned before, in the steady-state of financial repression considered by McKinnon and Mathieson a substantial part of the budget deficit is financed by an inflation tax. The need for this source of financing emerges in countries where budget deficits are difficult to finance by extra taxation on income, sales and property, where tax evasion is widespread and where expenditure cuts are not politically feasible. This is a situation likely to be faced by most developing countries. To see the main implications of domestic financial liberalisation for fiscal policy let us consider the dynamics of debt accumulation such as that presented in Dorbusch and Giovannini (1990)

$$db/dt = (r-x).b + g - s \qquad (1)$$

where: b is the debt-income ratio; r is the real interest rate; x is the growth rate of real income; g is the ratio of non-interest deficit to income; s is the seigniorage-income ratio where seigniorage is the revenue flow accruing to the government from the issue of base money.

The main determinants of the dynamics of public debt accumulation are the level of the debt-income ratio, the real interest rate, the real growth rate, seigniorage and the primary deficit. Negative real interest rates, high and positive growth rates (or more generally real growth exceeding the real interest rate) and seigniorage, tend to dampen the rate of debt accumulation. Primary deficits have the opposite effect.

By forward integration of (1) and imposing the no-Ponzi-game condition (NPG)[9] we get the intertemporal budget constraint of the government

$$b_o = \int_0^\infty (s_t - g_t).\exp(-h_t).dt \tag{2}$$

where $h_t = \int_0^t (r_v - x_v).dv$ is the discount rate. If the real interest rate and the real growth rate of income are constant the exponential term in (2) becomes $\exp(-h_t) = \exp[-(r-x).t]$ and the NPG condition means that $r > x$. Equation (2) states that the value of the deficit-income ratio today (b_o) must be equal to the present value of future seigniorage revenues (s_t) and primary surpluses ($-g_t$) as a ratio of income.

Domestic financial liberalisation is likely to eliminate or reduce very significantly the amount of seigniorage revenues because the elimination of reserve requirements and the increase in the real interest rate on term deposits will tend to erode the base on which the inflation tax is collected (the monetary base). Furthermore, under a fixed exchange rate regime a permanent increase in the level of the inflation rate is not feasible and thus, constrained by the exchange rate regime, the government cannot compensate for the loss

9 - The no-Ponzi-game condition (NPG) states that the government debt-income ratio must not increase asymptotically faster than (r-x). It is equivalent to imposing, in deriving (2), that:

$$\lim_{t \to \infty} bo.\exp(-ht) = 0$$

See, for example, Buiter (1986).

of revenue caused by the erosion of the tax base through an increase in the tax rate.[10] Financial liberalisation is also likely to imply the end of Ponzi financing because, as we assume, the real interest rate rises above the trend real growth rate of income. This proposition however is not uncontroversial.[11] Thus, we can say that starting domestic financial liberalisation from a situation of high Public debt must involve the prospect of running primary surpluses in the future for, otherwise, there is a possibility of serious fiscal imbalances ahead. The main conclusion is that there is the need to combine changes in the financial structure with budgetary reform. Edwards emphasizes that the fiscal deficit must be under control before interest rates can be liberalised.

It should be mentioned that Fry (1988) refers to Portugal as a case of financial restriction, and not as a case of financial repression. According to Fry in the case of financial repression the real rate of growth and size of the financial system, relative to the nonfinancial sectors of the economy, are reduced which gravely impair the development process. In the case of financial restriction, the development of financial institutions and instruments from which the government can extract seigniorage is encouraged (money and the banking system) and the development of the other discouraged (private bond and equity markets). Under financial restriction there will be a substantial flow of resources to the public sector

10 - If fiscal and monetary policies are not directed at keeping the fixed exchange rate regime, the currency will be prone to speculative attacks that, eventually, either will cause the collapse of the fixed exchange rate regime or force the authorities to adjust their policies. See section 2.3.

11 - In the 1980s, a decade marked by financial de-regulation, the real interest rate rose above the real growth rate in the USA ($r-x = +3.1$). This contrasts with the experience of the 1960s ($r-x = -2$) and 1970s ($r-x = -2.8$).

even with moderate inflation, interest rates or taxes. Will this gravely impair economic development ? In reviewing the evidence on financial factors in economic development Dornbusch and Reynoso (1989) show that the empirical support for the growth effects of a liberalised financial system is episodic except when asset returns are significantly negative. However, the evidence also shows that inflationary finance acquires very often a dynamics of its own with perverse effects on the development process:

> Latin America today is a striking example of the risks of budget deficits and of earlier excessive reliance on external finance ... financial liberalisation (including the promotion of capital flight at the official exchange rate) in the face of poor fiscal positions continues to be a major factor in accelerating inflation and instability. Dornbusch and Reynoso (1989, p. 209).

Given the apparent lack of control over public finances in Portugal, as illustrated above, Edwards' analysis has obvious implications for the timing and sequencing of the liberalisation of the Portuguese domestic and external financial sectors, whether or not we believe that the financial repression model provides an adequate description of the Portuguese economy.[12] Portugal should use the transitional period until 1996 to improve the fiscal position and concentrate on domestic financial liberalisation. Only then should the complete lifting of foreign exchange controls (capital controls) be considered.

12 - A discussion of whether the financial repression model provides an adequate description of the evolution of Portuguese financial system and of its likely effects on the process of development is beyond the scope of this thesis. The main point is that even beginning from financial restriction, liberalisation will have important implications for public finance.

2.1.2 - The real exchange rate and the sequencing of real and financial external liberalisation

Let us assume next that the fiscal position is under control and that the domestic financial system is already liberalised. We can focus our attention now on the question of sequencing external liberalisation. The opening up of the capital account will tend to generate important capital inflows. These are long-term non-speculative capital movements motivated by the international differences in the real returns to capital. Developing countries, or more generally countries where capital is the scarce factor of production, will tend to be capital importing countries. An important point made by Edwards is that the initial flow of capital following the liberalisation of the capital account will be above the long-term or steady-state capital flow, that is, there will be an overshooting phenomenon.[13] These large capital inflows will tend to appreciate the real exchange rate. Under a fixed exchange rate regime inflationary pressures will tend to develop, at least in the short-run, and a gradual real appreciation of the exchange rate is likely to take place. Under flexible exchange rates the loss in competitiveness can be very sharp and brought forward by nominal exchange rate appreciation. Two important conclusions can be drawn from this analysis. The first is that the opening up of the capital account will generate a loss of competitiveness that can be considered an equilibrium movement. In fact, the loss of competitiveness generates the current account deficit that is matched by the capital

13 - The overshooting phenomenon can be interpreted as the optimal investment choice, in a standard dynamic model of profit maximization, when there are (capital stock) adjustment costs for the firm (see, for example, Beavis and Dobbs (1990, ch.6)). This is not mentioned in Edwards (1984).

account surplus, keeping the balance of payments in equilibrium. The second is that the initial capital inflow is larger than the sustainable (long-run) flow and thus the initial loss in competitiveness is magnified - at least part of the initial real appreciation will have to be reversed.[14]

The opening up of the current account will eliminate import tariffs, quotas and other barriers to trade in goods and services. This should foster the reallocation of resources from the import competing and non-tradables sectors into the exportables sector. The argument for beginning the liberalisation of the external sector with the opening up of the current account has two aspects. The first, is that if the capital account and the current account are liberalised at the same time, the initial real exchange rate appreciation will squeeze profitability in the export sector. This raises the adjustment costs of moving resources into the tradables sector and there might even be an initial expansion of the non-tradables sector with the export sector waiting for the reversal of the trend in the real exchange rate. The other is a welfare, second-best argument. If the capital account is liberalised in the presence of real distortions these will be amplified because part of the imported capital will be invested in the import-substitution

14 - In annex 1 we present an equilibrium model of the real exchange rate due to Stein (1990). The model can be used to derive three propositions relating to the effects of the process of capital market integration similar to those mentioned by Edwards. The first is that there will be a real exchange rate appreciation of the home currency which occurs when the domestic real interest rate exceeds the foreign rate and capital flows into the country. The second is that the real exchange rate might depreciate under the impact of the wealth and productivity effects of capital stock accumulation; even after real interest rates have been equalized there will be capital movements motivated by the international differences in thrift. The third is that in the steady-state capital flows will stop.

sector; there might even be a reduction in welfare as shown by Edwards and Wijnbergen (1986). In conclusion, the correct sequencing of external liberalisation is from 3 to 4 (3 -> 4).

Edwards' analysis on sequencing external liberalisation suggests how Portugal should use the transitional period, until 1996, to full integration in the EC: the capital account should be liberalised gradually, and, preferably, only after the exportables sector had adjusted to the new structure of relative prices. Thus the analysis of this section tends to confirm the previous conclusion on the correct sequencing of financial liberalisation, reinforcing the advisability of delaying the complete opening of the capital account until 1996.

2.1.3 - The real exchange rate and the policy mix

With fiscal adjustment, an early liberalisation of the capital account need not hamper adjustment in the real sector. To understand why we have to introduce the role of short-term speculative capital flows into the analysis. From the Mundell-Fleming model we can derive four results that are important for our discussion on sequencing financial liberalisation and ERM accession.

First, fiscal correction under flexible rates and high capital mobility tends to depreciate the real exchange rate. Fiscal contraction reduces aggregate demand; as a result, output shrinks, imports fall and the balance of trade improves. This tends to appreciate the exchange rate. However, there will be excess supply of money in the economy and thus interest rates decline. This generates a capital outflow that depreciates the exchange rate. With high capital mobility the capital account effect will dominate the trade account effect and therefore the net outcome will be a real devaluation that fosters the reallocation of resources into the exportables sector.

Second, financial external liberalisation tends to appreciate the real exchange rate. External financial liberalisation can be seen as a once-for-all increase in the demand for domestic assets resulting, for example, from the abolition of a capital import tax. There will be excess demand for money which raises interest rates. This generates a capital inflow, appreciates the exchange rate and has a negative effect on the trade balance - it hampers the transfer of resources into the tradables sector.

The first and second propositions combined lead to an important result. If the capital account is liberalised and, simultaneously, there is fiscal contraction, anything can happen. With decisive action on the fiscal side the net effect can be a gradual real depreciation of the home currency from one steady-state to the next, financial liberalisation notwithstanding. This will foster the transfer of resources into the tradables sector.

Third, fiscal contraction shrinks output, both under fixed and flexible rates, but the output effect is amplified under fixed rates. The money supply is endogenous under pegged rates. To fix the exchange rate at the initial level the quantity of money must contract in order to balance the excess supply generated by the fiscal contraction. In the pegged rates case the capital outflow (if it is not sterilized) reduces the money stock. As a result the interest rate does not change, nor does the exchange rate, and output is reduced by the full amount of fiscal contraction because there is no crowding-in (increase in net exports).

Fourth, financial liberalisation shrinks output only in the flexible rates case. To fix the exchange rate at the initial level the (endogenous) quantity of money must expand in order to balance the excess demand generated by the liberalisation. In the pegged rates case the capital inflow (if not sterilized) expands the money stock. As a result, the interest rate does not change, nor does the exchange rate, and output is not reduced. There is no crowding-out of net exports.

Propositions three and four lead to another important conclusion. When fiscal correction is needed[15], pegging the exchange rate should be avoided. However, if the domestic financial system has been liberalised and the fiscal position is under control, fixed rates seem to be the most appropriate choice when the country is liberalising the capital account, in particular, if the current account has already been opened up.

15 - The need for fiscal correction is related to our previous discussion on financial liberalisation.

2.2 - Deficits, Seigniorage and Inflation

To further understand the links between fiscal-domestic financial reforms and external financial liberalisation we discuss in this section the implications for debt accumulation and inflation of different expectations about the future prospects for fiscal reform. We review the important link that exists between the choice of an exchange rate regime and fiscal policy, along the lines set out in Fischer (1982) and also the need for close coordination between budgetary and monetary policy under fixed exchange rates, along the lines suggested by Sargent and Wallace (1981). The theoretical arguments reviewed in this section can be derived within a relatively simple theoretical framework suggested by Blanchard and Fischer (1989) as follows.

$$M/(P.y) = L(r+\pi) \tag{3}$$
$$d = g_o + r.b \tag{4}$$
$$(dM/dt)/Py = \alpha.d \tag{5}$$
$$db/dt = (1-\alpha).d \tag{6}$$

where y is real income, M is money, P is the price level, π is the rate of inflation and d is the ratio of the government deficit to income.

Equation (3) represents monetary equilibrium. The demand for money is an increasing function of real income and a decreasing function of the nominal interest rate. The nominal interest rate is equal to the sum of the real interest rate with the expected inflation rate where perfect foresight is assumed: $L'(.)<0$. It is assumed that the inflation tax $[\pi.L(.)]$ is increasing in π for $\pi<\pi'$ and decreasing in π for $\pi>\pi'$. This means that the graph of seigniorage revenue against the inflation rate has the Laffer curve property.

Equation (4) states that the deficit of the government as a ratio of income is equal to the primary deficit (g_o) plus the interest payments on the debt both as a ratio of income. It is assumed that the primary deficit is constant. For simplicity the real growth rate of income is set equal to zero (x=0). Assuming the NPG condition (r>0) it follows immediately that the intertemporal constraint (2) is violated unless the government collects in the future a sufficiently large amount of seigniorage - otherwise a constant primary deficit would imply an explosive path for b.

Equations (5) and (6) show how the government finances the deficit: a share of α by printing money and a share of $(1-\alpha)$ by borrowing.

By differentiating (3) with respect to time and substituting in (5), and by substituting (4) into (6), we get the following system for the dynamics of debt and inflation:

$$db/dt = (1-\alpha).[g_o + r.b] \tag{7}$$
$$d\pi/dt = [1/L'(.)].[\alpha.(g_o + r.b) - \pi.L(.)] \tag{8}$$

which can be re-written in matrix form as:

$$\begin{bmatrix} db/dt \\ d\pi/dt \end{bmatrix} = A \begin{bmatrix} b \\ \pi \end{bmatrix} + C \tag{9}$$

where:

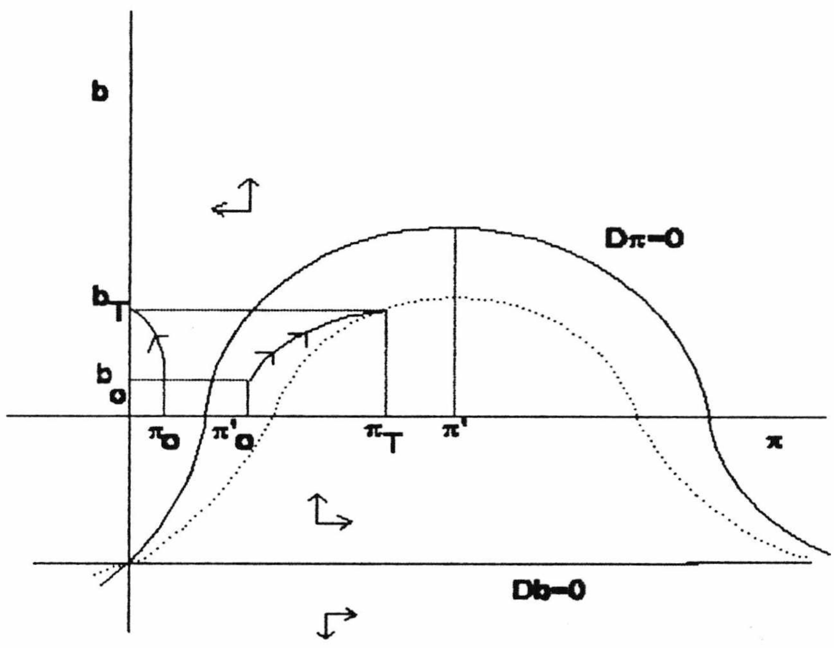
$$A = \begin{bmatrix} (1-\alpha).r & 0 \\ \alpha.r/L'(.) & -L(.)/L'(.) \end{bmatrix} \quad \text{and} \quad C = \begin{bmatrix} (1-\alpha).g_o \\ \alpha.g_o/L'(.) \end{bmatrix}$$

It can be easily checked that Det A>0 and Trace A>0 which confirms that the system is unstable (see Gandolfo (1980)).

Setting Db=db/dt=0 and Dπ=dπ/dt=0 in (9) we get, respectively:

$$b=-g_o/r \tag{10}$$
$$\pi=\alpha.(g_o + r.b)/L(.) \tag{11}$$

Figure 1 - Dynamics of inflation and debt



The phase diagram of the dynamic system is represented in figure 1. Db=0, which corresponds to equation (10), is the locus where the debt-income ratio is constant. If the government does not collect the inflation tax ($\pi=0$) it must be a net creditor to earn sufficient interest to offset the positive primary deficit. The debt-income ratio is increasing (decreasing) above (below) the Db=0 locus. This is shown by the vertical arrows in the phase diagram. $D\pi=0$, which corresponds to equation (11), is the locus where the inflation rate is constant. Along this locus, the inflation tax $[\pi.L(.)]$ is equal to the seigniorage revenue $[\alpha.(g_o + r.b)]$. For low levels of inflation ($\pi<\pi'$) an increase in the inflation rate increases the inflation tax and the seigniorage revenue and thus increases the feasible level of debt. When $\pi=\pi'$ seigniorage is maximized which gives the maximum level of the debt-income ratio consistent with constant inflation. For high levels of inflation

($\pi>\pi'$) an increase in inflation reduces the inflation tax, seigniorage declines and so does the level of sustainable debt. Above (below) the $D\pi=0$ locus inflation is declining (increasing). This is shown by the horizontal arrows in the phase diagram. If the economy does not start at d=0 and $\pi=0$ it will follow a divergent path and we cannot determine the rate of inflation. However, it is reasonable to assume that at some point in time (T) there must be a fiscal reform - either the government will move entirely to money financing of the deficit or it will balance the budget through increased taxes and no longer use seigniorage. And as noted by Blanchard and Fischer it is the expectation of a change in policy that ties down the dynamics of inflation.

Suppose that the government chooses (or is expected to choose) the option of full financing by money creation from t=T onwards. The path of b_t for $0<t<T$ is given by the solution to the differential equation (7) because the dynamic system (9) is recursive. The solution is given by:

$$b_t = -g_o/r + (b_o + g_o/r).\exp[(1-\alpha).r.t] \qquad (12)$$

where b_o is the initial debt-income ratio (t=0). It is clear that knowing r, g_o, b_o and T we can calculate the level of the debt-income ratio at T (b_T) (or, equivalently, if we know the latter we can determine the exact moment of the policy shift).

Now, setting $\alpha=1$ in (7) and (8) we can see that the debt-income ratio stabilizes at time T ($db/dt=0$ for $t>T$) and that the lower (constant) rate of inflation consistent with full financing of the deficit by money creation is given by:

$$\pi_T=(g_o+r.b_T)/L(.) \qquad (13)$$

Having determined (π_T,b_T), knowing r, g_o, b_o and using the condition that the inflation rate must not contain any expected jumps[16] there will be only one trajectory and thus only one initial value of the rate of inflation (π'_o) that set the economy in (π_T, b_T) at t=T. This is illustrated in figure 1 by the non-linear trajectory (π'_o, b_o) -> (π_T, b_T).

Now, consider the case when the government chooses (or is expected to choose) the option of an increase in taxes and no longer use seigniorage after t=T. This means that at t=T the government will run a primary surplus just sufficient to pay the interest on its debt and stabilize the debt-income ratio ($-g_T=r.b_T$ and $\alpha=1$). We know also that $\pi=0$ from T onwards. Knowing r, g_o, b_o and using again the condition that the inflation rate must not contain any expected jumps there will be only one trajectory and thus only one initial value of the rate of inflation (π_o) that set the economy in ($0, b_T$) at t=T. This is illustrated in figure 1 by the non-linear trajectory (π_o, b_o) -> ($0, b_T$).

We can see now how different prospects about future fiscal reform affect the current level of the rate of inflation and the dynamics of debt accumulation and inflation. If the government is expected to shift to complete money financing, inflation will be higher and both the rate of inflation and the debt-income ratio will be increasing until the stabilization takes place. If the government is expected to increase taxation, inflation will be lower and the rate of inflation and the debt-income ratio will move in opposite directions. The debt-income ratio will be increasing and

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16 - If the inflation rate were expected to jump either on the dynamic path or at the moment of the change in policy there would be large and expected capital gains or losses on money holdings, inconsistent with rational behaviour. See Sargent and Wallace (1973).

inflation rate decreasing until the stabilization takes place.

Let us turn now to the likely consequences of financial liberalisation. Within this framework we can think of financial reform as increasing the responsiveness of velocity of circulation (yP/M) to inflation, that is, $L'(.)$ will increase in absolute terms after the financial deregulation. This means that the inflation tax base will be reduced and therefore a higher level of inflation will be needed to extract the same pre-reform amount of seigniorage. Or, to put it differently, the sustainable level of the debt-income ratio at each constant level of inflation will be reduced. Thus, after the financial reform the locus $D\pi=0$ will shift downwards. The important consequence is that if the government chooses the option of full financing by money creation along with financial deregulation, inflation will be higher, not only in the future (higher than π_T at T) but also in the present (higher than π'_o at t=0).

This framework can also be used to illustrate the important link between the choice of an exchange rate regime and fiscal policy, along the lines set out in Fischer (1982); and to exemplify the need for close coordination between budgetary and monetary policy, along the lines suggested by Sargent and Wallace (1981).

In the steady-state of financial repression considered by McKinnon and Mathieson the authorities follow a passive crawling-peg exchange rate policy[17] which can be represented as

$$De = de/dt = \pi - \pi^* \qquad (14)$$

where e is the log of the nominal exchange rate, defined as the

17 - The idea is to keep the real exchange rate path as predictable as possible and to prevent major departures from relative purchasing power parity in order to avoid any destabilizing cycles of overvaluation and undervaluation and balance of payments crisis.

domestic currency price of foreign currency; accordingly a continuous increase in e (De>0) means a depreciating currency. π^* denotes the foreign rate of inflation. Setting foreign inflation equal to zero, for simplicity, there must a one-to-one correspondence between the rate of the crawl and the rate of inflation, keeping the real exchange rate stable ($de/dt=\pi$). In that case figure 1 shows the dynamics of the rate of the crawling peg and debt.

Suppose that the government announces that a change in the exchange rate regime will occur at t=T, from crawling to pegging. Let us call it the option of fixing the exchange rate (De=0 from t=T onwards). If that choice is to be credible it is clear, from figure 1 and the discussion above, that it must be equivalent to the choice of an increase in taxes at t=T - any other option would involve a positive rate of inflation and thus a continuous depreciating exchange rate. Or, to put it differently, by announcing that the exchange rate will be pegged at t=T the government precommits itself to increase taxation in the future and no longer use seigniorage from t=T onwards. Inflation will be lower and during the transition, the debt-income ratio will be increasing and the rate of the crawl will be gradually decreasing (along with inflation). The case for (benefit of) a national money (a managed exchange rate regime), put forward by Fischer, arises precisely from the collection of seigniorage by the government which allows the financing of the budget without the need to resort to distortionary taxation.

Consider now the case where the government and the monetary authority are two separate entities. Suppose that fiscal policy is dominant, that is, the government sets fiscal policy independently of monetary policy and that the latter must eventually conform.

Furthermore, assume that there is some definite limit to the amount of government debt that the public will hold as a proportion of income, say b_T. Let us start from a situation (t=0) of zero inflation-zero debt, (0,0) in figure 1. If the government runs a constant primary deficit (g_o) and the monetary authorities "keep money tight" (α=0) the economy will follow an upward path on the b axis like (0,0) -> (0,b_T). In reaching the maximum level of the debt-income ratio that the public is willing to tolerate the monetary authorities will have to set α=1 accommodating the full financing of the deficit by money printing: the economy will have to move to (π_T,b_T). Thus, tight money now implies inflation later. However, as we have seen, there must be no expected jump on the rate of inflation - the economy cannot jump to (π_T,b_T) at t=T. Therefore the economy cannot start at (0,0) at t=0 - it must start from a positive rate of inflation ($\pi''_o<\pi'_o$ to the right of the Dπ=0 locus) such that it reaches (π_T,b_T) at t=T. Thus, tight money now implies inflation now.[18] This is of course the unpleasant monetarist arithmetic of Sargent and Wallace. This example shows that if the monetary authority is committed to pegging the exchange rate, tight money alone is not sufficient. There must be a close coordination of monetary and fiscal policies. Another possible solution would be giving full autonomy to a monetary authority committed to price stability[19] - in this case the government would be forced to increase taxes at t=T.

Finally, it should be mentioned that the solution to high

18 - It means also that the monetary authorities cannot, in fact, set α=0.

19 - The incentives for the monetary authorities to tie their hands during a disinflationary process are discussed in chapter 5.

public debt has a political dimension because it is likely to involve income and wealth redistribution. Alesina (1988) argues that the solution chosen by the government to the debt problem is the result of the political struggle between social groups and their political representatives. The political economy of public debt accumulation comes into motion when there are alternative solutions and conflicting social preferences. On the one hand, there are basically four options to solve the debt problem: to default, to introduce a capital levy, to generate inflation and to create surpluses by reducing expenditures and/or by increasing taxes. On the other hand, there are three main groups in the society which have conflicting preferences in so far as the solution of the debt problem is concerned: rentiers, the holders of the debt, businessmen, the holders of physical capital, and workers, the holders of human capital. Each party's first preference is of course for taxation of the other parties: rentiers and businessmen oppose taxes on wealth and physical capital, and oppose progressive taxation. Workers oppose indirect taxation on necessary goods (those in workers' consumption basket) and income taxation (although they may favour progressive income taxes). When one group has enough political control, it imposes the burden of the debt on the other side. According to Alesina the key to the solution of the debt problem is the emergence of a stable political situation which is defined as a situation when one political side has a solid majority and controls economic policy decisions and/or there is a low level of polarization between political parties. In an unstable political situation a fiscal deadlock is likely to emerge because each group is strong enough to block explicit taxes on itself but has not the power to impose explicit taxes on the others. Thus in this case public debt grows and so does the likelihood of monetization and inflation. Furthermore, as Alesina notes, political instability has in general negative effects on entrepreneurs' expectations and may generate capital flight and exchange rate depreciation - an additional channel to inflationary pressure. The interesting point is that some groups may have a second (or even first) preference for inflation as a mean of eroding the real value of the outstanding debt. Businessmen may prefer inflation over taxation if there is a lag between price and wage adjustments and if nominal exchange rate depreciation shelters the export and import competing sectors from a loss of price competitiveness. Workers may well prefer to live with inflation if there are some employment gains when real wages fall. Rentiers will always oppose inflation.

In the debt-inflation model of Blanchard and Fischer it is the expectation of a change in policy that ties down the dynamics of inflation. In the light of Alesina's contribution we can say that the option of full financing by money creation is equivalent to a situation of (expected) continuing political instability whereas the option of tax increases is equivalent to a situation of (expected) political stability. Equivalently, we may say that political stability is perhaps as important as tight money and central banking independence for the credibility of a fixed exchange rate regime.[20] However, as noted by Sargent (1986; p.114), we should

20 - Alesina's review of the European experience in the inter-war period seems to confirm the idea that fiscal correction and fixed exchange rates were achieved only after political stability had been achieved. The conservative (rentiers) solution seems to have prevailed in 1926 in France, under Raymond Poincaré's government, in the 1920's Conservative United Kingdom, and in Italy, under the Fascist regime.

bear in mind that

> it is not in the power of a prime minister or even an united political party to create the circumstances required to bring about a quick and costless end to inflation. Whether or not the stage is set for successfully implementing a significant new policy regime is the result of intellectual and historical forces that individual political figures influence only marginally.

From the discussion in section 2.1 and the arguments reviewed in this section we may conclude that a successful liberalisation of the financial system involves a judicious sequencing, begining with the liberalisation of the domestic financial sector and only then proceeding to the liberalisation of the capital account. But extensive financial liberalisation requires prudence and time because there is the need for fiscal adjustment which might very well be constrained by the political environment of the country.

2.3 - Speculative attacks and collapsing exchange rate regimes

A country that opens up the capital account, pegs the exchange rate, and, having relied heavily on seigniorage revenues to finance the budget, does not engage in any substantial fiscal reform, will be prone to balance of payments crisis. The causes and effects of speculative attacks on fixed exchange rate regimes are recurrent topics in the international finance literature.[21] However, formal models of such crisis have been proposed only very recently, beginning with the seminal article of Krugman (1979). These models provide a useful benchmark to start thinking about the problems facing countries that engage in external financial liberalisation without fiscal correction.

2.3.1 - The basic model

Essentially, formal models of balance of payments crisis are extensions of the monetary approach to the balance of payments and exchange rate determination. In this section we present the basic insights of the theory, which are derived within a common framework, and develop a model to study the dynamics of the exchange rate when the authorities announce a currency band. This target zone model emerges directly from the speculative attack models and can be interpreted as a useful synthesis of the literature. The structure of the models reviewed in this section is relatively simple. This facilitates the exposition of the techniques used in solving the

21 - See, for example, Yeager (1968) and Einzig (1970).

models, which have a much wider application.[22]

We consider a simple monetary model of an open economy as presented in Flood and Garber (1984)[23]

$$M/(P.y) = a_0 - a_1.i \qquad (15)$$
$$M = R + C \qquad (16)$$
$$dC/dt = \mu \qquad (17)$$
$$P = E.P* \qquad (18)$$
$$i = i* + (dE/dt)/E \qquad (19)$$

where M is money, P is the price level, y is real income, i is the nominal interest rate, R is the level of foreign exchange reserves, C is domestic credit, E is the nominal exchange rate defined as the domestic currency price of foreign currency, dx/dt denotes the time derivative of a variable, the star (*) denotes foreign variables and a_0, $a_1>0$ are parameters. Time subscripts are omitted for simplicity.

Equation (15) represents monetary equilibrium. For a constant level of real income (y=1) the demand for real money is a linear(ized) function of the nominal interest rate.[24] Equation (16) defines the stock of nominal money as the sum of foreign exchange reserves and domestic credit. Equation (17) states that domestic credit grows at a constant rate. Equation (18) and (19) impose purchasing power parity and uncovered interest rate parity, respectively. Using (18) and (19) in (15) we obtain

$$M_t = \beta.E_t - \gamma\, dE_t/dt \qquad (20)$$

where

$$\beta = a_0.P* - a_1.i*.P* > 0 \quad \text{and} \quad \gamma = a_1.P* > 0$$

β and γ are constants if we assume that P* and i* are constant.

22 - In annex 2 we discuss the techniques used and present the formal derivation of the results. The same techniques are applied in chapter 5 within a more general theoretical framework.

23 - This model can be interpreted as an open economy extension of Blanchard and Fischer's model in the case of full financing of government expenditures by money creation (α = 1).

24 - Equation (15) can be interpreted as the linear terms of a Taylor series expansion of equation (3) for values of ao, a1 and i such that ao - a1.i > 0.

This model can be solved under different exchange rate regimes. First we solve the model when the exchange rate is floating. Assuming instantaneous asset market clearing set dR/dt = 0, and, using (16) and (17) in (20) obtain

$$dE_t/dt - (\beta/\gamma).E_t = -(1/\gamma)(C_o + \mu.t) \quad (21)$$

where C_o is a constant (initial level of domestic credit); we set $R_o=0$ (initial level of reserves) for convenience. The solution to the differential equation (21) is given by

$$E_t=[E_o-\mu.\gamma/\beta^2-C_o/\beta].\exp[(\beta/\gamma).t] + \mu.\gamma/\beta^2+C_o/\beta+(\mu/\beta).t \quad (22)$$

where E_o is the initial value of E_t.

The path of the exchange rate under floating is given by equation (22) and we see that it can be expressed as the sum of two components: an exponential term and a linear term. In the literature on exchange rate and asset price determination the former is termed bubble and the latter fundamentals.[25] It is important to note that the path of the exchange rate under floating is indeterminate, or, put differently, to find a non-explosive solution to equation (20) we must impose either an initial condition (E_o) or a terminal condition. To rule out the occurrence of bubbles, and following a common procedure, we impose the initial condition

$$E_o = \mu.\gamma/\beta^2 + C_o/\beta \quad (23)$$

and by substitution in (22) we get

$$\hat{E}_t = E_o + (1/\beta).\mu.t \quad (24)$$

25 - The exponential term reflects the basic indeterminacy of asset pricing models with rational expectations. To understand this, note that, in equation (20) the price level (Et) depends on its fundamental determinant, monetary policy (Mt), and on asset returns (dEt/dt) and the latter will be self-fulfilling under rational expectations. This implies that there are an infinite number of admissible solutions to equation (20).

$$Et = (1/\beta).Mt + (\gamma/\beta).dEt/dt \quad (20)$$

See, for example, Flood and Garber (1982) and Obstfeld and Stockman (1985).

The (linear) path of the exchange rate under floating given by equation (24) depends only on the rate of growth of domestic credit (μ) and on the parameters of the demand for money (β and γ). Thus, in this case, we can say that the exchange rate is determined only by fundamentals.

We turn now to the solution of the model under pegged exchange rates. If $E_t = E_{peg}$ then $dE/dt = 0$ and by substitution in equation (20) we must have

$$M_t = \beta . E_{peg} \tag{25}$$

From (16) using (17) and (25) we have

$$R_t = \beta . E_{peg} - (C_o + \mu . t) \tag{26}$$

From equation (26) we can see that unless $\mu = 0$ foreign exchange reserves will be declining over time. It can be easily checked that at $t = R_o/\mu$ ($R_o = \beta . E_{peg} - C_o$) reserves will be exhausted and the exchange rate must float. At that moment demand for money falls (the interest rate increases) and monetary equilibrium must be achieved through a discrete reduction in the level of real balances brought about by a discrete devaluation of the currency. This implies the prospect of (expected) massive capital losses on assets denominated in domestic currency which must generate a run on the reserves of the central bank before they are totally exhausted, say at $t = T' < R_o/\mu$.

To determine the exact moment of the speculative attack we set

$$E_{peg} = \mu . \gamma/\beta^2 + C_o/\beta + (1/\beta) . \mu . T' \tag{27}$$

We can solve equation (27) to find the moment of the run

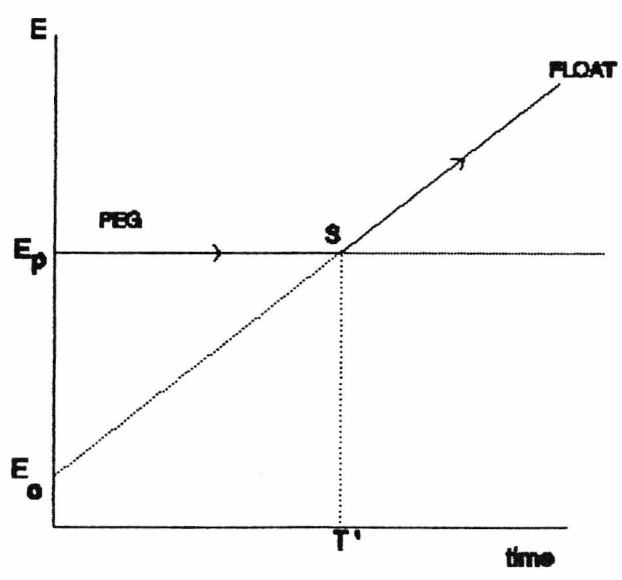
$$T' = R_o/\mu - \gamma/\beta \tag{28}$$

and use (26) to determine the amount of reserves lost by the central at the time of the attack

$$R_{T'} = \mu . \gamma / \beta \qquad (29)$$

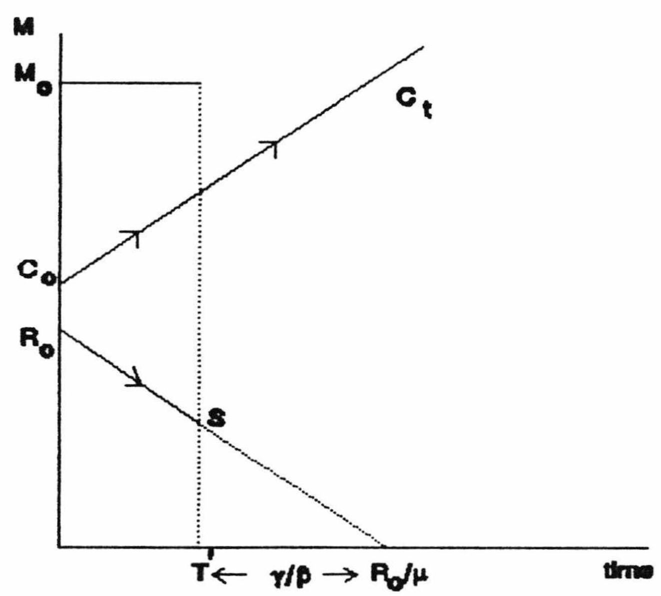
Equation (27) states that at the moment of the regime switch there must be no jump in the level of the exchange rate. Thus, at the time of the run, the level of the pegged exchange rate (on the left hand side of (27)) must be equal to the value of the floating rate given by the fundamentals (on the right hand side of (27)). Using this condition we determine the moment of the speculative attack. As illustrated in figure 2 the moment of the run (T′) is determined by the intersection of the "floating path" with the "pegging path" at S. From equation (28) we can see that as is intuitively plausible a larger initial volume of foreign exchange reserves (R_o) and a smaller rate of growth of domestic credit (μ) delay the moment of the run.

Figure 2 Determining the moment of the speculative attack



Equation (29) and the discussion above show that in the case of the speculative run monetary equilibrium is achieved through a discrete reduction in the money stock, equal to the amount of reserves lost, and not through a discrete increase in the level of the exchange rate. As illustrated in figure 3, the speculative attack occurs at $t = T'$ before reserves are exhausted, which would have occurred at $t = R_o/\mu$ without the run. Before T' the money stock is constant (M_o) but its composition is changing: domestic credit is increasing and foreign exchange reserves are decreasing. At the moment of the run the existing stock of foreign exchange reserves is depleted and the money stock declines by the amount of the reserve drain ($-\mu.\gamma/\beta$). Thereafter $M_t = C_t$ as $R_t = 0$.

Figure 3 The timing and the magnitude of the run on the foreign exchange reserves



2.3.2 - Borrowing to defend the parity

Buiter (1987) extends Flood and Garber's model by considering the possibility of borrowing to defend the parity.[26] In this extension of the model the authorities engage in one act of (foreign) borrowing at time t_b. At this date there is a stock-shift reduction in the stock of domestic credit and an equal increase in the stock of foreign exchange reserves and in the stock of interest-bearing public debt. After the open market sale no further borrowing occurs and it is assumed that reserves are non-interest bearing assets.[27] Allowing explicitly for the government budget constraint and in particular for the interest cost of servicing the public debt and using the monetary authority's balance sheet we have (see equations (4), (5) and (6)).

$$dC/dt + E_{peg}.dB^*/dt = G_t + i^*.E_{peg}.B^*_t \qquad (30)$$

where B* is the stock of government debt and G is the primary deficit. Equation (30) states that the government deficit, equal to the primary deficit (G) plus interest payments on the outstanding stock of debt ($i^*.E_{peg}.B^*$), is financed either by domestic credit expansion (dC/dt) or foreign borrowing ($E_{peg}.dB^*/dt$). Foreign debt and

26 - Obstfeld (1984) considers the case where the central bank, faced with a speculative attack, withdraws from the foreign exchange market temporarily and repegs the exchange rate at a higher level after a transitional period of floating. In this extension of Flood and Garber's model, the balance of payments crisis will lead to a devaluation rather than a permanent abandonment of the fixed exchange rate regime. If the transitional period of floating is neither too large nor too short the moment of the run is postponed when compared to the timing of the run in the simplest case and there is a capital inflow when the central bank repegs the currency because the domestic interest rate declines (and inflation stops).

27 - The assumption of zero yielding foreign exchange reserves is not crucial and is made only for convenience. What is important for the results to be derived is that there must be some opportunity cost for the government of holding foreign exchange reserves.

borrowing are expressed in domestic currency at the current level of the (pegged) exchange rate. Note that if there is no foreign borrowing and the primary deficit is constant ($G_t = \mu$), equation (30) becomes equation (17).

The open market operation or act of foreign borrowing at time t_b can be formalized as

$$B*_t = B*.u_a(t) \tag{31}$$

where $u_a(t)$ is the unit step function

$$u_a(t) = 0 \text{ if } t < a = t_b$$
$$u_a(t) = 1 \text{ if } t \geq a = t_b$$

This specification allows us to solve differential equation (30) to find the path of domestic credit and (implicitly) the path of foreign exchange reserves when borrowing occurs at time t_b.[28] The solution is

$$C_t = C_o+\mu.t-E_{peg}.B*.u_a(t)+i*.E_{peg}.B*.u_a(t).(t - t_b) \tag{32}$$

The interpretation of equation (32) is straightforward. First, consider the case when borrowing does not occur. Setting $B* = 0$ we get $C_t = C_o + \mu.t$ which corresponds exactly to the path implicit in equation (17), the path of domestic credit considered in the previous examples. Second, setting $u_a(t) = 0$ we can see that the path of domestic credit before the open market operation ($t < t_b$) is the same as in the no borrowing case. Third, setting $u_a(t) = 1$ we get the path of domestic credit after the open market sale ($t \geq t_b$)

$$C_t = C_o - E_{peg}.B* - i*.E_{peg}.B*.t_b + (\mu + i*.E_{peg}.B*).t \tag{33}$$

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28 - Note that because we have $dB*/dt = \infty$ at $t = tb$ the Laplace transform is the most convenient method to solve the differential equation (30). This method is most powerful in solving continuous time models where the policy variable is expressed in rate of change and where the basic policy experiment is expressed in terms of a discrete increase in the policy variable. For an application see Ambler (1987).

From equation (33) two conclusions emerge. First, we confirm that at the date of the open market operation domestic credit is reduced by the amount of the borrowing ($-E_{peg}.B^*$). This is the stock-shift effect. Second, we can see that after the open market sale the rate of domestic credit expansion will be higher than it would have been without the borrowing because of the debt service component in the public sector deficit, assuming that the primary deficit remains constant ($\mu + i^*.E_{peg}.B^* > \mu$). This is the interest-debt effect. For further reference note that

$$C_{t_b} = C_o + \mu.t_b - E_{peg}.B^* \tag{34}$$

and rewrite (33) as

$$C_t = C_{t_b} + (\mu + i^*.E_{peg}.B^*).(t - t_b) \tag{35}$$

To determine the effect of borrowing on the timing of the collapse we follow the method used in solving the previous examples. First, we determine the path of the exchange rate under floating when domestic credit is driven by (32).[29] As the path of credit before the open market operation is the same as in the case of no borrowing, the path of the exchange rate for $t < t_b$, ruling out the occurrence of bubbles, is given by equations (23) and (24). Furthermore, the problem of finding the path of the exchange rate after time t_b is similar. Thus, for $t \geq t_b$, we have from (22), by analogy

$$E_t = \{ E_o - (\mu+i^*.E_{peg}.B^*)\gamma/\beta^2 -$$

$$- [C_{t_b} - (\mu+i^*.E_{peg}.B^*).t_b]/\beta \}.\exp[(\beta/\gamma).t] +$$

$$+(\mu+i^*.E_{peg}.B^*).\gamma/\beta^2+C_{t_b}/\beta+(\mu+i^*.E_{peg}.B^*).(t-t_b)/\beta \tag{36}$$

---

29 - As in Buiter's original analysis we ignore the second order effects of exchange rate changes, under floating, on the value of the stock of debt and interest payments.

To rule out the occurrence of bubbles we impose the initial condition

$$E_o = (\mu+i^*.E_{peg}.B^*)\gamma/\beta^2 + [C_{t_b} - (\mu+i^*.E_{peg}.B^*).t_b]/\beta \qquad (37)$$

and by substitution in equation (36) we get the path of the exchange rate given by the fundamentals

$$E_t=(\mu+i^*.E_{peg}.B^*).\gamma/\beta^2+C_{t_b}/\beta+(\mu+i^*.E_{peg}.B^*).(t-t_b)/\beta \qquad (38)$$

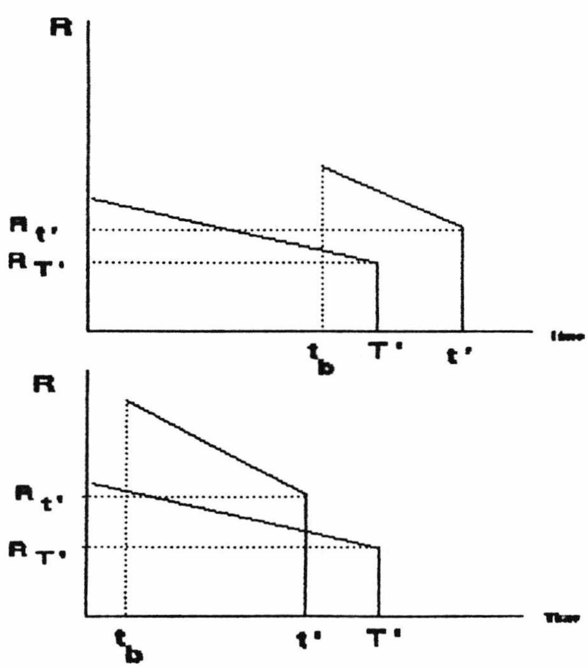
Next, we set $E_t = E_{peg}$ in equation (38) to find the moment of the speculative attack (t′)

$$(t' - t_b) = \frac{R_o - \mu.t_b + E_{peg}.B^*}{\mu + i^*.E_{peg}.B^*} - \frac{\gamma}{\beta} \qquad (39)$$

Borrowing will postpone the speculative run if $t' - T' > 0$. From (39) after some algebraic manipulation we have

$$t' - T' > 0 \iff T' - t_b < 1/i^* - \gamma/\beta \qquad (40)$$

Figure 4 Borrowing to defend the parity and the timing and magnitude of the run



Thus, as noted by Buiter, the effect of borrowing on the timing of the collapse is ambiguous. As illustrated in figure 4 if the open market sale occurs just before the exchange rate regime would have collapsed without the borrowing the collapse is postponed. If borrowing occurs long enough before the moment the pegged regime would have collapsed without the borrowing, the run is brought forward. This ambiguity provides an open economy illustration for Sargent and Wallace's unpleasant monetarist arithmetic - the act of borrowing increases the level of reserves now at the cost of a higher rate of reduction in the stock of reserves, until the fixed exchange rate regime collapses. If the latter (interest-debt) effect dominates the former (stock-shift) the run will occur before the date it would have occurred absent borrowing.

Finally, the magnitude of the run on the reserves is given by

$$R_{t'} = \mu\gamma/\beta + i^*.E_{peg}.B^*.\gamma/\beta \qquad (41)$$

Comparing equations (29) and (41) we can see that the amount of reserves lost by the central bank at the time of the run is larger when there is borrowing.

Two main conclusions emerge from this analysis. The first is that without fiscal correction borrowing too soon may hasten the run on the reserves. The second is that timely borrowing to defend the parity may buy time to implement the necessary adjustment in the fundamentals.

2.3.3 - Announcing a currency band

We turn now to the analysis of a currency band deriving a target zone model that emerges from the speculative attack models previously reviewed. Suppose the authorities announce at time t_a

that thereafter the exchange rate will be kept within a band; that is, the authorities establish an upper and lower limit for all future levels of the exchange rate ($E_{low} \leq E_t \leq E^{up}$). We assume that before the announcement the exchange rate is floating and thus is following the linear path given by the fundamentals (equations (23) and (24)). As illustrated in figures 5 and 6 the dynamics of the exchange rate after the announcement depends on how the upper and lower limits will be defended and whether or not the band will be allowed to slide. If the exchange rate continues on the linear track (F), assuming no change in the fundamentals, it will reach the upper edge of the band at a certain moment (point B in figure 5, time t_b). At that moment the authorities will have to intervene to defend the parity. They have four basic options to carry out the intervention, each one having different consequences for the future path of the exchange rate and reserves. The first option is to defend the upper edge of the band by committing the whole stock of reserves; the second is to defend the upper edge but devalue the currency when reserves reach a certain threshold; the third option is to borrow and defend the upper edge of the band, and the fourth is to borrow, defend the band for a brief moment and then withdraw from the foreign exchange market.

If the authorities commit the whole stock of foreign exchange reserves to defend the upper edge, the complete stock will be immediately lost. To understand why, recall our earlier result on the timing of the run - in fact, a speculative attack at a later moment would involve anticipated capital losses inconsistent with perfect foresight and rational behaviour (see point S in figure 2). Nevertheless, such an extreme event can be prevented if the authorities do not commit the whole stock of reserves to defend the parity and let the currency float temporarily. However, this policy option would mean that the authorities were not committed to defend the fixed currency band - and the announcement could not be credible in the first place. Alternatively, if the authorities engage in a timely open market sale, borrowing to defend the upper edge of the band will postpone the run. However, without any change in the fundamentals there will be a run on the reserves and eventually the currency band will have to slide upwards. In this case the band will have destabilizing[30] effects as illustrated in figure 5. In fact, although the run will be postponed from t_b to t', with the length of the fixed exchange rate period $(t' - t_b)$ being given by equation (39), after the run the exchange rate will follow the linear path F', given by equation (38), instead of path F meaning that it will have to depreciate at a faster rate than it would have absent the band. Finally, another option is to announce that if the exchange rate reaches the upper edge of the band the authorities will engage in one act of borrowing to defend the fixed band and withdraw from the foreign exchange market. This policy means that the authorities will borrow to defend the upper level of the band, but, at the same time, they will either not fix the parity or do it only for a brief (infinitesimal) time interval. In this case the currency band will have a stabilizing effect as illustrated in figure 6.

To understand the stabilizing effect, recall that the exchange

30 - By destabilizing (stabilizing) effect we mean that, eventually, with the announcement of the currency band the exchange rate will have to depreciate at a faster (slower) rate than it would have to depreciate without the announcement of the band.

rate path under floating, when the authorities borrow at time t_b is given by equation (24) if $t < t_b$ and by equation (38) if $t \geq t_b$

$$E_t=\mu.\gamma/\beta^2 + C_o /\beta + (\mu/\beta).t \quad \text{if } t < t_b \tag{24}$$

$$E_t=(\mu+i^*.E_{peg}.B^*).\gamma/\beta^2+C_{t_b} /\beta+(\mu+i^*.E_{peg}.B^*).(t-t_b)/\beta \quad \text{if } t \geq t_b \tag{38}$$

The important point to make here is as follows. If the authorities borrow at time t_b and simultaneously withdraw from the foreign exchange market, the exchange rate path will shift downwards and there will be at that moment a capital loss for the holders of foreign assets. As this is perfectly foreseen from the date of the announcement, the exchange rate cannot continue on the linear path F after that date. In fact as soon as the news hit the market the exchange rate must jump into the non-linear path illustrated in figure 6. What ties down the dynamics of the exchange in this case is, again, the general condition that there must not be any anticipated capital gain or loss: but we must add a specific condition applicable only to this case - the new trajectory must be tangent to the upper edge of the band.

To justify the tangency condition we must look at what would happen if the exchange rate did not follow that path. First, note that, if the exchange rate follows any trajectory that crosses the upper edge, the authorities will intervene at some point implying perfectly anticipated capital losses for the holders of foreign assets. Second, if the exchange rate follows a non-linear path, that, although not crossing the upper edge is not the tangent trajectory, there will be excessive capital losses at the moment of the announcement, losses that can be avoided by choosing the tangent trajectory. Thus, the tangency condition implies the elimination of any capital gain or loss when the exchange rate reaches (touches) the upper edge and ensures the minimization of the unexpected capital gain or loss at the date of the announcement.

Accordingly, with the target zone and the policy of instantaneous borrowing at the margin, the exchange rate will follow the path given by equation (24) if $t < t_*$, and the path given by equation (22) if $t > t_*$, where the initial condition (E_o) is determined by the tangency condition, $dE/dt = 0$ at $t = t*$ such that $E_{t*} = E^{up}$ (see equation (37)). That is

$$E_{t*}=(E_o-\mu\gamma/\beta^2-Co/\beta).\exp[(\beta/\gamma).t*]+\mu.\gamma/\beta^2+C_o/\beta+(\mu/\beta).t*=E^{up} \quad (42)$$

$$dE/dt=0\Big|_{t=t*}\Leftrightarrow(\beta/\gamma).(E_o-\mu\gamma/\beta^2-Co/\beta).\exp[(\beta/\gamma).t*]+(\mu/\beta)=0 \quad (43)$$

Solving the system of equations (42) and (43) we get

$$t* = (\beta.E^{up}-C_o) / \mu \quad (44)$$

$$E_o = \mu\gamma/\beta^2 + C_o/\beta - (\mu\gamma/\beta^2).\exp[-(\beta/\gamma).t*] \quad (45)$$

Using (45) in (22) we get the path of the exchange within the target zone, that is for $t > t_*$

$$\tilde{\tilde{E}}_t = -(\mu\gamma/\beta^2).\exp[(\beta/\gamma).(t-t*)] + \mu\gamma/\beta^2 + Co/\beta + (\mu/\beta).t \quad (46)$$

or

$$\hat{E}_t - \tilde{\tilde{E}}_t = (\mu\gamma/\beta^2).\exp[(\beta/\gamma).(t-t*)] \quad (47)$$

where $\hat{E}_t$ is the path given by the fundamentals, in the absence of the band.

The important point made by equation (47) is that the authorities will manage the exchange rate (i.e. keep it within the target zone) without any actual intervention, borrowing or immediate change in the fundamentals. In fact, we can say that announcing a currency band generalizes Buiter's argument that timely borrowing to defend the parity buys time to implement the necessary adjustment in the fundamentals. Eventually, there must be a change in the fundamentals even in the currency band model (in the case of stabilizing effects); from figure 6 we can see that the change in fiscal policy must occur not later than the moment the exchange rate reaches the lower edge of the band.[31] Thus, the currency band buys time to adjust the budget with the advantage of not involving actual borrowing: it avoids an early fixing of the parity without eliminating the incentives to act on the fundamentals.

31 - The authorities will have to intervene to fix the parity at Elow. Without a future change in fiscal policy this level of the exchange rate is not sustainable and a balance of payments crisis situation will develop. This must affect the path of the exchange rate within the band (after the announcement) and will tend to have destabilizing effects.

Figure 5 The destabilizing effect of a currency band

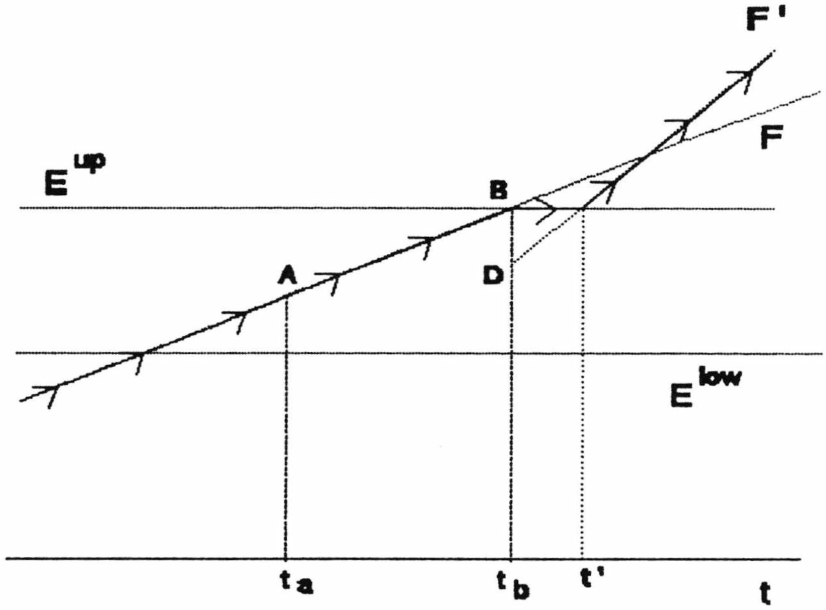
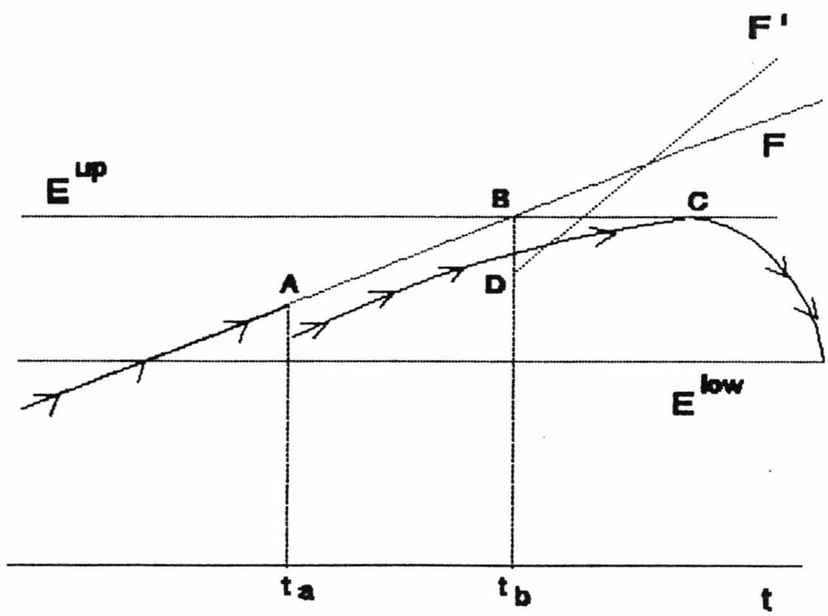


Figure 6 The stabilizing effect of a currency band



2.3.4 - Conclusions on speculative attacks

A country where the government relies heavily on seigniorage revenues to finance the budget is prone to balance of payments crisis, in particular, if it opens up the capital account, pegs the exchange rate, and does not engage in major fiscal reform. With a policy of domestic credit expansion that, ultimately, is inconsistent with the fixed exchange rate regime, foreign exchange reserves will be declining over time and, at a certain moment, will be exhausted. This forces the authorities to switch the exchange rate regime from pegging to floating.[32] In its simplest case the change in regime implies a reduction in the demand for real balances because the domestic interest rate increases (and there is inflation). This means that monetary equilibrium must be achieved through a discrete devaluation of the currency. To avoid capital losses speculators mount a run on the foreign exchange reserves. The speculative attack must occur when foreign exchange reserves are still sufficiently large to allow a smooth transition from pegging to floating. This ensures that monetary equilibrium is achieved through a discrete reduction in the nominal money stock and that the path of the exchange rate will not have any discontinuity. With the possibility of foreign borrowing the options of the authorities are enlarged. This might be important when the authorities need time for fiscal adjustment because the attack will be postponed if borrowing occurs just before the run would have occurred in the absence

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32 - The basic monetary model of balance of payments crisis can be easily extended to study the transition from a crawling-peg to floating. The crawling-peg regime will colapse when the rate of growth of domestic credit is inconsistent with the rate of the crawl in a way that is similar to the collapse of a fixed exchange rate regime. See Connoly and Taylor (1984) and Connoly (1986).

of borrowing. But the authorities may also announce a currency band. The dynamics of the exchange rate within the band is a non-linear combination of fixed and flexible rates. If time is needed for decisive action on the fiscal side, keeping the exchange rate within a band seems preferable to fixing the parity through borrowing because it avoids an early fixing of the parity without eliminating the incentives to act on the fundamentals.

The structure of the models reviewed in this section is relatively simple and might be open to criticism. However, the same techniques can be applied to study balance of payments crisis within a more general framework without changing the basic insights. For example, Obstfeld (1988) uses the analytical framework provided by the overshooting model of Dornbusch (1976).[33] With sticky output prices there might be deviations from purchasing power parity. Within this framework an expansionary fiscal policy[34], under fixed exchange rates, will tend to generate excess output demand and inflation, which appreciates the currency in real terms. The loss in competitiveness crowds-out net exports and eventually restores output-market equilibrium. The scenario considered by Obstfeld is

33 - Penati and Pennacchi (1989) use an intertemporal capital asset pricing model to derive a balance of payments crisis model. Their analysis is based on explicit optimizing behaviour and allows for uncertainty. The basic insight of the simple monetary model remains: the fixed exchange rate regime collapses because the domestic credit policy is inconsistent with the exchange rate level. However, the approach to the crisis differs in two main points. First, the run on reserves does not occur abruptly and there will be a period of reserve losses in excess of domestic credit creation. Second, the forward premium tends to increase well before the collapse of the regime. These results can also be derived in discrete time monetary models with uncertainty. See, for example, Lizondo (1983), Blanco and Garber (1986) and Cumby and Wijnbergen (1989).

34 - In this case the fiscal deficit is financed through borrowing. Without monetary accommodation the domestic interest rate will rise. The economy is assumed to work at full capacity.

one in which the authorities devalue the currency in an attempt to restore competitiveness. If the expected nominal devaluation is not too large this policy will lead to a speculative attack after a period of rising domestic prices and capital account surpluses, following the fiscal expansion. If the expected devaluation is too large the fiscal expansion sparks an immediate attack. Thus in this case the speculative attack is caused by the prospect of a currency realignment following a loss in competitiveness due to fundamental factors (fiscal expansion). But there is also the possibility of a speculative attack driven entirely by self-fulfilling expectations, that is without any fundamental factor driving it. Such self-fulfilling equilibria are likely to occur when the realignment rule followed by the authorities is one that attempts to restore or enhance price competitiveness. If the realignment rule is one that less than fully offsets past inflation differentials, such self-fulfilling attacks do not occur (only those justified by fundamentals will eventually happen).

Conclusions

In this chapter we have reviewed several theoretical arguments that apply to developing countries which, starting from a situation of high inflation, large fiscal deficits financed by money creation, underdeveloped financial systems, high barriers to international trade and stringent capital controls, engage in extensive real and financial external liberalisation. These conditions describe roughly the state of the Portuguese economy when the country joined the EC in 1986.

A first set of arguments led us to the conclusion that public finances must be under tight control for successful financial liberalisation (internal and external). With financial liberalisation real interest rates rise and the collection of seigniorage is more difficult. Under these circumstances the switch to bond financing of a largely unchanged deficit will eventually lead to monetization and inflation. Pegging the exchange rate will bring more trouble as the domestic currency becomes the target of speculators.

A second set of arguments led us to the conclusion that the current account should be liberalised first and that the opening up of the capital account should proceed gradually. The liberalisation of the capital account appreciates the real exchange which, on impact, tends to undershoot the long-run equilibrium level. This loss in competitiveness squeezes the profitability of the export sector and thus threatens the success of the liberalisation of the current account.

Without fiscal contraction the exchange rate (undershooting) effect of the liberalisation of the capital account will be magnified. Under fixed exchange rates the authorities might be tempted to realign the parity which again brings trouble as the domestic currency becomes the target of speculators.

In chapter 1 and in the introduction to this chapter we emphasized that whilst joining the ERM in the 1990s means, among other things, keeping the exchange rate within fixed narrow bands and the full liberalisation of capital movements, the previous 1979-89 experience of the ERM suggests that realignments and capital controls played an important role in the success of the arrangement.

In the light of the theoretical arguments reviewed in this chapter, the apparent lack of control over public finances in Portugal, the expansionary pressure on the budget during the transitional period to full EC integration, and the overlapping liberalisation of the current account and capital account (long-term capital) suggests caution in moving too quickly towards full liberalisation of the capital account (short-term capital) and fixing the level of the exchange rate.

CHAPTER 2

ANNEX 1:

The Real Exchange Rate and Capital Market Integration

In this annex we present an equilibrium model of the real exchange rate due to Stein (1990). The model is used to derive two possible effects of the process of capital market integration on the real exchange rate. The first is the initial real appreciation of the home currency, which occurs when the domestic real interest rate exceeds the foreign rate. The second is the real depreciation of the domestic currency, which might occur under the impact of the wealth and productivity effects of capital stock accumulation.

The real exchange rate is defined as the sum of two elements - fundamentals plus noise.

$$RER = RER(X) + z \qquad (A1-1)$$

An increase in the real exchange rate means real depreciation, $dRER/dt = dE/dt - (\pi - \pi*)$. Real depreciation can result, for example, from nominal exchange rate depreciation ($dE/dt > 0$) in excess of the domestic-foreign inflation differential ($\pi - \pi*$), or from foreign inflation ($\pi*$). The fundamental equilibrium real exchange rate (RER) is the real exchange rate produced by the fundamentals (X) when capital flows are exclusively long-term non-speculative generated by international differences in productivity and thrift, the economy is producing at capacity, and there is money neutrality. The other elements (z) result from speculative capital flows and short-run non-neutrality of money. The fundamentals are the propensity to spend for consumption relative to saving and the productivity of capital. Capital flows are long-term non-speculative which respond to the fundamentals. Economic agents expectations are that, in the long-run, there is convergence in real interest rates and no trend in the real exchange rate. We present only an intuitive and graphical analysis of the model.

Equations (A1-2) represent goods market equilibrium which can be stated in two ways. Investment (I) less saving (S) plus the current account (CA) sum to zero, equation (A1-2a), or absorption (A) less (GNP), plus the current account sum to zero, equation (A1-2b).

$$(I - S) + CA = 0 \qquad \text{(A1-2a)}$$
$$(A - GNP) + CA = 0 \qquad \text{(A1-2b)}$$

These equations imply a positive relation between the real exchange rate (RER) and the real interest rate (r) required to produce goods market equilibrium. A rise in the real interest rate reduces investment relative to saving and, to maintain goods market equilibrium, the real exchange rate must depreciate to raise the current account by an equal amount. This is the positively sloped IS curve represented in figure 1-A1.[1] With capital mobility, the difference between investment and saving (or absorption and GNP) is equal to the capital inflow K. Thus, goods market equilibrium or balance of payments equilibrium means that the capital account plus the current account sum to zero.

$$K + (B - r^*.F) = 0 \qquad \text{(A1-3)}$$

The first term in (A1-3) is the capital inflow and the current account is equal to the balance of trade (B) less interest payments to foreigners ($r^*.F$), where F is the net foreign debt and r^* is the world rate of interest. Figure 1-A1 can be interpreted as describing either goods market equilibrium (A1-2a, A1-2b) or balance of

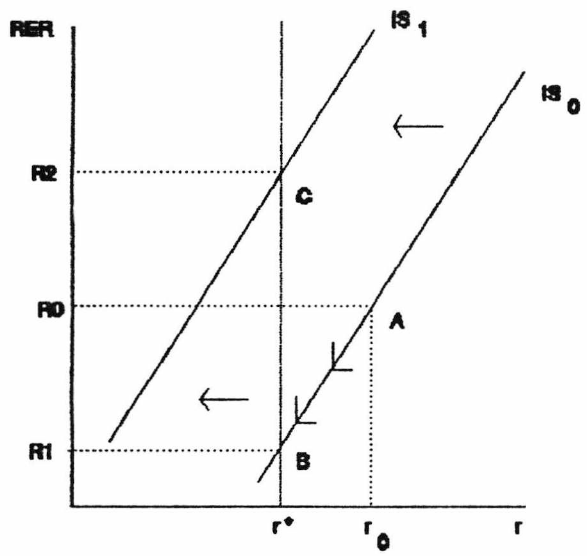
[1] - Stein's IS curve is negatively sloped because we measure the real exchange rate in the opposite way.

payments equilibrium (A1-3). The world real interest rate is exogenous which is equivalent to assuming a small-country and no risk premium.

We begin from a situation of no capital market integration. Domestic investment exceeds saving, and the domestic interest rate is above the world level. Following the opening up of the capital account, the country runs a current account deficit equal to the inflow of capital and the real exchange rate appreciates. This is represented in figure 1-A1 as the movement from A to B along the IS schedule. It is the real appreciation of the home currency that occurs when the domestic real interest rate exceeds the foreign rate and capital flows into the country.

If the capital inflow finances real investment the capital stock rises and raises GNP. The process of capital stock and foreign debt accumulation has several effects. First, wealth - which is the capital stock less foreign debt - raises consumption and imports of consumer goods. This effect tends to widen (narrow) the trade deficit (surplus) and depreciate the real exchange rate. Second, the rise in the capital stock raises both GNP and absorption - the net effect on (A-GNP) is ambiguous. Consider the case when GNP rises more than A. Initially, foreign debt rises but eventually as GNP-A = S-I rises there will be a capital outflow, foreign debt will decline, which reduces interest payments to foreigners, and the country might even become a net creditor. This tends to appreciate the real exchange rate. In the steady-state with full capital market integration, real interest rates are equalized and the flow of capital will stop. Thus, in the steady-state, balance of payments equilibrium is given by current account balance, $B=r*F$. If the first effect (trade balance) dominates the second (interest payments) the real exchange rate might depreciate above its initial level. This is represented in figure 1-A1 as the movement from B to C - the IS curve shifts upwards from IS_0 to IS_1. This is the real depreciation of the domestic currency, which might occur under the impact of the wealth and productivity effects of capital stock accumulation.

Figure 1-A1



CHAPTER 2

ANNEX 2:
On the Theory of Balance of Payments Crisis

In this Annex we present the solution to the models and the proof of the results discussed in section 2.3 of the chapter. We keep the numbering of the equations as in the main text to facilitate cross-references. Whenever necessary, other equations are introduced beginning in (A2-1), (A2-2), etc. Consider the simple monetary model of an open economy presented in the main text

$$M/P.y = a_o - a_1.i \quad (15)$$
$$M = R + C \quad (16)$$
$$dC/dt = \mu \quad (17)$$
$$P = E.P* \quad (18)$$
$$i = i* + (dE/dt)/E \quad (19)$$

where M is money, P is the price level, y is real income, i is the nominal interest rate, R is the level of foreign exchange reserves, C is domestic credit, E is the nominal exchange rate defined as the domestic currency price of foreign currency, dx/dt denotes the time derivative of a variable, the star (*) denotes foreign variables and a_o, $a_1>0$ are parameters. Time subscripts are omitted for simplicity.

Using (18) and (19) in (15) we obtain

$$M_t = \beta.E_t - \gamma\, dE_t/dt \quad (20)$$

where

$$\beta = a_o.P* - a_1.i*.P* > 0 \quad \text{and} \quad \gamma = a_1.P* > 0$$

β and γ are constants if we assume that P* and i* are constant.

This model can be solved under different exchange rate regimes.

Solving the model under flexible exchange rates

Assuming instantaneous market asset clearing set dR/dt = 0, and using (16) and (17) in (20) obtain

$$dE_t/dt - (\beta/\gamma).E_t = -(1/\gamma)(C_o + \mu.t) \quad (21)$$

where C_o is the initial level of domestic credit; we set $R_o = 0$ for convenience.

In solving the differential equation (21) we use the Laplace transform technique (see, for example, Ross (1984)). Thus

$$\mathcal{L}\{dE_t/dt\} - \mathcal{L}\{(\beta/\gamma).E_t\} = - \mathcal{L}\{(1/\gamma)(C_o+ \mu.t)\} \Rightarrow$$

$$s.\mathcal{L}\{E_t\}-E_o-(\beta/\gamma).\mathcal{L}\{E_t\} = - (1/s).(1/\gamma).C_o - (1/s^2).(1/\gamma).\mu \Rightarrow$$

$$\mathcal{L}\{E_t\}=[E_o-(1/s).(1/\gamma).C_o-(1/s^2).(1/\gamma).\mu]/[s-(\beta/\gamma)] \qquad \text{(A2-1)}$$

where s is the dummy variable associated with the Laplace transform.

In deriving (A2-1) and (22) (see below), we have used some basic proprieties of the Laplace transform

$$\mathcal{L}\{f'(t)\} = s.\mathcal{L}\{f(t)\} - f(0)$$
$$\mathcal{L}\{c_1.f_1(t) + c_2.f_2(t)\} = c_1.\mathcal{L}\{f_1(t)\} + c_2.\mathcal{L}\{f_2(t)\}$$
$$\mathcal{L}\{1\} = 1/s$$
$$\mathcal{L}\{t\} = 1/s^2$$
$$\mathcal{L}\{\exp(a.t)\} = 1/(s-a)$$

where c_1 and c_2 are constants and $f(t)$, $f_1(t)$ and $f_2(t)$ are functions whose Laplace transforms exist and $f'(t)$ denotes time derivative of $f(t)$.

Inverting (A2-1) yields

$$E_t=[E_o-\mu.\gamma/\beta^2-C_o/\beta].\exp[(\beta/\gamma).t] + \mu.\gamma/\beta^2+C_o/\beta+(\mu/\beta).t \qquad (22)$$

where E_o is the initial value of E_t.

In deriving equation (22) we have used the partial fractioning

$$1/\{s.[s-(\beta/\gamma)]\}= -(\gamma/\beta)/s + (\gamma/\beta)/[s-(\beta/\gamma)]$$
$$1/\{s^2.[s-(\beta/\gamma)]\} =[-(\gamma/\beta)^2.s-(\gamma/\beta)]/s^2 + (\gamma/\beta)^2/[s-(\beta/\gamma)]$$

To rule out the occurrence of bubbles we impose the initial condition

$$E_o = \mu.\gamma/\beta^2 + C_o/\beta \qquad (23)$$

and by substitution in (22) we get

$$\hat{E}_t = E_o + (1/\beta).\mu.t \qquad (24)$$

Fixed exchange rates and Runs

We turn now to the solution of the model under pegged exchange rates. If $E_t = E_{peg}$ then $dE/dt = 0$ and by substitution in equation (20) we must have

$$M_t = \beta . E_{peg} \tag{25}$$

From (16) using (17) and (25) we have

$$R_t = \beta . E_{peg} - (C_o + \mu . t) \tag{26}$$

To determine the exact moment of the speculative attack we set

$$E_{peg} = \mu . \gamma/\beta^2 + C_o/\beta + (1/\beta) . \mu . T' \tag{27}$$

We can solve equation (27) to find the moment of the run

$$T' = R_o/\mu - \gamma/\beta \tag{28}$$

and use (26) to determine the amount of reserves lost by the central at the time of the attack

$$R_{T'} = \mu . \gamma/\beta \tag{29}$$

Borrowing to defend the parity

When the authorities engage in one act of (foreign) borrowing (at time t_b) there is a stock-shift reduction in the stock of domestic credit and an equal increase in the stock of foreign exchange reserves and in the stock of interest-bearing public debt. Allowing explicitly for the government budget constraint and in particular for the interest cost of servicing the public debt and using the monetary authority's balace sheet we have

$$dC/dt + E_{peg} . dB^*/dt = G + i^* . E_{peg} . B^* \tag{30}$$

where B^* is the stock of government debt and G is the primary deficit.

The open market operation (foreign borrowing) can be formalized as

$$B^*_t = 0 \text{ if } t < t_b$$
$$B^*_t = B^* \text{ if } t \geq t_b$$

or

$$B^*_t = B^* . u_a(t) \tag{31}$$

where $u_a(t)$ is the unit step function

$$u_a(t) = 0 \text{ if } t < a = t_b$$
$$u_a(t) = 1 \text{ if } t \geq a = t_b$$

To see what the act of foreign borrowing implies for the path of domestic credit and foreign exchange reserves we solve the differential equation (30) using the Laplace transform method. Note that because we have $dB^*/dt = \infty$ at $t = t_b$ this is the most convenient method to solve the differential equation (30). Thus

$$\mathcal{L}\{dC/dt + E_{peg}.dB^*/dt\} = \mathcal{L}\{\mu + i^*.E_{peg}.B^*\} \Rightarrow$$

$$s.\mathcal{L}\{C_t\}-C_o+E_{peg}.B^*.s.\mathcal{L}\{u_a(t)\} = \mu/s+i^*.E_{peg}.B^*.\mathcal{L}\{u_a(t)\} \Rightarrow$$

$$\mathcal{L}\{C_t\} = C_o/s - E_{peg}.B^*.\exp(-t_b.s)/s +$$

$$+ \mu/s^2 + i^*.E_{peg}.B^*.\exp(-t_b.s)/s^2 \qquad \text{(A2-2)}$$

In deriving equation (A2-2) we have used some of the basic proprieties of the Laplace transform mentioned before and also

$$\mathcal{L}\{u_a(t)\} = \exp(-a.s) / s$$

Inverting (A2-2) we get

$$C_t = C_o+\mu.t-E_{peg}.B^*.u_a(t)+i^*.E_{peg}.B^*.u_a(t).(t - t_b) \qquad (32)$$

In deriving (32) we have used the fact that

$$\exp(-t_b.s)/s^2 = [\exp(-t_b.s)/s].(1/s)$$

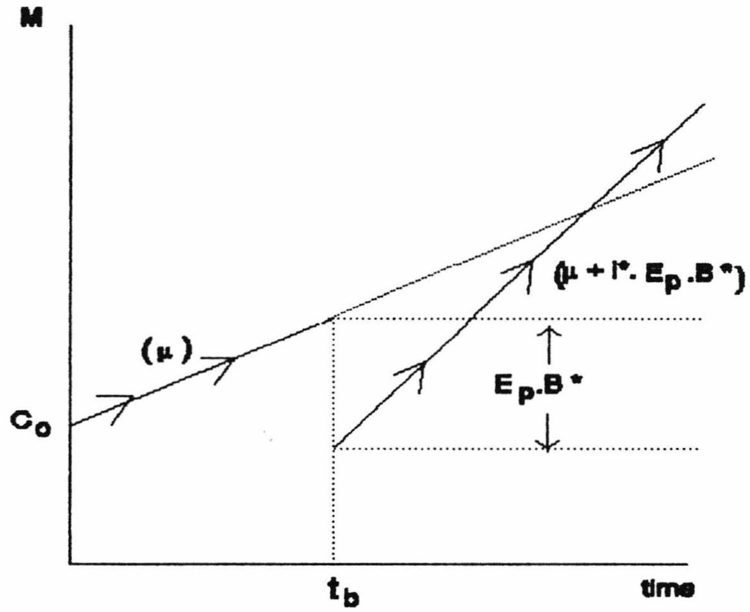
the proprieties of the Laplace transform mentioned before, and also

$$\mathcal{L}\{u_a(t).f(t-a)\} = \exp(-a.s).\mathcal{L}\{f(t)\}$$

The path of domestic credit given by equation (32) is illustrated in figure 1-A2. First, consider the case when borrowing does not occur. Setting $B^* = 0$ in equation (32) we get $C_t = C_o + \mu.t$ which corresponds exactly to the path implicit in equation (17).

Second, setting $u_a(t) = 0$ in equation (30) we can see that the path of domestic credit before the open market operation ($t < t_b$) is the same as in the no borrowing case. At the date of the open market operation domestic credit is reduced by the amount of the borrowing ($-E_{peg}.B^*$) illustrated by the downward shift of the C_t line. This is the stock-shift effect.

Figure 1-A1 The effect of borrowing on the time path of domestic credit



Third, setting $u_a(t) = 1$ in equation (32) we get the path of domestic credit after the open market sale ($t \geq t_b$)

$$C_t = C_o - E_{peg}.B^* + \mu.t + i^*.E_{peg}.B^*.(t - t_b)$$

or

$$C_t = C_o - E_{peg}.B^* - i^*.E_{peg}.B^*.t_b + (\mu + i^*.E_{peg}.B^*).t \qquad (33)$$

From (33) we see that after the open market sale the rate of domestic credit expansion will be higher than it would have been without the borrowing because of the debt service component in the public sector deficit (we assume that the primary deficit remains constant). This is the interest-debt effect illustrated by the change in the slope of the C_t line. For further reference note that

$$C_{t_b} = C_o + \mu.t_b - E_{peg}.B^* \qquad (34)$$

and rewrite (33) as

$$C_{t_b} = C_t + (\mu + i^*.E_{peg}.B^*).(t - t_b) \qquad (35)$$

To determine the effect of borrowing on the timing of the collapse we follow the method used before. First, we determine the path of the exchange rate under floating when domestic credit is driven by (32). As the path of credit before the open market operation is the same as in the case of no borrowing, the path of the exchange rate for $t < t_b$ is given by equations (23) and (24). Furthermore, the problem of finding the path of the exchange rate after time t_b is similar. Thus, for $t \geq t_b$, we have from (22), by analogy

$$E_t = \{ E_o - (\mu + i^* . E_{peg} . B^*) \gamma / \beta^2 - - [C_{t_b} - (\mu + i^* . E_{peg} . B^*) . t_b] / \beta \} . \exp[(\beta/\gamma) . t] + + (\mu + i^* . E_{peg} . B^*) . \gamma / \beta^2 + C_{t_b} / \beta + (\mu + i^* . E_{peg} . B^*) . (t - t_b) / \beta \tag{36}$$

To rule out the occurrence of bubbles we impose the initial condition

$$E_o = (\mu + i^* . E_{peg} . B^*) \gamma / \beta^2 + [C_{t_b} - (\mu + i^* . E_{peg} . B^*) . t_b] / \beta$$

and by substitution

$$E_t = (\mu + i^* . E_{peg} . B^*) . \gamma / \beta^2 + C_{t_b} / \beta + (\mu + i^* . E_{peg} . B^*) . (t - t_b) / \beta \tag{38}$$

Now, we set $E_t = E_{peg}$ in equation (38) to find the moment of the speculative attack (t')

$$(t' - t_b) = \frac{\beta E_{peg} - C_{t_b}}{(\mu + i^* . E_{peg} . B^*)} - \frac{\gamma}{\beta} \tag{A2-3}$$

Recalling that the moment of the run without borrowing is given by $T' = R_o/\mu - \gamma/\beta$, that the level of reserves under pegged exchange rates is given by $R_t = \beta . E_{peg} - C_t$, and $C_{t_b} = C_o + \mu . t_b - E_{peg} . B^*$ we rewritte equation (A2-3) as

$$(t' - t_b) = \frac{R_o - \mu . t_b + E_{peg} . B^*}{\mu + i^* . E_{peg} . B^*} - \frac{\gamma}{\beta} \tag{39}$$

Borrowing will postpone the speculative run if $t' - T' > 0$. From (39) after some algebraic manipulation we have

$$t' - T' > 0 \iff 1/i^* + t_b > R_o / \mu$$

or

$$t' - T' > 0 \iff T' - t_b < 1/i^* - \gamma/\beta \qquad (40)$$

The magnitude of the run on the reserves is given by

$$R_{t'} = \beta . E_{peg} - C_{t'} \Rightarrow$$

$$R_{t'} = \beta . E_{peg} - [C_{t_b} + (\mu + i^* . E_{peg} . B^*) . (t' - t_b)]$$

and using (A2-3)

$$R_{t'} = \mu\gamma/\beta + i^* . E_{peg} . B^* . \gamma/\beta \qquad (41)$$

CHAPTER 3

Income and price elasticities in Portuguese foreign trade

Introduction

From a macroeconomic point of view the transitional period of the late 1980s and early 1990s is likely to be marked in Portugal by sluggish disinflation and rapid financial liberalisation, which are expected to cause both a transitory and long lasting real effective exchange rate appreciation of the escudo, and thus a loss of price competitiveness. In our opinion it is crucial for the sustainability of this process that no major speculative attack on the escudo develops during the transitional period. And this will depend, in particular, on the magnitude of the real effective exchange rate adjustment and on the current account effects of the expected loss of price competitiveness. It will also depend on the ability of the Portuguese economy to change the structural characteristics of its exports.

In this chapter we design a partial equilibrium model of the balance of trade in goods and services in order to estimate income and price elasticities in Portuguese foreign trade. The estimation of price elasticities will allow us to quantify the effects of exchange rate changes on the trade balance and will then be used to quantify the expected effect of the real exchange rate appreciation of the escudo on the external balance. The estimation of income elasticities will allow us to emphasize the need for structural change in the pattern of Portuguese external trade. The chapter is divided into four main sections. In the first section we present the theoretical framework which is based on the traditional elasticities approach to the balance of payments. We discuss also how different assumptions about market structure affect the specification of export and import functions and consequently the expected price and quantity effects of a devaluation or revaluation. In section two we review the empirical evidence. We present the performance of the Portuguese balance of trade during the last three decades (from 1960 to 1989) as well as the performance of some economic variables which are fundamental to the explanation of the time series behaviour of trade flows. In particular we emphasize the evolution of various measures of price competitiveness. In the third section we present the design and estimation of the export side of the trade model. Firstly, it is shown that econometric models based on small-country and/or perfect competition assumptions generate results which are theory inconsistent. Secondly, two models of the export side both based on imperfect competition assumptions are estimated and are shown to be theory consistent. In the fourth section we present the design and the estimation of the import side of the trade model. In sections three and four our results are also compared to previous empirical work on the Portuguese economy. In our econometric work we use standard econometric techniques (OLS and IV) as well as the more recent cointegration techniques and we follow the econometric methodology known as "Professor Hendry's methodology" which is sketched in Annex 2. The conclusions are presented at the end of the chapter. Our analysis suggests that nominal and real exchange rate changes are a poor tool to improve the competitiveness of Portuguese exports. However, this conclusion does not imply that the level of the real exchange rate is a matter of indifference. In fact, when major "real shocks" affect the economy exchange rate adjustments are likely to be useful, if not necessary. On the other hand, major real exchange rate changes are likely to have a long lasting effect on the external balance. For structural reasons, the income elasticity of import demand is greater than the income elasticity of export demand and this, on its own, tends to generate "permanent" external deficits over time and/or require a trend real depreciation of the exchange rate (if the Portuguese economy grows faster than EC average). Therefore, during the transitional period to full EC integration, real convergence (reduction of existing disparities in GDP per capita) and nominal convergence (reduction of existing divergences in rates of inflation) will both tend to warrant real exchange rate changes, but in opposite directions. This suggests that a rapid change in the pattern of Portuguese external trade is needed - otherwise the sustainability of the escudo's participation in the ERM, under the conditions set out for stage 2 of EMU, might be undermined and/or will generate great costs in terms of growth and employment.[1]

3.1 - The theoretical framework

3.1.1 - The elasticities approach to devaluation and the role of market structure

Writing a number of years ago Dornbusch (1975; p.859) observed that in spite of its apparent lack of general equilibrium properties, the elasticities approach to the analysis of a devaluation

1 - The partial equilibrium analysis carried out in this chapter needs to be extended in several directions. An important issue discussed at length in chapter 7 is the inflationary (or deflationary) impact of an exchange rate change as the devaluation (or revaluation) works its way through the wage-price mechanism.

enjoys

> substantial popularity in policy discussions and interpretations of current events, in empirical work, and in recent textbooks

and that the Bickerdike-Robinson-Metzler (BRM) model

> is likely to remain the preferred tool in the analysis of trade balance issues.

As the voluminous applied research on international trade issues to be referred in section 3.1.2 reveals, these observations are still entirely valid today. For this fact, we review in this section the main conclusions of the elasticities approach to devaluation, which is fully discussed in Annex 1.

To quantify the effect of a devaluation on the terms of trade we calculate the exchange rate elasticity of the terms of trade which is given by:

$$d(px^*-pm^*)/de = (\epsilon_x\epsilon_m-n_xn_m)/[(n_m-\epsilon_m)(n_x-\epsilon_x)] \qquad (1)$$

> where: px^* and pm^* are the logs of the prices of exports and imports expressed in the foreign currency; e is the log of the exchange rate defined as the domestic currency price of foreign currency (that is, a devaluation means an increase in e); n_x and n_m are price elasticities of export supply and import supply, both positive; ϵ_x and ϵ_m are price elasticities of export demand and import demand both negative and $(n_m-\epsilon_m)(n_x-\epsilon_x)>0$.

In general, the terms of trade effect of an exchange rate devaluation is ambiguous as it depends on the sign of the numerator of the expression on the RHS of (1). If $\epsilon_x\epsilon_m > n_xn_m$ there will be an improvement in the terms of trade following a devaluation, and, if $\epsilon_x\epsilon_m < n_xn_m$ there will be a deterioration in the terms of trade. If $\epsilon_x\epsilon_m = n_xn_m$ the terms of trade will not change.

Two particular cases where this ambiguity disappears are worth mentioning: the small-country case and the semi-small country case, following the classification proposed by Branson (1983). In the small-country case, import and export prices expressed in foreign currency are independent, respectively, of the quantities imported and exported by the country. In particular, this implies the assumption of a perfectly competitive export market structure. Thus, the price elasticity of export demand and the price elasticity of import supply are infinite (ϵ_x and $\eta_m \to \infty$). In this case a devaluation will never affect the terms of trade. To see this we calculate:

$$\lim_{\epsilon_x, \eta_m \to \infty} (\epsilon_x \epsilon_m - \eta_x \eta_m)/[(\eta_m - \epsilon_m)(\eta_x - \epsilon_x)] = 0 \qquad (2)$$

In the semi-small country case, both price elasticities of supply are infinite (η_x and $\eta_m \to \infty$). This means that, although the country is small on the import side, it has some monopoly power on the export side, equivalent to the assumption of an imperfectly competitive export market structure. In this case a devaluation will always cause the terms of trade to deteriorate in the exact proportion to devaluation. To see this we calculate:

$$\lim_{\eta_x, \eta_m \to \infty} (\epsilon_x \epsilon_m - \eta_x \eta_m)/[(\eta_m - \epsilon_m)(\eta_x - \epsilon_x)] = -1 \qquad (3)$$

Starting from a situation of trade balance equilibrium the effect of a devaluation on the trade balance expressed in foreign currency (B), is given by the BRM condition:

$$dB/de = (PX^*.X).[(\epsilon_x+1).\eta_x/(\epsilon_x-\eta_x) - (\eta_m+1).\epsilon_m/(\eta_m-\epsilon_m)] \qquad (4)$$

where: X and M are the quantities exported and imported; PX* and PM* are the export and the import prices expressed in foreign currency.

In general, the balance of trade effect of an exchange rate devaluation is ambiguous as it depends on the sign of the expression between square brackets on the RHS of (4). This expression is difficult to interpret but again some particular cases are worth mentioning because either the ambiguity disappears or the expression simplifies allowing a suggestive interpretation.

In the semi-small country case, both price elasticities of supply are infinite (n_x and $n_m \to \infty$). In this case a devaluation will improve the trade balance if the sum of the price elasticities of demand for exports and imports is, in absolute value, greater than 1 ($-\epsilon_x - \epsilon_m > 1$). This is known as the Marshall-Lerner (ML) condition for a devaluation to improve the trade balance. To see this we calculate:

$$\lim_{n_x, n_m \to \infty} [(\epsilon_x+1).n_x/(\epsilon_x-n_x)-(n_m+1).\epsilon_m/(n_m-\epsilon_m)]=-\epsilon_x-\epsilon_m-1>0 \qquad (5)$$

In the small-country case, the price elasticity of export demand and the price elasticity of import supply are infinite (ϵx and $n_m \to \infty$). In this case a devaluation will improve the trade balance unless export supply and import demand are rigid. To see this we calculate:

$$\lim_{\epsilon_x, n_m \to \infty} [(\epsilon_x+1).n_x/(\epsilon_x-n_x) - (n_m+1).\epsilon_m/(n_m-\epsilon_m)] = n_x-\epsilon_m > 0 \qquad (6)$$

The results derived are summarized in table 1.

Table 1 - Effects of a devaluation on the balance and terms of trade

Case \ Effect	Terms of Trade	Balance of Trade
General	Ambiguous (BRM)	Ambiguous (BRM)
Small-country	Not affected	Improves
Semi-small country	Deteriorates	Improves if $-\epsilon_x-\epsilon_m>1$ (ML)

These results highlight two important points. Firstly, that market structure plays an important role in the theoretical discussion of the impact of a devaluation, even within a partial equilibrium framework and, secondly, that we must specify very carefully the hypothesis underlying the econometric modelling of the foreign trade sector. The latter point will be further discussed below.

3.1.2. - Econometric modelling

Econometric research on income and price effects in foreign trade is voluminous and at least four comprehensive surveys are available, namely Leamer and Stern (1970), Magee (1975), Stern et al. (1976) and Goldstein and Khan (1985). In the last survey, Goldstein and Khan present a "bare-bones" imperfect substitutes model of a country's exports and imports. The export-side of the model can be represented as follows:

$$X^d=X^d(Y*;\ PX*/P*) \text{ with } \partial X^d/\partial Y*>0 \text{ and } \partial X^d/\partial(PX*/P*)<0 \qquad (7)$$

$$X^s=X^s(Y;\ PX/P) \text{ with } \partial X^s/\partial Y>0 \text{ and } \partial X^s/\partial(PX/P)>0 \qquad (8)$$

$$PX = PX*.E \qquad (9)$$

$$X^d = X^s \qquad (10)$$

> where X^d is the quantity of exports demanded by the rest of the world; X^s is the quantity of exports supplied by the home country; PX* is the price of exports in foreign currency; PX is the domestic price of exports received by the exporter; E is the exchange rate; P* is the price of goods produced in the rest of the world in foreign currency; P is the price of domestically produced goods; Y is the level of domestic real income; and Y* is the level of foreign real income. The exogenous or predetermined variables in the system are Y*, P*, Y, P, E, and the system determines the endogenous variables, X and PX (or PX*).

Equation (7) is the export demand function. In accordance with conventional demand theory, the quantity demanded is a positive function of real income in the importing region, a negative function of the exported good's own price and a positive function of the price of the foreign competitor's good. Assuming that the consumer has no money illusion and that the own and cross price elasticities of demand are equal in absolute value and that the goods are substitutes in consumption, the arguments of the function are real income and relative prices.

The basic ideas behind equation (8), the export supply function, are firstly, that the supply of exports is an increasing function of the profitability of producing and selling for exports and, secondly, that the ability to supply depends positively on output capacity. The relative profitability of exports is proxied by the relative price term, which can also be seen as a measure of the ratio of the prices of tradable to non-tradable goods (P_T/P_{NT}). If this relative price increases the domestic supply of exports will increase. The income term (trend income), or instead a time trend, act as a proxy for capacity growth as the domestic supply of exports is expected to grow over time due to investment and growth. Equation (9) defines the exchange rate as the domestic currency price of foreign currency. Thus, an increase in the exchange rate means devaluation (or depreciation) of the domestic currency. Equation (10) is a market clearing condition.

Despite the simultaneous character of the model, the bulk of time-series modelling of the export sector has assumed infinite supply-price elasticities and therefore has concentrated on the estimation of the export demand function using Ordinary Least Squares (OLS). Houthakker and Magee (1969) is the classic reference among the various papers that follow this <u>a priori</u> approach. The direct estimation of the demand function corresponds to the assumption that the country is "large" in its export market (as in the semi-small country case mentioned above) but is also consistent with the less extreme assumption of a monopolistic competitive market.

The alternative assumption is to consider infinite demand-price elasticities and concentrate on the estimation of the export supply function using OLS. This corresponds to the small-country case or perfectly competitive market structure and, as will be discussed below, has been the approach followed when modelling the Portuguese external sector. A distinguishing feature of this a priori approach is the exclusion of the foreign demand variable as a relevant determinant of export performance (although its inclusion may be justified under certain conditions - see discussion below).

Another alternative is to recognize explicitly the simultaneous character of the external sector model and estimate the system of equations using the appropriate techniques. This is the approach pioneered by Goldstein and Khan (1978). In this case the export supply function is inverted, thus determining the price of exports, as follows:

$$PX=PX(X;\ P;\ Y) \text{ with } \partial PX/\partial X>0, \partial PX/\partial P>0 \text{ and } \partial PX/\partial Y<0 \qquad (8a)$$

and the export demand function is re-written without imposing any restriction on the cross price-elasticity of demand, as follows:

$$X=X(Y^*;\ PX;\ P^*.E) \text{ with } \partial X/\partial Y^*>0,\ \partial X/\partial PX<0 \text{ and } \partial X/\partial (P^*.E)>0 \qquad (7a)$$

The model is then estimated using system estimation techniques such as Two Stages Least Squares (2SLS) or Full Information Maximum Likelihood (FIML).

Finally, we can also estimate the reduced form equation that emerges from the system of equations by OLS. This can be written as follows:

$$X=X[Y^*;\ Y;\ P/(P^*.E)] \text{ with } \partial X/\partial Y^*>0,\ \partial X/\partial Y>0 \text{ and } \partial X/\partial [P/(P^*.E)]<0 \qquad (11)$$

where the ratio $P/(P^*.E)$ is the real exchange rate.

The import-side of the imperfect substitutes trade model can be written in general terms as follows:

$$M^d = M^d(Y;\ PM/P) \text{ with } \partial M^d/\partial Y > 0 \text{ and } \partial M^d/\partial (PM/P) < 0 \quad (12)$$

$$M^s = M^s(Y^*;\ PM^*/P^*) \text{ with } \partial M^s/\partial Y^* > 0 \text{ and } \partial M^s/\partial (PM^*/P^*) > 0 \quad (13)$$

$$PM = PM^*.E.(1+t_m) \quad (14)$$

$$M^d = M^s \quad (15)$$

where M^d is the quantity of imports demanded by the home country; M^s is the quantity of imports supplied by the foreign country; PM^* is the price of imports in foreign currency; PM is the domestic price of imports paid by the importer; E is the exchange rate; P^* is the price of goods produced in the rest of the world in foreign currency; P is the price of domestically produced goods; Y is the level of domestic real income; Y^* is the level of foreign real income and t_m is the domestic import tax rate (in %).

Comparing equations (7)-(10) to equations (12)-(15) we can see that the export and the import-sides of the trade model are symmetric and therefore the economic justification for the latter equations can be established very easily from that given for the export side. Therefore, we do not repeat it. Here, again, despite the simultaneous character of the model, the bulk of the time-series modelling of the import sector has assumed infinite supply price elasticities and therefore has concentrated on the estimation of the import demand function.

In our econometric work we follow a general-to-simple modelling strategy, and we also apply the more recent developments on cointegration theory. The main aspects of the econometric methodology followed are sketched and references are given in Annex 2.[2]

2 - Our applied research is closely related to the approach followed by Tansel and Togan (1987) in modelling the Turkish foreign trade sector, and to the discussion on the relative performance of various price competitiveness measures in modelling the behaviour of UK's export volumes of manufactures presented in Anderson and Dunnett (1987).

3.2 - Empirical evidence

3.2.1 - Exports and Price Competitiveness

Portugal is an exporter of manufactured goods. For example, in 1985, over 95% of goods exported fell within the broad category of manufactures. In that year categories 6, 7 and 8 of the SITC (basic manufactures, machines and miscellaneous manufactured goods) alone contributed to 70% of total exports. At a more disaggregated level, shown in table 2, we can see that five groups of goods contributed to over 40% of total exports.

Table 2 - Portuguese exports of goods (SITC) in 1985 (% of total)

63	65	77	84	851
4.4	11.7	4.1	17.8	5.3

Note: 63-wood, cork manuf.; 65-textil yarn, fabrics, etç; 77-electric machinery; 84-clothing; 851-footwear leather
Source: United Nations, Trade Statistics Yearbook

As illustrated in table 3 Portuguese exports are geographically concentrated. In 1985, European markets (EEC+EFTA) accounted for over 70% of total exports and the four main markets (UK, Germany, France and USA) accounted for about 50% of total exports. By 1989, four years after acceding to the EC, the relative position of the main export markets had changed. The UK and the USA lost some of their importance, France and Germany reinforced their position and more importantly, Spain increased its share very rapidly and emerged as one of the main export markets for Portuguese goods.

Table 3 - Direction of Portuguese exports of goods (% of total)

	France	Germany	Spain	UK	USA
1985	13	14	4	15	9
1989	15	16	13	12	6

Source: United Nations, Trade Statistics Yearbook

As illustrated in table 4, the share of African markets, in particular that of the ex-colonies of Angola and Mozambique, has been substantially reduced after 1975. Taken together, the evidence on the evolution of the direction of Portuguese trade reveals that Continental trade has been replacing Atlantic trade and therefore the Portuguese economy has become less "insular".[3]

Table 4 - Portuguese exports to Africa (% of total)

	1960	1970	1975	1980	1985
Angola	13	15	4	4	3
Mozamb.	9	9	3	1	0.4
Africa	25	26	13	8	6

Source: United Nations, Trade Statistics Yearbook

From a balance of payments perspective exports of goods represented, in 1985, 73% of the total credit of the balance of trade and services and the receipts from tourism represented 56% of the remainder. Foreign visitors came mainly from Spain (75%), UK (7.5%), Germany (3.4%), France (3%) and USA (2%).

Turning now to the time-series behaviour of the volume of Portuguese exports of goods and services (X), in figures 1 and 2 we compare its performance to that of the other EC countries (X*) during the 1960-1989 period. The data was taken from European Economy. In figure 1 we show the real growth rate of Portuguese and EC (average) exports and in figure 2 we show an index of the relative demand for Portuguese exports defined as the ratio of the two export volume indices (X/X*). Three facts emerge from these fig-

3 - For further reference on the increasing importance of Continental trade it should be added that, in 1960, exports to the UK, USA and Africa represented 50% of total exports and today exports to EC markets alone represent more than 60% of total exports.

ures. First, there is the exceptional performance of Portuguese export volumes in the early 1960s, presumably reflecting the impact of EFTA's trade preferences given to Portuguese exports of industrial products in 1958 (see Silva (1989)). Second, export performance in the 1974-76 and 1980-81 periods was poor, apparently related to the two major recessions of the post-II World War period. This occurred in spite of trade preferences given by the EC to Portuguese exports of industrial products in 1972. Third, the performance of export volumes after 1981 has been steady.

Turning now to the time-series behaviour of price competitiveness we show in figure 3 the path of four relative price indices during the 1960-1989 period. The relative price indices shown are an index of relative GDP deflators expressed in a common currency, the real exchange rate (RER); an index of relative unit labour labour costs (RULC); an index of relative deflators of exports of goods and services, expressed in a common currency, the relative price of exports (RPX); and an index of the terms of trade, defined as the ratio of export over import price indices of goods and services (PX/PM=TT). An increase (decrease) in the index means a loss (gain) of price competitiveness or an improvement (deterioration) in the terms of trade.

The relative price indices (RER, RULC and RPX) are geometrically weighted averages of bilateral indices ($\log RER = \Sigma_i \omega_i . \log RER_i = \Sigma_i \omega_i . \log(P/P^*.E)_i$). The countries included in the construction of these indices are France, Germany, Italy, UK and USA, with the weights (ω's) being the normalized export share ($\Sigma_i \omega_i = 1$). The exclusion of Spain does not affect the results in any significant way because its increasing importance in the Portuguese external

Figure 1

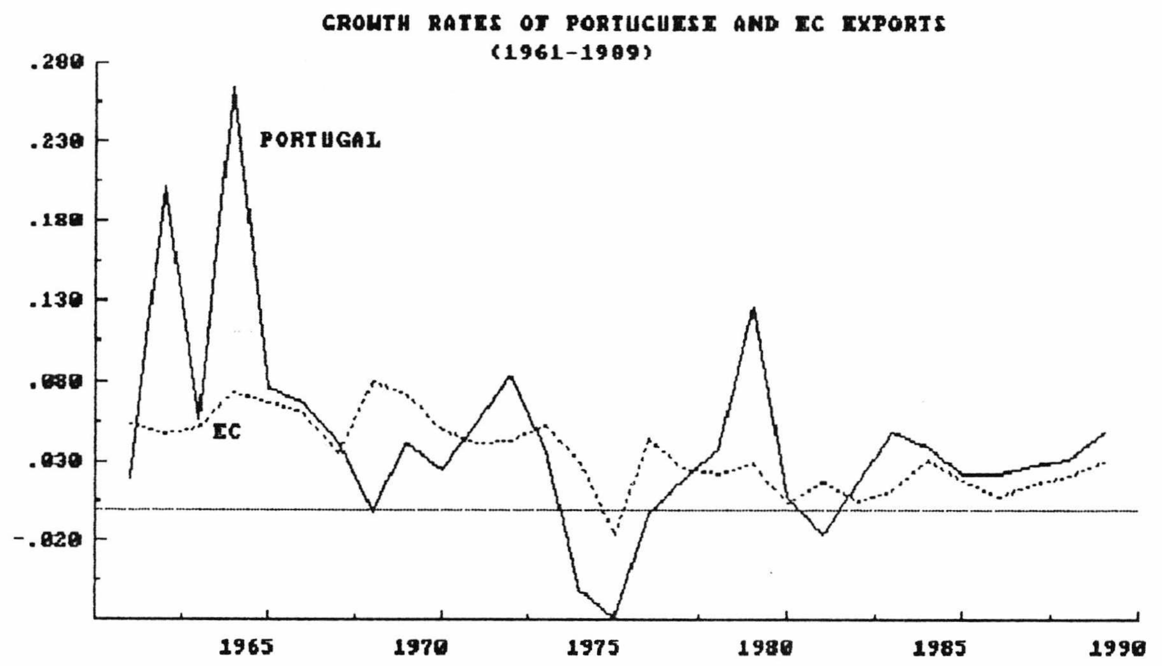
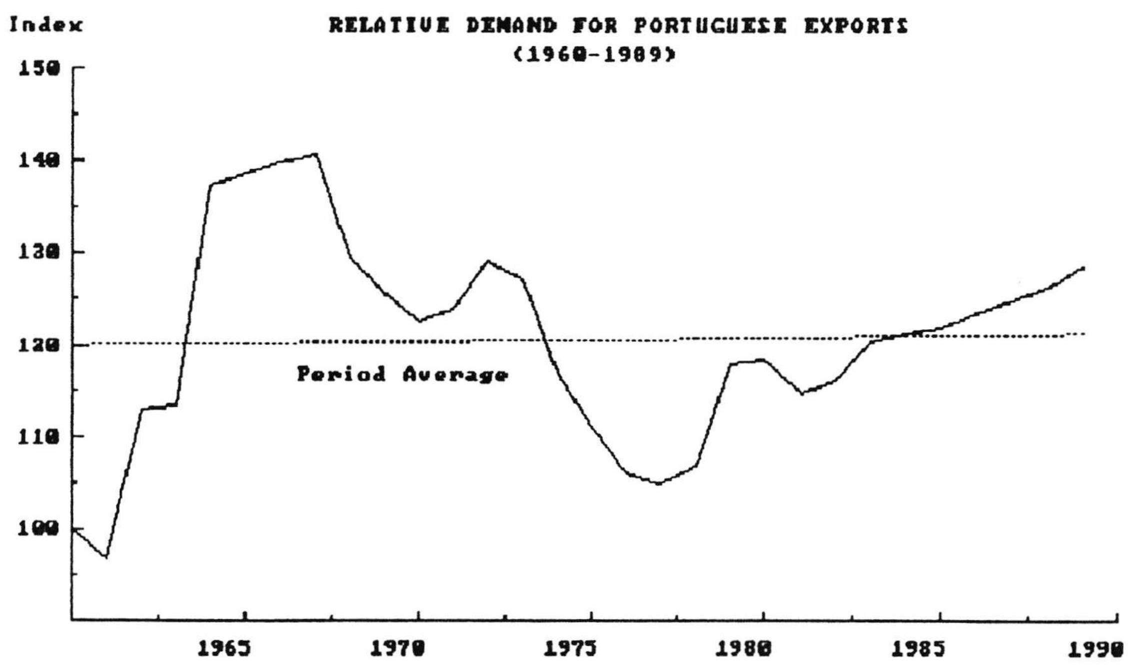


Figure 2



trade is only a very recent phenomenon. The data on prices and exchange rates was taken from European Economy and the export shares from United Nations, Trade Statistics Yearbook.

Two main facts that emerge from figure 3, and are further illustrated in figures 4 and 5. First, all series are trended. Second, they do not all move in the same direction; three of them show a downward trend (RULC, RPX and TT), which is consistent with a long-run price competitiveness gain at the cost of some deterioration in the terms of trade, but the RER moves in the opposite direction. In order to gain some understanding of what might explain this divergence we decompose the real exchange rate index, as suggested by Balassa (1964) as follows:[4]

$$rer = (p-p^*-e) = rpx + (1-a).(q-q^*) + (1-a).(v^*-v) \qquad (16)$$

$$rpx = (p_T-p^*_T-e) \qquad (17)$$

$$p = a.p_T + (1-a).p_{NT} \qquad (18)$$

$$p_T = w-q \quad \text{and} \quad p_{NT} = w-v \qquad (19)$$

where: a is the share of tradable goods in consumption; w are labour costs; q is labour productivity in the tradable goods sector; v is labour productivity in the non-tradable goods sector; the other symbols have the meaning already explained, all variables are in logs and the * denotes foreign variables.

The decomposition of the real exchange rate index presented in equation (16) is based on the following equilibrium (long-run) assumptions. First, prices in each sector are equal to unit labour costs. Second, wages are equalized across sectors although productivity differentials between the two sectors remain. These assumptions justify (19). Third, the share of tradables in consumption (a) is assumed to be the same at home and abroad. This assumption is made for convenience as it simplifies the results. Fourth,

4 - See also Marston (1987) and De Grauwe (1989) for recent applications.

Figure 3

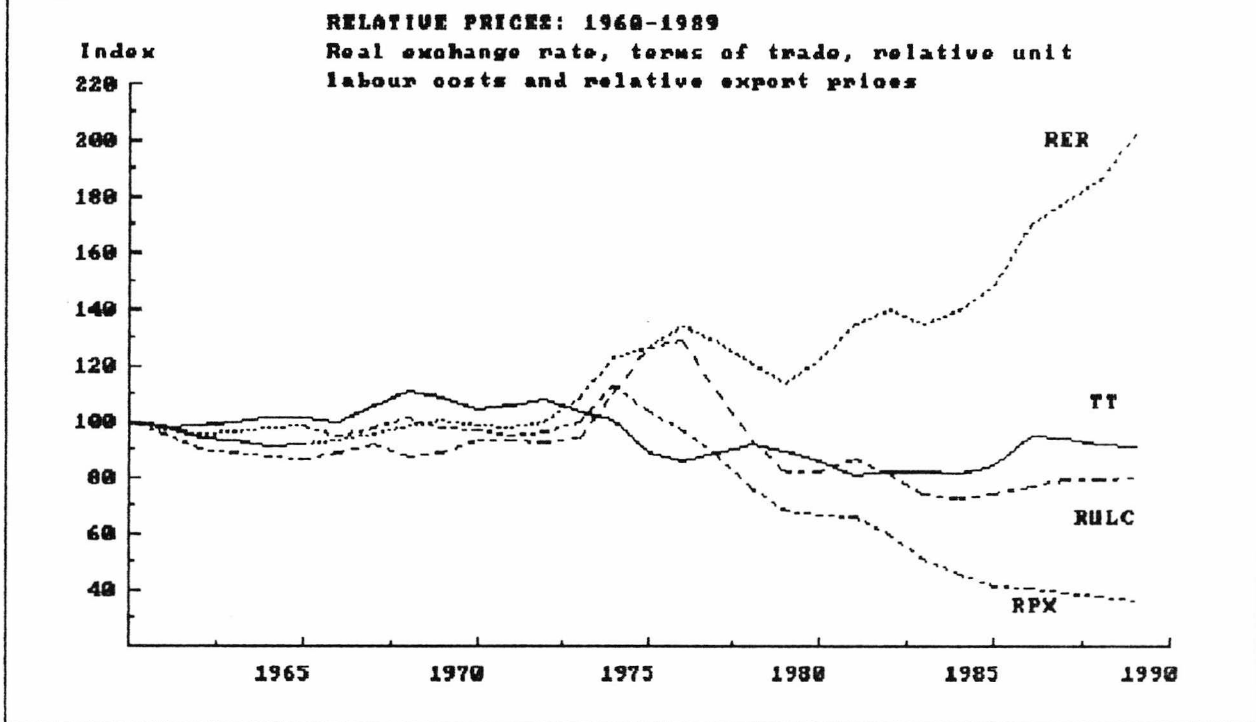


Figure 4

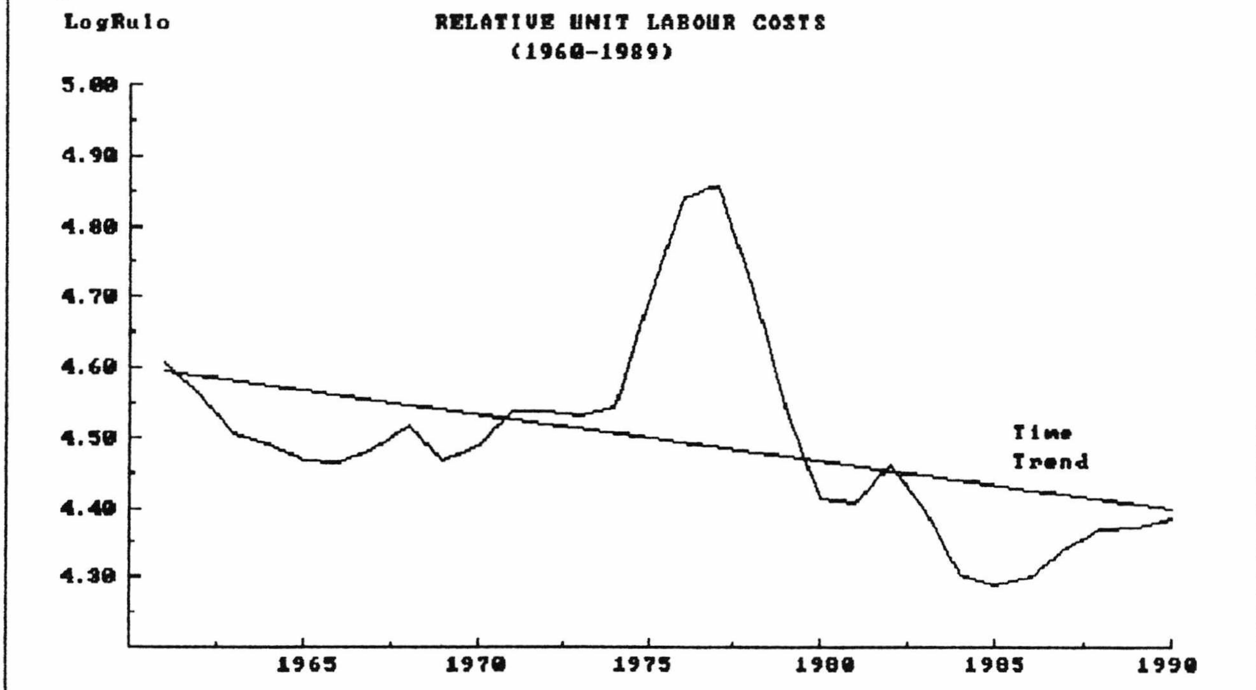
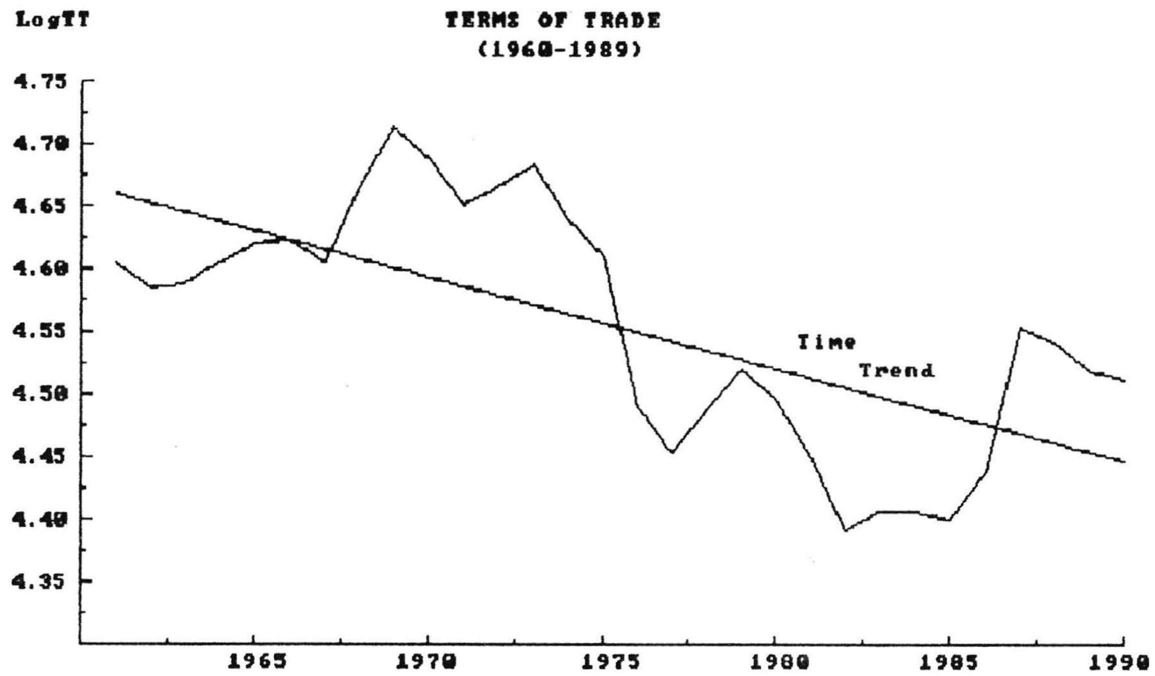


Figure 5



Source: RULC and TT from EC, European Economy.
RER and RPX own calculations from EC, European Economy.

equation (17) defines the relative price of exports as the relative price of tradables, that is, as relative unit labour costs in the tradable goods sector.

With the decomposition of the real exchange rate index presented above, the divergence between the paths of RER and RPX can be explained by two factors. First, productivity growth in the Portuguese tradable goods sector could be stronger than in the export sector of portuguese competitors, that is $q > q*$. Second, productivity growth in the non-tradable goods sector is lower in Portugal than abroad, that is $v < v*$. In Portugal, the latter effect has been perhaps more relevant than is assumed in the literature, which, in general, considers $v = v*$. This interpretation is confirmed by the evolution of RULC (whole economy) relative to RPX: as the latter price index declined more than the former this suggests that unit labour costs in the non-tradable goods sector have been rising faster in Portugal, relative to its foreign competitors.

3.2.2 - Imports and the trade deficit

As table 5 shows in 1985 Portuguese imports were mainly composed of intermediate inputs and capital goods, most of them presumably non-substitutable for export and/or home goods and vital for economic development.

Table 5 - Portuguese imports in 1985 (% of total)

Food and Bev	Ind Suppl	Fuels	Mach Equip	Transp	Consum Goods	Goods NES
11.4	36.2	26.3	13.2	8.1	4.4	0.3

Source: United Nations, International Trade Statistics Yearbook

As illustrated in table 6 Portuguese imports are geographically concentrated. In 1985, European markets (EEC+EFTA) accounted for

52% of total imports and the five main markets (Germany, USA, France, UK and Spain) accounted for 44% of total imports. In 1989, the relative position of the main import markets has changed. The USA has lost some of its importance, Germany, France and Spain reinforced their position and the UK maintained its share. This evolution is similar to the evolution noted in the direction of Portuguese exports.

Table 6 - Direction of Portuguese imports of goods (% of total)

	France	Germany	Spain	UK	USA	OPEC
1985	8.1	11.5	7.4	7.5	9.7	17.3
1989	11.6	14.4	10.9	7.4	4.5	6.1

Source: United Nations, International Trade Statistics Yearbook

Due to the characteristics of Portuguese imports we expect import volumes to be closely associated with domestic demand, and in particular with investment demand. Moreover it seems sensible to expect that relative prices play only a minor role as determinants of imports.

In figures 6 and 7 we compare the time-series behaviour of import volumes (of goods and services) and real GDP during the 1958-1988 period. The data for the 1958-85 period was taken from Cartaxo and Rosa (1986) and the data for the last three years was taken from Banco de Portugal, Annual Report, 1990. Two major conclusions emerge from these figures. First, import volumes have been growing faster than real income suggesting an income elasticity of import demand greater than unity. This idea is confirmed by the behaviour of the average propensity to import (M/Y), which having increased substantially since 1958, shows two major drops correlated with the domestic recessions of 1974-75 and 1983-84. Second, we observe a

Figure 6

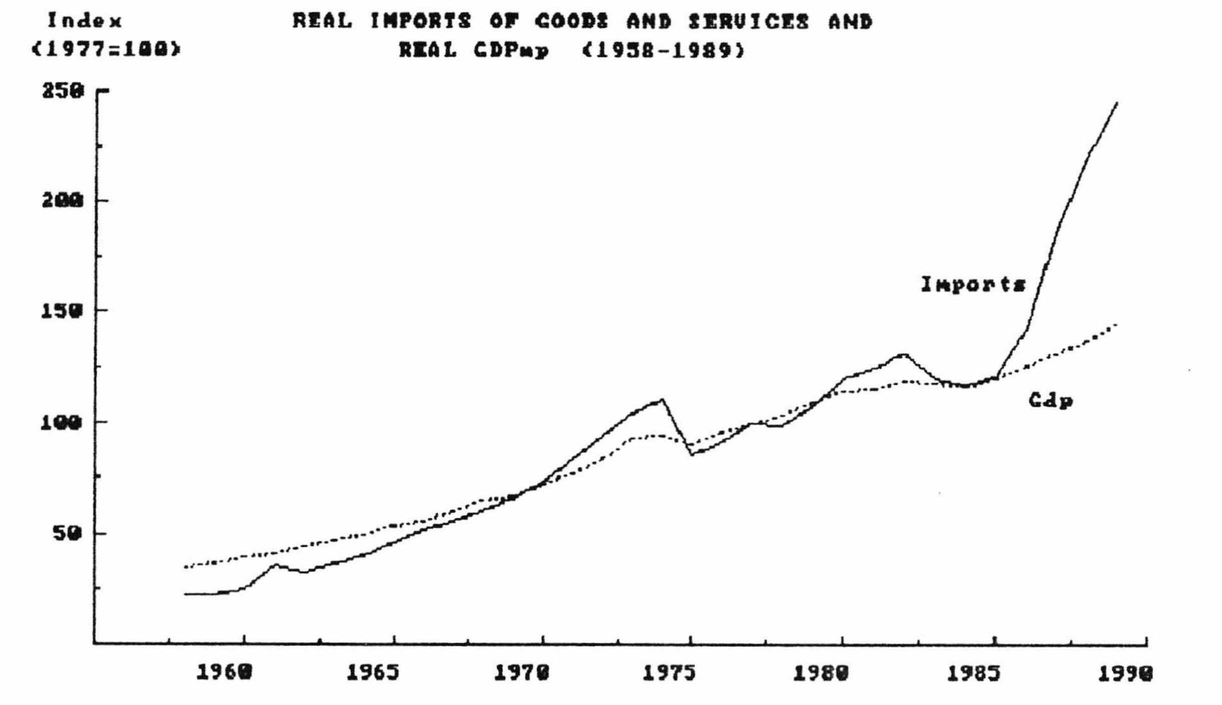


Figure 7

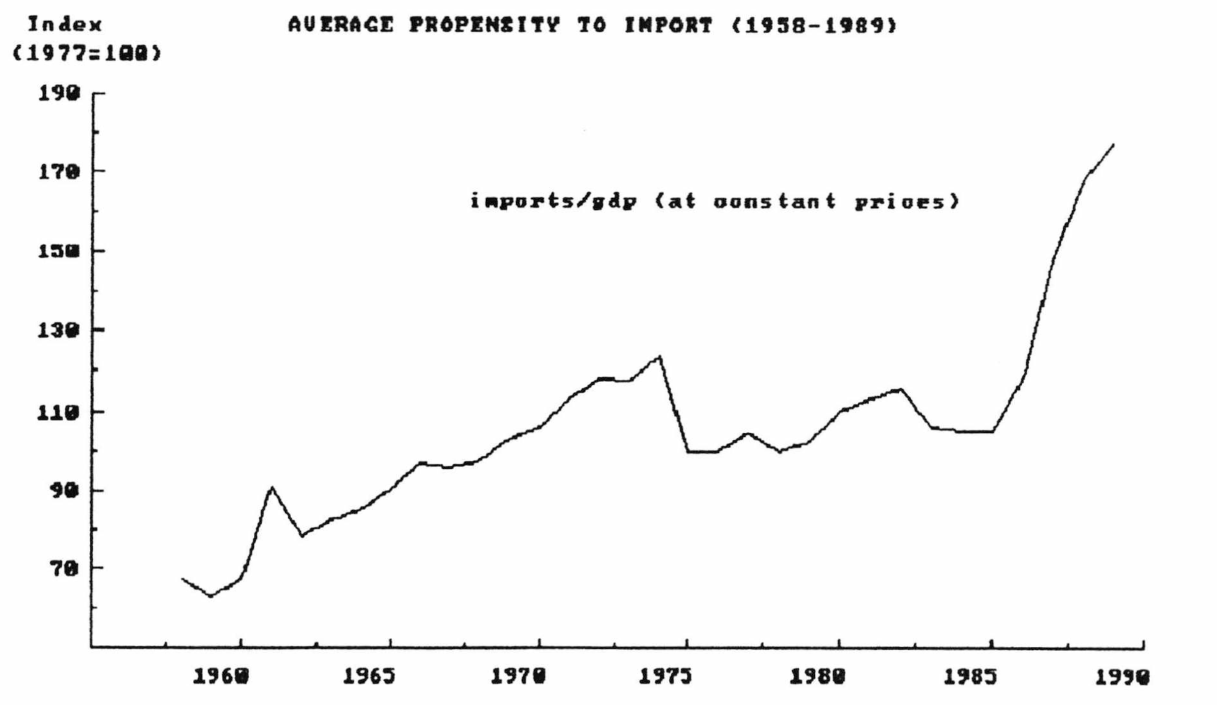
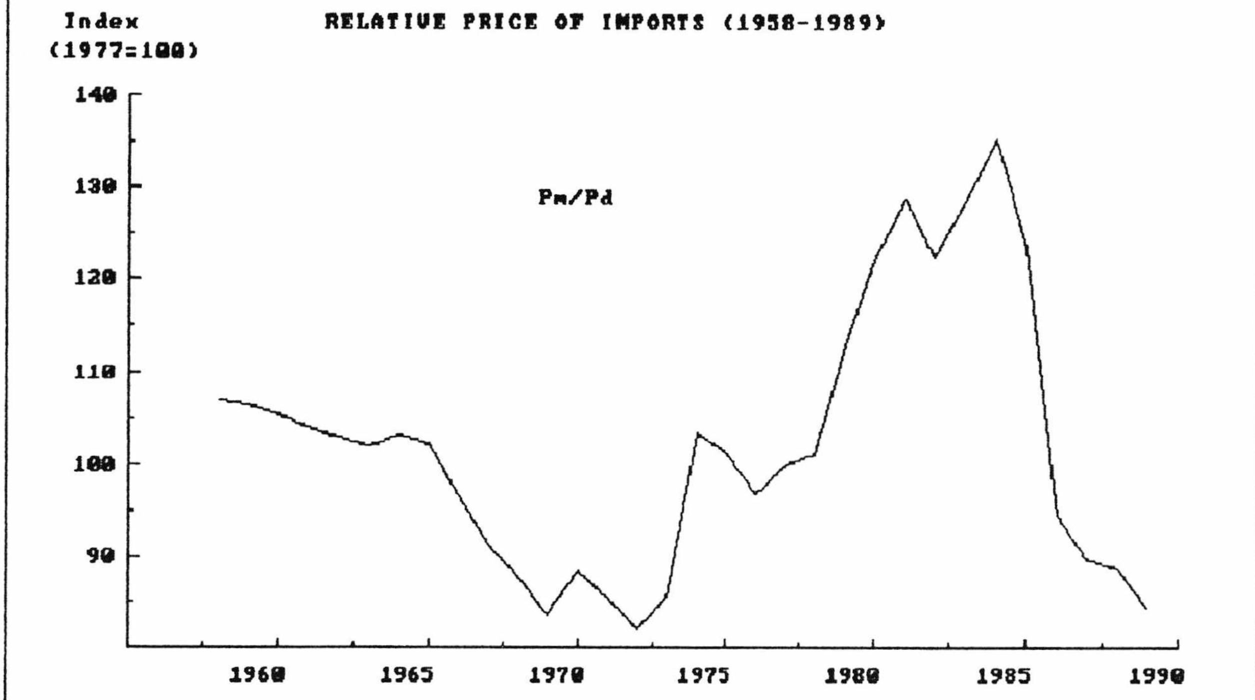


Figure 8



Source: Banco de Portugal, Annual Report, 1990, and, Cartaxo, R. and N. Rosa. 1986. Séries longas para as contas nacionais portuguesas 1958-1985, Doc. Trabalho no. 15, Lisboa, Banco de Portugal.

steep increase in the volume of imports and in the average propensity to import in the last three years of the sample, suggesting that Portugal's entry into the EC (1986) has boosted Portuguese imports.

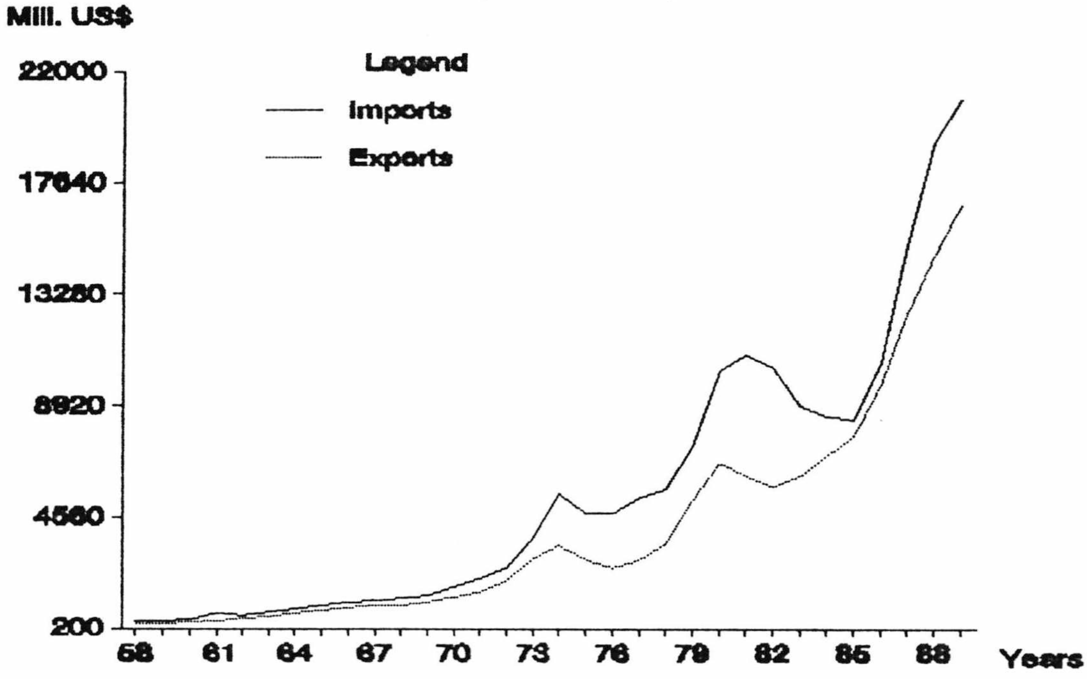
The relative price index shown in figure 8 is the ratio of the price deflators of imports of goods and services and GDP (PM/P). The data for the 1958-85 period was taken from Cartaxo and Rosa (1986) and the data for the last three years was taken from Banco de Portugal, Annual Report, 1990. During the sample period the relative price of imports has moved substantially and in different directions. From 1958 to 1973 the relative price of imports shows a decreasing trend which might have facilitated import penetration. From 1973 to 1984 the price ratio moves in the opposite direction and it is possible to see this trend reversion as one of the factors determining the reduction in the post-1974 average propensity to import. In the last four years of the sample, from 1985 to 1988, we observe a dramatic drop in the relative price of imports which may have been one of the factors behind the recent surge in import volumes. Four main factors lie behind this recent price movement: the 1986 fall in oil prices; the devaluation of the dollar from its February 1985 peak; the reduction of tariffs and the elimination of most quantitative and administrative barriers to trade after Portugal's entry into the EC; and the persistence of a substantial inflation differential between Portugal and its main trade partners in spite of the non-accommodative exchange rate policy followed by the Portuguese authorities in recent years.[5]

The evolution of the values of imports and exports of goods and

5 - This topic is discussed at length in chapter 7.

services during the 1958-1989 period is shown in figure 9. In relation to the goods and services trade deficit four major facts emerge from this figure. The first is the persistence of the trade deficit during the last three decades. The second is the widening of the import-export gap during the 1970s, under the impact of the two oil shocks. The third is the rapid narrowing of the deficit which occurred during the 1983-1985 period. The fourth is the most recent widening of the trade deficit in spite of the favorable evolution of terms of trade since 1985 and of the steady growth in export volumes after 1982.

Figure 9 Portuguese Imports and Exports of Goods and Services (1958-1989)



<u>Source</u>: Banco de Portugal, <u>Annual Report</u>, 1990 and Cartaxo, R. and N. Rosa (1986).

3.3 - The Export function

3.3.1 - Econometric modelling under perfect competition assumptions

An export function for goods and services based on the assumption that Portugal is a pure price taker (small-country) was estimated by Cartaxo (1985). In that paper export supply is modelled as follows:

$$X^{*}=X^{*}(PX;\ UC;\ DP) \qquad X_{PX}>0;\ X_{UC}<0;\ X_{DP}<0 \tag{20}$$

where X is the volume of exports; PX is the price of exports in domestic currency; UC are unit costs of production (or ULC unit labour costs) and DP is a domestic demand pressure variable. $\partial X/\partial i = X_i$ (i=PX,UC,DP) are the partial derivatives.

According to equation (20) export supply is an increasing function of the price of exports and a decreasing function of the costs of production. The demand pressure variable reflects the derived character of the function, that is, according to this specification, export supply is the excess of domestic supply of goods and services. In this case, an expansion of domestic demand reduces domestic excess supply and consequently export supply contracts at each price.

The model was estimated in log-linear form using yearly data covering the period 1962-1982. Cartaxo tried various combinations of the variables, either levels or changes. He also tried including a lagged dependent variable and the variable ln(PX/UC) rather than lnPX and/or lnUC. As the results were disappointing the small country assumption was "relaxed" and Cartaxo added a world demand variable (WD). After some experimentation the best equation obtained, estimated by the Cochrane-Orcutt technique, was:

$$\ln X_t=5.965+0.507\ \ln(PX/UC)_t+0.53\ \ln WD_t+0.287\ \ln X_{t-1}+\hat{e}_t \qquad (21)$$
$$\qquad\quad (1.8) \qquad\qquad\qquad (3.1) \qquad\quad (1.7)$$

where the residuals $e_t = \rho e_{t-1} + \epsilon_t$ with ρhat=0.51 and ϵ_t is white noise. t-statistics are indicated between ().

The conclusions, summarized in English at the end of the paper, are as follows:

> This simple specification of the export function [small country model] provides a reasonable explanation of the behaviour of Portuguese exports. Nevertheless, the inclusion of an index of foreign demand clearly improves the performance of the equation...the inclusion of lagged exports...is found to improve significantly the fit of the export function. The inclusion of a proxy for domestic demand pressure was also tried but the results were mixed.

The econometric methodology followed by Cartaxo may be characterized as Simple-to-General. Starting from (20) the author performed a limited number of tests based on the estimation of a simple specification (coefficient signs, magnitude and significance, DW near 2) and as the results were unsatisfactory the model was complicated to correct its deficiencies (additional or alternative lags, autoregressive estimation, etç). However, in spite of the inclusion of the lagged dependent variable, its coefficient is not statistically significant at the 5% level and the coefficient of $\ln(PX/UC)_t$ is barely significant at the 5% level. In fact, in the light of these results, we can say that the main determinant of the performance of Portuguese exports is world demand, not export profitability. The conclusions drawn from the empirical model are at odds with the small-country assumption and so the model appears to be theory inconsistent. However, in so far as the small-country faces quantity rationing in export markets, world demand may still be relevant even with an infinitely elastic demand curve. This would be the case if, for instance, the stringency of non-tariff barriers varies with the business cycle. Thus, the world demand variable in equation (21) might be capturing the effect of non-tariff barriers to trade. It should be stressed that if quantitative restrictions are biting, as the statistical significance of the world demand variable suggests, it is also likely that the price elasticity of export supply is under-estimated. This is so because in that case the econometric identification of the supply function requires the separation within the sample of periods when the quantitative restrictions are biting from periods when they are not. We cannot see how the world demand variable added to equation (20) allows such discrimination and identification. Be that as it may we replicated the estimation of (20) using a different econometric methodology whose details are given in Annex 2. The results are shown in table 7. The model explains 60% of the yearly variance of real exports of goods and services. The residuals are neither autocorrelated nor heteroscedastic according to the Lagrange Multiplier tests reported.

The long-run static equilibrium implied by this model is given by:

$$x = 3.1 - 1.346\ \text{ulc} + 3.03\ \text{dp} + 1.0\ \text{px} \tag{22}$$

In the long-run the price elasticity of export supply is unity.[6] However, the impact effect is -0.8 a result inconsistent with an upward sloping supply curve. The signs of the domestic demand pressure variable are positive, both the impact effect and the long-run effect. When domestic income rises above the trend by 1% export supply increases 2.1% within one year and 3% in the long-run. This

6- The low t-statistic and estimate of the coefficient of pxt-1 suggest that the ADL(1,1) specification can be simplified. As explained in Annex 2 dropping the lagged price level term from the equation yields the steady-state unit price-elasticity.

result is inconsistent with the domestic demand pressure theory and suggests a kind of "export led growth" with a causal (positive) relation from exports to growth (x -> dp) rather than a (negative) relation from excess demand to exports (dp -> x)[7]. The main conclusion that can be derived from these results is that the estimates of the small-country excess supply model are not theory consistent. The only result that is theory consistent is the negative effect of real unit labour costs on export supply. We think that the econometric evidence reviewed and presented casts some doubts about the assumptions of the model and therefore we must seek alternative specifications based on different theoretical perspectives.

7 - On export-led growth models see Thirlwall (1986).

Table 7 - Estimation of a small-country model for exports

Estimation by OLS
The sample period is 1960-1987

$$\Delta x_t = \underset{(-3.0)}{-0.801}\ \Delta px_t \underset{(-1.4)}{-0.448}\ \Delta ulc_t + \underset{(1.9)}{2.1}\ \Delta dp_t$$

$$- \underset{(-1.3)}{0.09}\ px_{t-1} \underset{(-2.2)}{-0.533}\ ulc_{t-1} + \underset{(2.6)}{1.216}\ dp_{t-1}$$

$$- \underset{(-3.1)}{0.396}\ (x - px)_{t-1} + \underset{(2.4)}{3.1} + \hat{e}_t$$

R^2=0.59 SER=0.068 RSS=0.084 F(7,18)=3.75 DW=2 k=8 n=26

Model validation tests

Serial Correlation	$Chi^2(1)$=2.43
Heteroscedasticity	$Chi^2(7)$=8.337
ARCH	$Chi^2(2)$=0

X are real exports of goods and services; PX is an index of export prices in escudos; ULC are unit labour costs; DP is the deviation of real Gdp from trend. Small characters represent logs of variables. For details on data and sources see section 3.2.

3.3.2 - Econometric modelling under imperfect competition

We turn now to the estimation of two models based on imperfect competition assumptions. The first is an imperfect substitutes model and the second can be seen either as the reduced form equation derived from the former or as the direct estimation of a model which is consistent with monopolistic competition.

3.3.2.1 - The imperfect substitutes model

The first is a simultaneous equations imperfect substitutes model which corresponds to equations (7) to (10). Written in Autor-regressive Distributed Lag specification, ADL(1,1), is as follows:[8]

8 - The time trend in the supply equation act as a proxy for capacity growth.

Export demand

$$x_t-\alpha_1 x_{t-1} = \beta_0 px_t+\beta_1 px_{t-1} + \beta_0' pex_t+\beta_1' pex_{t-1} + \\ + \gamma_0 wd_t + \gamma_1 wd_{t-1} + \text{constant} + e_{1t} \qquad (23)$$

Export supply

$$px_t - \theta_1 px_{t-1} = \mu_0 x_t + \mu_1 x_{t-1} + \phi_0 pd_t + \phi_1 pd_{t-1} + \\ + \lambda \text{time} + \text{constant} + e_{2t} \qquad (24)$$

The symbols used are: X is an index of the quantity of exports; PX is an index of Portuguese export prices in domestic currency; PEX is an index of competitors' export prices expressed in escudos; RPX=(PX/PEX) is an index of the relative export price defined as the ratio of the Portuguese export price (PX) to competitors' export price (PEX); WD is world demand for Portuguese exports proxied by the volume of EC exports (X*); (PX/PD) is the relative profitability of exports defined as the ratio of the export price (PX) to the price of domestic output (PD). It can also be seen as a proxy for the ratio of the prices of tradables (PT) to non-tradables (PNT); time is a proxy for productive capacity (time trend). Small letters denote logs of variables. For details on data and sources see section 3.2.

Without imposing any restrictions these equations can be re-written as:

Export demand

$$\Delta x_t = \beta_0 \Delta px_t+(\beta_0+\beta_1)px_{t-1} + \beta_0' \Delta pex_t+(\beta_0'+\beta_1')pex_{t-1} + \\ + \gamma_0 \Delta wd_t +(\gamma_0+\gamma_1+\alpha_1-1)wd_{t-1}-(1-\alpha_1)(x-wd)_{t-1}+\text{constant} + e_{1t} \qquad (23a)$$

Export supply

$$\Delta px_t = \mu_0 \Delta x_t + (\mu_0+\mu_1)x_{t-1} + \\ + \phi_0 \Delta pd_t + (\phi_0+\phi_1+\theta_1-1)pd_{t-1} - (1-\theta_1)(px-pd)_{t-1}+ \\ + \lambda \text{time} + \text{constant} + e_{2t} \qquad (24a)$$

In our econometric work we start by estimating the unrestricted model and then try to simplify. The main objective of this procedure is to discover a model that reproduces the long-run steady-state given by (or consistent with) economic theory whilst leaving the short-run dynamics to be determined by the data. For example, a simplified representation of the export model - unit income elasticity of demand and relative price specification - can be obtained if three linear restrictions on the export demand function,

$$\gamma_0+\gamma_1+\alpha_1-1=0, \quad \beta_0=-\beta_0' \text{ and } \beta_1=-\beta_1'$$

and two linear restrictions on the export supply function,

$$\phi_0=1 \text{ and } \theta_1=-\phi_1$$

are not rejected by the data, in which case the export side of the trade model simplifies to:

<u>Export demand</u>

$$\begin{aligned}\Delta x_t = {} & \beta_0\Delta rpx_t + (\beta_0+\beta_1)rpx_{t-1} + \\ & + \gamma_0\Delta wd_t - (1-\alpha_1)(x-wd)_{t-1} + \text{constant} + e_{1t}\end{aligned} \tag{25}$$

<u>Export supply</u>

$$\begin{aligned}\Delta(px/pd)_t = {} & \mu_0\Delta x_t+(\mu_0+\mu_1)x_{t-1}-(1-\theta_1)(px-pd)_{t-1} \\ & + \lambda\,\text{time} + \text{constant} + e_{2t}\end{aligned} \tag{26}$$

This simplified representation of the export model - unit income elasticity and relative price specification - has the following long-run solution (static steady-state) which is consistent with the theory discussed above.

<u>Export demand steady-state</u>

$$\begin{aligned} & x=wd+[(\beta_0+\beta_1)/(1-\alpha_1)]rpx+\text{constant}/(1-\alpha_1) \\ & \text{or } X=C.WD^{\sigma_x}.(PX/PEX)^{\epsilon_x}\end{aligned} \tag{27}$$

with $\sigma_x=1$ and $\epsilon_x=(\beta_0+\beta_1)/(1-\alpha_1)$, being, respectively, the income elasticity of export demand and the price elasticity of export demand.

<u>Export supply steady-state</u>

$$x=[(1-\theta_1)/(\mu_0+\mu_1)](px-pd)+[\lambda/(\mu_0+\mu_1)]\ \text{time} + \text{constant}$$

$$\text{or } X=K.(PX/PD)^{n_x}.\exp\{[\lambda/(\mu_0+\mu_1)]\ \text{time}\} \tag{28}$$

with $n_x=[(1-\theta_1)/(\mu_0+\mu_1)]$ being the price elasticity of export supply.

If restriction $\beta_1=-\beta_1'$ is rejected the own and cross price elasticities of demand differ, and the export demand steady-state becomes

$$x=wd+[(\beta_0+\beta_1)/(1-\alpha_1)]px+[(\beta_0'+\beta_1')/(1-\alpha_1)]pex+\text{constant}/(1-\alpha_1)$$

$$\text{or } X=C.WD^{\sigma_x}.PX^{\epsilon_x}.PEX^{\epsilon'_x} \tag{27a}$$

with $\sigma_x=1$, $\epsilon_x=(\beta_0+\beta_1)/(1-\alpha_1)$, and $\epsilon'_x=(\beta_0'+\beta_1')/(1-\alpha_1)$ being, respectively, the income elasticity of export demand, the own and the cross price elasticities of export demand.

The estimates of the unrestricted model (equation 23a) and of a restricted version (equation 25) of export demand are presented in table 8. The residuals of both versions of the model are neither autocorrelated nor heteroscedastic according to the Lagrange Multiplier tests reported and no significant departure from normality is noted. The Chow-test (unrestricted version) suggests that no structural break occurred in 1986, when Portugal joined the EC.

As far as the unrestricted model is concerned the parameters estimated have the expected signs and plausible magnitudes but most of the t-statistics are low; this might be due to multicollinearity, as the various price terms are highly correlated. Nevertheless, the magnitude of the estimated coefficients suggest that the model can be simplified in the direction discussed above, that is, in order to obtain a proportional error correction specification (unit income elasticity of demand) expressed or not in terms of relative prices.[9]

As far as the parsimonious representation is concerned, most of the t-statistics are now above the critical value and we note that the magnitude of the estimates did not change significantly. But in spite of the re-parametrization and simplifications carried out, the

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9 - Looking back to equation (23a) we can see that the low t-statistic (0.158) and estimate of the coefficient (0.019) of wdt-1, suggest that the restriction $\gamma 0+\gamma 1+\alpha 1-1=0$ might not be rejected by the data. As the estimated coefficients of the price terms in changes have similar magnitude and opposite signs, the restriction $\beta 0=-\beta 0'$ might not be rejected. Although the estimated coefficients of the lagged price terms in levels have opposite signs, they seem to differ substantially and thus the restriction $\beta 1=-\beta 1'$ might be rejected by the data. However the three restrictions might not be jointly rejected by the data.

low t-statistic found for the coefficient of Δwd_t (which has the expected sign and magnitude) suggests that we did not achieve substantial orthogonality between the explanatory variables. This is illustrated by the correlation matrix between the explanatory variables, where we note, in particular, the high correlation between px_{t-1}, pex_{t-1} and Δwd_t.

It should be noted that the equality between the long-run own and cross price elasticities of demand is rejected by the data as shown by a simple t-test on the $H_0:\beta_1=-\beta_1'$ against $H_a:\beta_1\neq-\beta_1'$ (given that $\beta_0=-\beta_0'$). The t statistic is $t=(0.197-0.425)\times2.238 = -2.591$ and the critical value at 5% for a two-tailed test is $t(23)=2.0687$. Thus, the relative price specification, common in the literature, is rejected by the data.

The economic interpretation of the results is as follows. Firstly, the demand for Portuguese exports is price elastic as the steady-state own price elasticity is -1.5 (-0.425/0.281). Secondly, in absolute value, the impact effect of a price change is much lower than the long-run effect (0.234 < 1.5) and, if we admit that the short-term (one year) effect is not statistically different from 0 (t=-0.908) we conclude that price changes affect the quantities exported with a one year lag; in that case it takes four and a half years for the quantity adjustment following a price change to be completed (1.5/0.425=3.5 + 1 year lag = 4.5 years). Thirdly, the assumption that Portuguese exports and competitors' exports are substitutes in consumption is confirmed by the positive sign of the estimated cross price elasticity, and, although international competition is less than perfect (own price elasticity high but clearly finite) it is likely to be intense, as the cross price elasticity is relatively high (0.70 in the long-run). Fourthly, the income elasticity of export demand is unity suggesting that Portuguese exports are neither luxury goods nor necessities.

Table 8 - Estimation of the export demand function

Estimation by OLS
The sample period is 1961-1989 less 3 Forecasts (1987-89)

$$\Delta x_t = \underset{(-0.676)}{-0.226}\,\Delta px_t \underset{(-1.400)}{-0.425}\,px_{t-1} + \underset{(0.665)}{0.211}\,\Delta pex_t + \underset{(1.606)}{0.234}\,pex_{t-1} +$$

$$+ \underset{(1.148)}{1.015}\,\Delta wd_t + \underset{(0.158)}{0.019}\,wd_{t-1} - \underset{(-1.790)}{0.297}\,(x-wd)_{t-1} + \underset{(1.504)}{0.868} + \hat{e}_{1t}$$

R^2=0.51 SER=0.057 RSS=0.058 F(7,18)=2.65 DW=2.0 n=26 k=8

Model validation tests

Serial Correlation	F(1,17)=0.56	F(2,16)=0.51
ARCH	F(1,16)=0.04	F(2,14)=0.02
Normality	$Chi^2(2)$=3.049	
Chow test [1986]	F(3,18)=0.11	

Estimation of a restricted model over the whole sample

$$\Delta x_t = \underset{(-0.908)}{-0.234}\,\Delta rpx_t \underset{(-2.041)}{-0.425}\,px_{t-1} \underset{(2.238)}{+0.197}\,pex_{t-1} +$$

$$\underset{(1.305)}{+1.008}\,\Delta wd_t \underset{(-2.291)}{-0.281}\,(x-wd)_{t-1} \underset{(1.843)}{+0.842} + \hat{e}_{1t}$$

R^2=0.50 SER=0.051 RSS=0.059 F(5,23)=4.61 DW=2.0 n=29 k=6

Model validation tests

Serial Correlation	F(1,22)=0.47	F(2,21)=0.65
Heteroscedasticity	F(10,12)=2.01	
ARCH	F(1,21)=0.09	F(2,19)=0.05
Normality	$Chi^2(2)$=6.168	

Correlation matrix

Δrpx_t	px_{t-1}	pex_{t-1}	Δwd_t	$(x-wd)_{t-1}$
1	-0.58	-0.55	0.50	0.46
	1	0.99	-0.73	-0.18
		1	-0.65	-0.15
			1	0.29
				1

where: X is an index of the quantity of exports; PX is an index of Portuguese export prices in domestic currency; PEX is an index of competitors' export prices expressed in escudos; RPX=(PX/PEX) is an index of the relative export price defined as the ratio of the Portuguese export price (PX) to competitors' export price (PEX); WD is world demand for Portuguese exports proxied by the volume of EC exports (X*). Small letters denote logarithms.

The estimates of the unrestricted version of the export supply equation are shown in table 9, where the OLS estimates are presented at the top of the table. The residuals of the model are neither autocorrelated nor heteroscedastic according to the Lagrange Multiplier tests reported and no significant departure from normality is noted. The Chow-test suggests that no structural break occurred in 1986, when Portugal joined the EC. The parameters have the expected signs but the low magnitudes of the coefficients and t-statistics of the export quantity terms suggest that the price elasticity of export supply is infinite ($\Delta x/\Delta px = 1/0 \rightarrow \infty$). We tried to simplify the model in the direction discussed above, that is, to obtain a supply equation formulated in terms of relative prices, but we were unsuccessful.

Re-estimation by Instrumental Variables (IV) (or 2SLS) does not change the main conclusions. In table 9 we show also the results obtained when estimating the supply equation by IV. Firstly, the equation was estimated without the constant and trend terms and, as instruments, we used all the pre-determined variables in both the supply equation and the demand equation. This is equivalent to 2SLS estimation. Secondly, the equation was estimated with the constant and the trend terms and, as instruments, we used all the pre-determined variables in the supply equation and constrained export demand equation. To be more specific, the difference between the two estimations is that, besides the constant and the trend not included in the first estimation, we use the relative price variable $rpx_{t-1} = (px-pex)_{t-1}$ as instrument in the second estimation, instead of the two price variables, px_{t-1} and pex_{t-1}, used in the first. The second regression was performed in order to test the robustness of the results to the exclusion of the constant and the trend term which had to be dropped due to the singularity of the variance covariance matrix, occurring when the constant, the trend, px_{t-1} and pex_{t-1} are simultaneously used as instruments.

In the first IV estimation reported in table 9, the coefficient and the t-statistic of the Δx_t variable have increased substantially (from 0.162 to 0.532 and from 1 to 1.922) and the coefficient and the t-statistic of the x_{t-1} variable have also increased significantly (from 0.035 to 0.121 and from 0.298 to 2.011). As both coefficients of the export quantity terms are now statistically significant this could be interpreted as confirming the simultaneous determination of Δx_t and Δpx_t and the bias of the OLS estimates. However, the coefficient and t-statistic of the error correction term $(px-pd)_{t-1}$ have dropped in absolute terms (from -0.29 to -0.06 and from -1.78 to -1.50). This means that we are now unable to determine a steady-state relation between the supply price of exports and the quantities supplied. In fact, the static equilibrium implied by this model is $x=0$, that is, the quantity supplied is independent of the (domestic) relative price.

Table 9 - Estimation of the export supply function

Estimation by OLS
The sample period is 1961-1989 less 3 forecasts (1987-89)

$$\Delta px_t = \underset{(1.010)}{0.162\,\Delta x_t} + \underset{(0.298)}{0.035 x_{t-1}} + \underset{(3.936)}{1.35\,\Delta pd_t} \underset{(-2.039)}{-0.224 pd_{t-1}} -$$

$$\underset{(-1.783)}{-0.289(px-pd)_{t-1}} \underset{(-0.000)}{-0.005\ time} + \underset{(1.423)}{2.969} + \hat{e}_{2t}$$

R^2=0.66 SER=0.040 RSS=0.032 F(6,19)=6.08 DW=2.19 n=26 k=7

Model validation tests

Serial Correlation	F(1,18)=0.44	F(2,17)=1.15
ARCH	F(1,17)=0.22	F(2,15)=0.10
Normality	Chi²(2)=0.374	
Chow test [1986]	F(3,19)=0.55	

First estimation by IV over the whole sample

$$\Delta px_t = \underset{(1.922)}{0.532\,\Delta x_t} + \underset{(2.011)}{0.121 x_{t-1}} + \underset{(4.461)}{0.852\,\Delta pd_t} \underset{(-2.599)}{-0.086 pd_{t-1}} -$$

$$\underset{(-1.498)}{-0.058(px-pd)_{t-1}} + \hat{e}_{2t}$$

Instruments: Δwd_t, $(x-wd)_{t-1}$, Δpex_t, pex_{t-1}, px_{t-1}, x_{t-1}, Δpd_t, pd_{t-1}, $(px-pd)_{t-1}$
(pre-determined variables in the export demand and export supply equations; constant and trend not included)

SER=0.048 RSS=0.056 DW=2.4

Specification Chi²(4)/4=1.61
Serial Correlation Chi²(1)=1.57 Chi²(2)=3.94

Second estimation by IV over the whole sample

$$\Delta px_t = \underset{(1.592)}{0.340\,\Delta x_t} + \underset{(0.427)}{0.050 x_{t-1}} + \underset{(4.053)}{1.241\,\Delta pd_t} \underset{(-2.679)}{-0.260 pd_{t-1}} -$$

$$\underset{(-2.569)}{-0.370(px-pd)_{t-1}} + \underset{(0.203)}{0.002\ time} + \underset{(1.96)}{2.60} + \hat{e}_{2t}$$

Instruments: Δwd_t, $(x-wd)_{t-1}$, Δpex_t, rpx_{t-1}, x_{t-1}, Δpd_t, pd_{t-1}, $(px-pd)_{t-1}$, time, constant
(pre-determined variables in a constrained export demand and in the export supply equation)

SER=0.042 RSS=0.038 DW=2.3

Specification Chi²(3)/3=1.21
Serial Correlation Chi²(1)=0.63 Chi²(2)=2.78

As shown at the bottom of table 9 the second IV estimation yields results which are very similar to those obtained by OLS. In particular, the low magnitude of the coefficient and t-statistic of x_{t-1} variable suggests that, in the steady-state, the supply price of exports does not depend on the quantity supplied, or, to put it differently, the export supply function is horizontal in the (x,px) space. However, the coefficient and the t-statistic of the Δx_t variable have increased substantially (from 0.162 to 0.340 and from 1 to 1.592). Although not statistically significant at the 5% level this coefficient might be interpreted as the (inverse of the) impact or short-term supply price elasticity. This elasticity is lower than the long term (infinite) elasticity but it is still very large ($\Delta x/\Delta px = 1/0.34 \approx 3$).

3.3.2.2 - Direct estimation of a reduced form/monopolistic competition model

To simulate the effects of a loss in competitiveness on the volume of exports and on the balance of trade and services it is more convenient to estimate a reduced form export equation. Thus, the second export function to be estimated is a reduced form equation derived from the imperfect substitutes model.[10] Alternatively equation (30) can be interpreted as an export function that is consistent with monopolistic competition. The model to be estimated is a very simple export function as follows:

$$X=X(RULC;\ WD) \text{ with } \partial X/\partial RULC < 0 \text{ and } \partial X/\partial WD > 0 \qquad (29)$$

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10 - It corresponds to equation (11). However, note that, in equation (29), price competitiveness is not measured by the real exchange rate - it is measured by relative unit labour costs. See footnote 11.

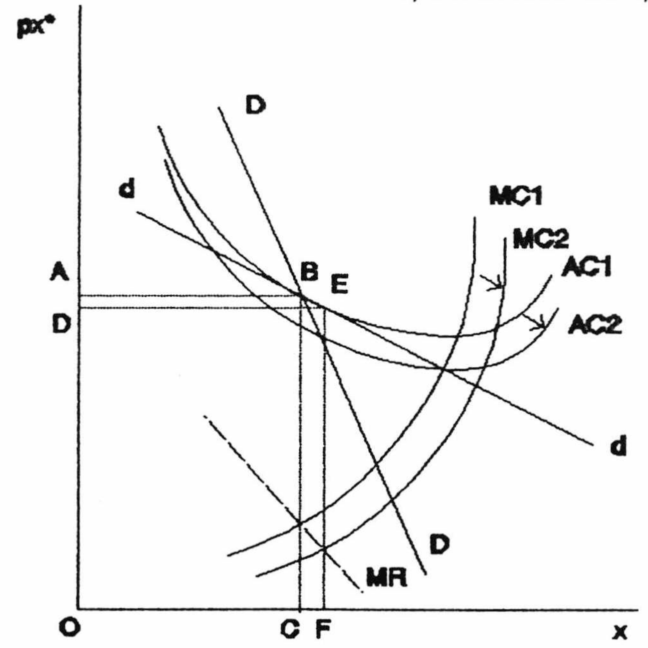
which, written in ADL(1,1), is:

$$\Delta x_t = \text{constant} + \beta_0 \Delta rulc_t + \gamma_0 \Delta wd_t + \\ +(\beta_0+\beta_1) rulc_{t-1} + (\gamma_0+\gamma_1+\alpha_1-1) wd_{t-1} - (1-\alpha_1)(x-wd)_{t-1} + e_t \qquad (30)$$

where X-is the volume of exports; RULC-are relative unit labour costs and WD-is a World demand variable proxied by the volume of EC exports. Small letters denote logs of variables.

According to equation (29) the volume of exports is a negative function of relative unit labour costs, and a positive function of world demand. Among various possible measures of international price competitiveness, relative unit labour costs is the most popular and influential.[11] The microeconomic rationale for equation (29) is illustrated in figure 10, where we represent the optimal choice of a firm under Chamberlian monopolistic competition.

Figure 10 Devaluation and monopolistic competition



11 - For a discussion on the advantages and drawbacks of various measures of international price competitiveness, in relation to econometric modelling the foreign trade sector, see Enoch (1978). According to Enoch the RULC measures were the best at explaining U.K.'s export volumes. See also Anderson and Dunnett (1987).

CHAPTER 3

Following Hague et al. (1974) we look at how a firm sets its export prices after a devaluation if it is maximising profit under monopolistic competition. The (single) domestic firm produces a differentiated good facing a large number of foreign competitors and is assumed to export its total output to one market. The vertical axis shows the export price in foreign currency (PX*) and the horizontal axis the amounts produced and exported (X). The average revenue curve DD is drawn on the assumption that all firms set the same price and the average revenue curve dd is drawn on the assumption that the home firm charges the price shown on the vertical axis, while all other firms charge OA. Consequently, the dd curve is more elastic than the DD curve. We start from a situation of Chamberlian equilibrium where the firm sets marginal costs equal to marginal revenue (MC1=MR) producing the quantity OC at the price OA, with profit zero - the average costs curve (AC1) is tangent to the average revenue curve (dd) at B. The effect of a devaluation is shown as lowering the marginal cost curve to MC2 and the average cost curve to AC2, the downward movement being net of the increase in costs due to the increase in the prices of imported inputs. The crucial point to understand the effect of a devaluation, made by Hague et al., is that if the competitors in export markets are foreign, the supply curve for the whole industry (Portuguese and foreign) in export markets is unlikely to fall by much because the market share of the Portuguese firm is small and because the devaluation will affect world supply only to the extent that firms in the industry are operating from Portugal. Thus the devaluation will allow the Portuguese firm to extend sales along the demand curve dd, that is, by making a small reduction in the foreign price of its good. The new profit maximising price is OD, the new quantity exported is OF and the firm will make an economic profit.

The estimates of the model are presented in table 10. The residuals are neither autocorrelated nor heteroscedastic according to the Lagrange Multiplier tests reported and no significant departure from normality is noted. The Chow-test suggests that no structural break occurred in 1986, when Portugal joined the EC. The estimated parameters have the expected signs and plausible magnitudes. The low t-statistic and magnitude of the coefficient of the lagged world demand variable in levels suggests that the model can be simplified in order to obtain a unit income elasticity model. The low t-statistic found for the coefficient of Δwd_t (which has the expected sign and magnitude) suggests that we did not achieve substantial orthogonality between the explanatory variables. However, the correlation between Δwd_t and the other explanatory variables is relatively low.

The economic interpretation of the results is as follows. Firstly, the income elasticity of export demand is unity. This confirms our previous finding that Portuguese exports are neither luxury goods nor necessities. Secondly, exports are inelastic to relative unit labour costs as the steady-state elasticity is -0.77 (-0.227/0.294). Thirdly, as the impact (one year) effect of a change in relative unit labour costs is not statistically different from zero, we conclude that relative cost changes affect the quantities exported with a one year lag. It takes nearly four and a half years for the quantity adjustment following a cost change to be completed (0.77/0.227= 3.4 + 1 year lag = 4.4 years).

When relative unit labour costs and world demand grow at constant rates (Δrulc = g_u; Δwd = g_w) the dynamic steady-state implied by (30) is:[12]

$$x = (1-\alpha_1)^{-1} [\text{constant} + (\beta_0+\beta_1).\text{rulc} + (\gamma_0+\gamma_1).\text{wd}] -$$

$$- (1-\alpha_1)^{-2} [(\beta_1+\alpha_1\beta_0).g_u + (\gamma_1+\alpha_1\gamma_0).g_w] \qquad (31)$$

From equation (30) and table 10, the low estimates of the coefficients and t-statistics of the relative unit labour cost term in changes, and, world demand variable in levels suggest that the linear restrictions

$$(i): \beta_0=0 \text{ and } (ii): \gamma_0+\gamma_1+\alpha_1-1=0$$

might not be rejected by the data. Furthermore, as the estimate of the coefficient of the world demand variable in changes is approximately equal to unity the linear restriction

$$(iii): \gamma_0=1$$

might not be rejected by the data. As discussed above, the first restriction ($\beta_0=0$) means that price competitiveness affects the quantities exported with a one year lag. The second and the third restrictions taken together ($\gamma_0+\gamma_1+\alpha_1-1=0$; $\gamma_0=1$) mean that the income elasticity of export demand is unity and that world demand affects the quantities exported without a lag. If these three linear (simultaneous) restrictions are not rejected the dynamic steady-state becomes:[13]

$$x - wd = (1-\alpha_1)^{-1} (\text{constant} + \beta_1 \text{ rulc}) - (1-\alpha_1)^{-2} \beta_1.g_u \qquad (32)$$

12 - For the derivation of the dynamic steady-state see Annex 2.

13 - To obtain the dynamic steady-state note that restrictions (ii) and (iii) imply that $\gamma_1 + \alpha_1 \gamma_0 = 0$. This means that y and wd have a common factor (COMFAC). See Annex 2.

Table 10 - Estimation of a reduced form export function

Estimation by OLS
The sample period is 1961-1989 less 3 Forecasts (1987-89)

$$\Delta x_t = \underset{(-1.188)}{-0.002}\,\Delta rulc_t \underset{(-2.354)}{-0.218}\,rulc_{t-1} +$$

$$+ \underset{(1.255)}{1.045}\,\Delta wd_t - \underset{(-1.272)}{0.076}\,wd_{t-1} - \underset{(-1.902)}{0.287}\,(x-wd)_{t-1} + \underset{(2.563)}{1.433} + \hat{e}_t$$

$R^2=0.54$ SER=0.052 RSS=0.054 $F(5,20)=4.75$ DW=2.2 n=26 k=6

Model validation tests

Serial Correlation	$F(1,19)=1.86$	$F(2,18)=0.91$
ARCH	$F(1,18)=0.05$	$F(2,16)=0.02$
Normality	$Chi^2(2)=3.420$	
Chow test [1986]	$F(3,20)=0.07$	

Estimation of the model over the whole sample

$$\Delta x_t = \underset{(-1.221)}{-0.002}\,\Delta rulc_t \underset{(-2.745)}{-0.227}\,rulc_{t-1} +$$

$$+ \underset{(1.478)}{1.126}\,\Delta wd_t - \underset{(-1.271)}{0.068}\,wd_{t-1} - \underset{(-2.088)}{0.294}\,(x-wd)_{t-1} + \underset{(2.757)}{1.431} + \hat{e}_t$$

$R^2=0.54$ SER=0.049 RSS=0.055 $F(5,23)=5.41$ DW=2.2 n=29 k=6

Model validation tests

Serial Correlation	$F(1,22)=1.94$	$F(2,21)=0.97$
Heteroscedasticity	$F(10,12)=2.13$	
ARCH	$F(1,21)=0.11$	$F(2,19)=0.06$
Normality	$Chi^2(2)=5.190$	

Test of the three linear restrictions

(i): $\beta_0=0$ (ii): $\gamma_0=1$ (iii): $\gamma_0+\gamma_1+\alpha_1-1=0$ $F(3,23)=3.614$ *

Correlation matrix

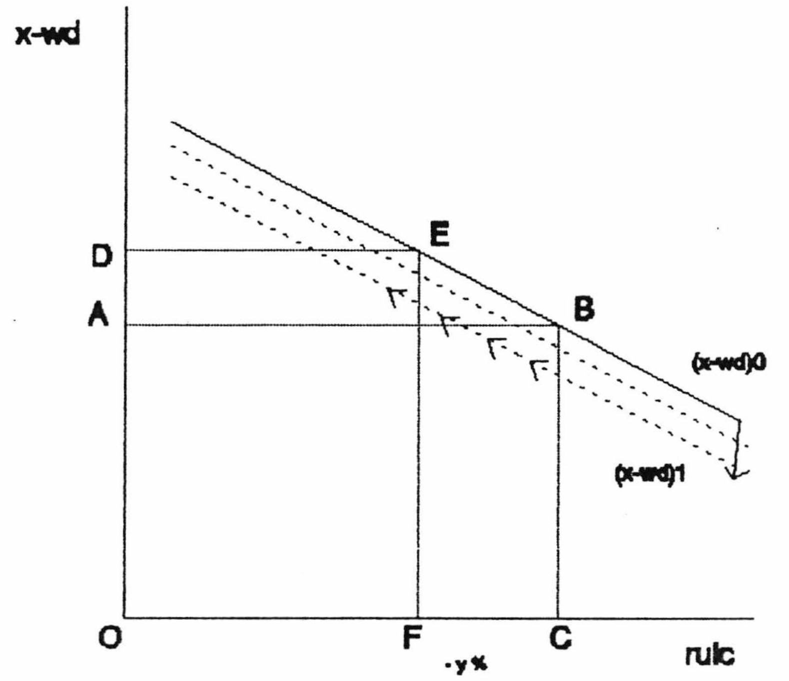
$\Delta rulc_t$	$rulc_{t-1}$	Δwd_t	wd_{t-1}	$(x-wd)_{t-1}$
1	-0.66	-0.32	-0.64	0.44
	1	-0.31	-0.62	-0.82
		1	-0.03	0.25
			1	0.65
				1

where X-is the volume of exports; RULC-are relative unit labour costs and WD-is a World demand variable proxied by the volume of EC exports. Small letters denote logs of variables.

According to equation (32) the steady-state relative demand for Portuguese exports (x-wd) depends on the level as well as on the rate of change of relative unit labour costs. However, the level and the changes in rulc affect exports in opposite directions. The lower the level of relative costs (the more competitive) the higher the equilibrium volumes exported, as the elasticity is negative ($\beta_1<0$). But the rate of change of relative costs affects the volumes exported in the opposite direction, that is, the higher the rate of increase in cost competitiveness ($rulc_t-rulc_{t-1}=\Delta rulc<0$) the lower the steady-state volumes exported. This is apparently at odds with economic theory. As the estimates of the coefficients of Δrulc and $rulc_{t-1}$ suggest we cannot rule out the occurrence of these dynamic effects in the Portuguese export function. In order to offer an explanation for these findings we show in figure 11 the equilibrium export equation (32). The vertical axis measures (x-wd) and the horizontal axis measures rulc. We start from a steady-state (B) with export volume OA and relative cost OC. Suppose that there is a once-and-for-all $-g_u$ decrease in relative costs (gain in competitiveness): we move to the new rulc, say, OF and the new export volume will be OD. Suppose now that from the same initial equilibrium a policy of permanently lowering relative costs by $-g_u$ a year is initiated: the economy will not follow the solid line but, instead, one of the dashed lines, as if the export equation had moved downward. The main message of these "perverse" dynamic effects is that permanent relative cost changes (or exchange rate policies) appear to be less effective than once-and-for-all changes in relative costs.

This result can be understood within the Chamberlinian model of

Figure 11 Dynamic effects of relative cost competitiveness



monopolistic competition. Looking back to figure 10 we can see that after the devaluation and the resulting reduction in marginal and average costs the firm decreases export prices in foreign currency and thus, export volumes increase along the dd line. This is in fact the profit maximising strategy. However, if relative costs are being permanently reduced the firm may not wish to permanently cut export prices and may simply let profit margins increase. Although additional microeconomic inquiry would be needed to justify our case it might be the case that the optimal choice is not to cut prices if permanent reductions in price are seen as a signal of changes in quality (less quality). Another reason for these "perverse" dynamic effects is related to non-tariff barriers to trade (NTBs) a topic to be discussed further below.

The estimates of a restricted version of the export function are presented in table 11.[14] The residuals are neither autocorrelated nor heteroscedastic (ARCH) and no significant departure from normality is noted. However the Breusch-Pagan test for heteroscedasticity is just above the critical value at 5% [F(6,18)=2.661]. The Chow-test suggests that no structural break occurred in 1986 and as confirmed by the one-step forecasts the model predicts very accurately the recent growth of Portuguese export volumes. The main difference between the estimates of the unrestricted and restricted versions of the export function is that the estimate of the coefficient (and respective t-statistic) of the Δwd_t term is significantly larger in the latter, restricted version, thus being significantly larger than the long-run elasticity. This fact has interesting consequences for the analysis of the dynamic steady-state, because, as we have $\gamma_0=2$ (or $\gamma_0\neq 1$) we may now reject the COMFAC restriction implied when $\gamma_0=1$ and $\gamma_0+\gamma_1+\alpha_1-1=0$, a rejection that is confirmed by the F-test reported in table 10. This means that the steady-state of exports depends on the rate of growth of world demand in a very suggestive way.

The coefficients estimated are $\beta_0=0$, $\beta_1=-0.21$, $\gamma_0=2$, $\gamma_1=-1.58$ and $\alpha_1=0.58$. Accordingly, by substitution in (31) we get the following dynamic steady-state:

$$x - wd = 2.342 - 0.5\ rulc + 1.134\ g_u + 2.381\ g_w \tag{33}$$

According to equation (33) the steady-state relative demand for Portuguese exports (x-wd) depends on the level as well as on the rate of change of relative unit labour costs, which affect the steady-state in opposite directions as discussed above. The steady-

14 - The model whose estimates are given in table 11 is equation (30) with two restrictions - (i): $\beta 0=0$ and (ii): $\gamma 0+\gamma 1+\alpha 1-1=0$.

state relative demand for Portuguese exports depends also on the rate of growth of world demand but in a virtuous way: the higher the rate of growth of world demand the higher the steady-state growth of exports. These dynamic demand effects are illustrated in figure 12. The vertical axis measures x and the horizontal axis measures wd. We start from a steady-state (B) with export volume OA and world demand OC. Suppose that there is a once-and-for-all g_w increase in world demand: we will move to the new x, at OD, proportional to the increase in the volume of world demand given by CF. Suppose now that from the same initial equilibrium world demand grows permanently at g_w (each year): the economy will not follow the solid line but, instead, the upper dashed line, as if the export function had moved upwards. Conversely, world recessions move the export function downwards. If the stringency of NTBs is related to the economic cycle there will be a relaxation (tightening) of administrative and quantitative barriers to the international flow of goods and services during the upward (downward) phase of the economic cycle which might explain the shifting of the steady-state of exports. And if this is true the price and or relative cost elasticities of exports might be under-estimated, either because there is an econometric problem in identifying the effects of price changes or because the relative cost advantage cannot be passed on to reduced export prices because of the quantitative constraints on export volumes (constrained optimisation in the monopolistic competition example).

Table 11 - Estimation of a constrained export function

Estimation by OLS

The sample period is 1961-1989 less 3 Forecasts (1987-89)

$$\Delta x_t = \underset{(-2.210)}{-0.204}\ rulc_{t-1} + \underset{(4.200)}{2.003}\ \Delta wd_t - \underset{(-\ 3.436)}{0.416}\ (x-wd)_{t-1} + \underset{(2.294)}{0.963} + \hat{e}_t$$

R^2=0.50 SER=0.052 RSS=0.059 F(3,22)=7.19 DW=2 n=26 k=4

Model validation tests

Serial Correlation	F(1,21)=0.47	F(2,20)=0.28
Heteroscedasticity	F(6,15)=2.13	
ARCH	F(1,20)=0.01	F(2,18)=0.11
Normality	Chi^2(2)=0.549	
Chow test [1986]	F(3,22)=0.00	

Analysis of one-step forecasts

Year	Actual	Forecast	t-value
1987	0.0267	0.0267	0.000
1988	0.0307	0.0298	0.016
1989	0.0481	0.0425	0.101

Estimation of the model over the whole sample

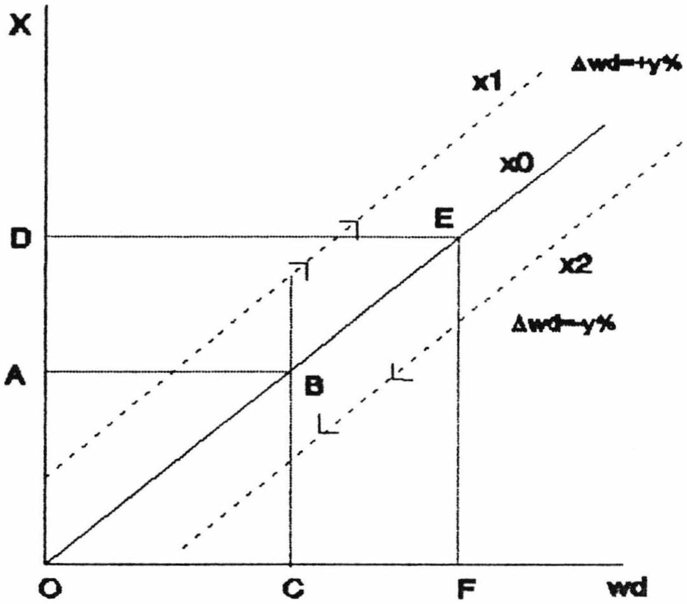
$$\Delta x_t = \underset{(-2.534)}{-0.206}\ rulc_{t-1} + \underset{(4.514)}{2.003}\ \Delta wd_t - \underset{(-\ 3.661)}{0.415}\ (x-wd)_{t-1} + \underset{(2.636)}{0.972} + \hat{e}_t$$

R^2=0.50 SER=0.049 RSS=0.059 F(5,25)=8.23 DW=2 n=29 k=4

Model validation tests

Serial Correlation	F(1,24)=0.54	F(2,23)=0.32
Heteroscedasticity	F(6,18)=2.77 *	
ARCH	F(1,21)=0.08	F(2,19)=0.18
Normality	Chi^2(2)=1.25	

Figure 12 Dynamic effects of world demand



3.3.3 - Conclusions on the export function and some simulations of the effects of a loss in competitiveness on the volume of exports

The main objective of this section was to estimate income and price elasticities of export demand and supply. Firstly, we began with the conventional view that Portugal is a pure price-taker in world markets and concentrated on the estimation of an export supply function along the lines suggested by previous econometric work on the Portuguese external sector. The main conclusion from this effort was that the estimates of the small-country excess supply model are not theory consistent and thus an alternative approach to modelling the Portuguese external sector seems to be needed. Secondly, as an alternative approach we estimated a simultaneous equations imperfect substitutes model. Here we were relatively unsuccessful at estimating the supply-side of the model. A possible reason is that supply constraints are nonexistent, because of a large price elasticity of export supply. Of course, it is also possible that our supply equations were not correctly specified. With this caveat in mind we estimated the demand-side of the model and found plausible results. Thus, it seems that Portuguese export performance is better understood within an imperfect competition model, a conclusion that justifies the importance of the role of world demand in determining the volume of Portuguese exports. Thirdly, we estimated an export model which emphasizes the role of relative cost competitiveness, as well as the role of world demand. This model is also consistent with monopolistic competition. Finally, we found that the income elasticity of export demand (or exports) is unity, a result which seems to be robust. The price elasticities estimated are summarized below.

Price elasticities

Function	Export Demand	Export Supply	Reduced Form
Short-run	-0.43 (1 lag)	3	-0.21
Long-run	-1.50	∞	-0.50

As the last equation estimated can also be interpreted as a reduced form model, we can use it to perform some simulations of the effects of a loss in competitiveness on the volume of exports. The simulations are shown in table 12 and illustrated in figures 13 and 14. We consider three scenarios for a 16% (total) loss in competitiveness (increase in relative unit labour costs) and a ten years horizon (say 1990-2000). In the first scenario (rulc I; export I) we consider a gradual loss in competitiveness, the loss being stretched and declining over five years. This could be seen as corresponding to a gradualist approach to ERM entry. In the second scenario (rulc II; export II) we consider a sharp loss in competitiveness, the loss being concentrated in the first year. This could be seen as corresponding to an immediate ERM entry approach. The third scenario (rulc I; export III; g_w=2%) is also a gradualist one which differs from the first only to the extent that in the third scenario we set world demand growing at a constant rate of 2% a year. This introduces a trend into the path of export volumes (and also the dynamic demand effects alluded) and thus the effect of a loss in competitiveness is simulated within a more "realistic" scenario. The main conclusions from this exercise are as follows. First, in the long-run the effect on volume of exports of a 16% loss in competitiveness (with world demand constant) is the same whether the loss in competitiveness is sharp or not. The new steady-state will be a lower export volume (-8%). Second, the transition to the new steady-state is different. The volume of exports along the transition to the new steady-state, will be lower under the second alternative, that is, the total loss of export volumes will be lower when the loss in competitiveness is stretched over time. Third, the effect of a gradual loss in competitiveness is shown as decelerating export growth when world demand is kept growing at a constant rate of 2%.

Table 12 - Simulated effects of a loss in competitiveness

	rulc I	rulc II	export I	export II	export III
0	100	100	100	100	100
1	105	116	100	100	104.1
2	109.4	116	98.9	96.9	106.3
3	112.7	116	97.5	95.1	107.6
4	115	116	96.1	94.1	108.6
5	116	116	94.8	93.5	109.6
6	116	116	94	93.2	110.9
7	116	116	93.4	93	112.6
8	116	116	93.1	92.9	114.6
9	116	116	92.9	92.85	116.7
10	116	116	92.85	92.8	118.9

Scenario I: rulc I and export I.

Scenario II: rulc II and export II.

Scenario III: rulc I and export III with g_w=2%.

Figure 13 Simulated effects of a gradual versus sharp loss in competitiveness (constant world demand)

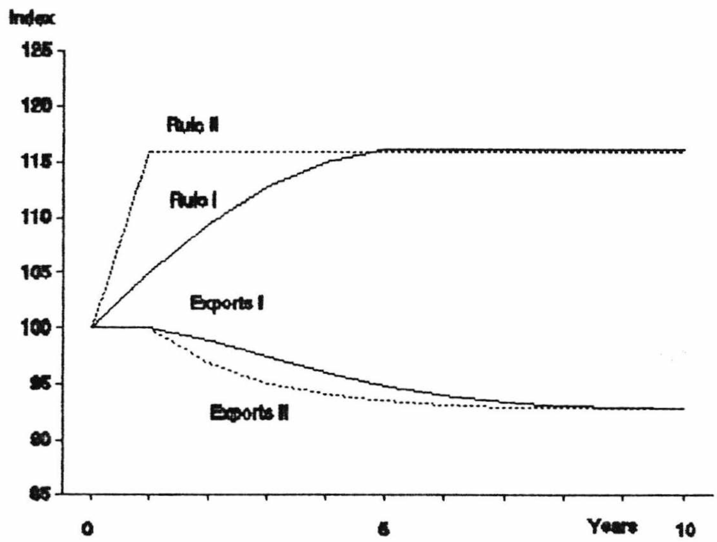
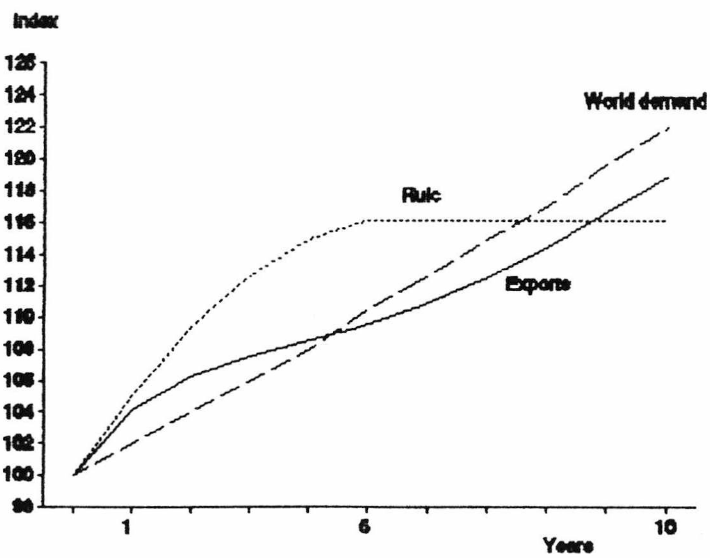


Figure 14 Simulated effects of a gradual loss in competitiveness when world demand grows at a constant rate of 2%



3.4 - The Import function

It seems less controversial to assume that Portugal faces an infinitely price-elastic supply of imports than to assume that it faces an infinitely price-elastic demand for exports. Thus, in estimating the import-side of the imperfect substitutes model we followed the conventional approach of concentrating on the estimation of the import demand equation, assuming that the prices of imports in foreign currency (PM*) are exogenous. Accordingly, the import-side of the model simplifies to equations (12), (14) and (15) and can be re-written as follows:

$M=M(Y;\ PM/P)$ with $\partial M/\partial Y>0$, $\partial M/\partial(PM/P)<0$ and $PM=PM^*.E.(1+t_m)$ (12a)

> where M is the quantity of imports; PM* is the price of imports in foreign currency; PM is the domestic price of imports paid by the importer; P is the price of domestically produced goods; E is the exchange rate; Y is the level of domestic real income and t_m is the domestic import tax rate (in %).

An import demand function (for goods and services) along these lines was estimated for Portugal by Cartaxo (1985). The model was estimated in log-linear form using yearly data covering the period 1962-1982. The best equation obtained, estimated by the Cochrane-Orcutt technique was:

$$\underset{}{\ln M_t}=-4.929\underset{(-1.3)}{-0.182}\ \ln(PM/P)_t\ \underset{(4.5)}{+1.1}\ \ln Y_t\ \underset{(1.3)}{+0.21}\ \ln M_{t-1}+\hat{u}_t \qquad (34)$$

> where the residuals $u_t = \rho u_{t-1} + \epsilon_t$ with ρhat=0.22 and ϵ_t is white noise. t-statistics are indicated between ( ).

According to these results the income elasticity of import demand is larger than unity [1.1/(1-0.21)=1.4] and imports are price inelastic or even rigid as the long-run price elasticity is very low and not statistically significant [-0.182/(1-0.21)=-0.23].

As far as the theoretical model is concerned we have no objections to the approach followed by Cartaxo. However, we have major objections regarding the econometric methodology followed, which is the simple-to-general strategy already discussed. In particular the model imposes a priori a COMFAC restriction on the parameters of the model (autorregressive estimation).[15]

Using an enlarged data set (1958-89) we re-estimated model (12a) which, in ADL(1,1) specification, is as follows:

$$\Delta m_t = \text{constant} + \beta_0 \Delta rpm_t + \gamma_0 \Delta y_t + \\ +(\beta_0+\beta_1)rpm_{t-1} + (\gamma_0+\gamma_1+\alpha_1-1)y_{t-1} - (1-\alpha_1)(m-y)_{t-1} + e_t \qquad (35)$$

where M is the volume of imports; RPM=(PM/P) is the relative price of imports and Y is real GDP. Small characters denote logs of variables. For details on data and sources see section 3.2.2.

When relative prices and domestic demand grow at constant rates ($\Delta rpm = g_{pm}$; $\Delta y = g_y$) the dynamic steady-state implied by (35) is:[16]

$$m = (1-\alpha_1)^{-1}\,[\text{constant} + (\beta_0+\beta_1)rpm + (\gamma_0+\gamma_1)y] - \\ - (1-\alpha_1)^{-2}\,[\,(\beta_1+\alpha_1\beta_0)g_{pm} + (\gamma_1+\alpha_1\gamma_0)g_y\,] \qquad (36)$$

The estimates of the import demand function are presented in table 13. The residuals are neither autocorrelated nor heteroscedastic, no significant departure from normality is noted, and the estimated parameters have the expected signs and plausible magnitudes. However, as indicated by the Chow-test a structural break occurred in 1986 when Portugal joined the EC and, as shown by the one-step forecasts, the model widely under-predicts the recent growth of Portuguese import volumes. This contrasts with the stability of the export function after 1986.

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15 - On the meaning of COMFAC restrictions see Annex 2 and the discussion in section 3.3.2.

16 - For the derivation of the dynamic steady-state see Annex 2.

Table 13 - Estimation of the import function

Estimation by OLS

The sample period is 1958-1989 less 3 Forecasts (1987-1989)

$$\Delta m_t = \underset{(-0.944)}{-0.198}\,\Delta rpm_t + \underset{(2.347)}{1.453}\,\Delta y_t -$$

$$\underset{(-1.776)}{-0.325}\, rpm_{t-1} \underset{(2.968)}{+0.273}\, y_{t-1} \underset{(-3.363)}{-0.700}\, (m-y)_{t-1} \underset{(-3.091)}{-4.386} + \hat{e}_t$$

$R^2=0.58$ SER=0.076 RSS=0.127 $F(5,22)=5.98$ DW=1.9 n=28 k=6

Model validation tests

Serial Correlation	$F(1,21)=0.20$	$F(2,20)=0.93$
Heteroscedasticity	$F(10,11)=0.93$	
ARCH	$F(1,20)=0.26$	$F(2,18)=0.68$
Normality	$Chi^2(2)=1.487$	
Chow test [1986]	$F(3,22)=3.11$ *	

Analysis of one-step forecasts

Year	Actual	Forecast	t-value
1987	0.264	0.109	1.837
1988	0.173	-0.027	2.315
1989	0.106	-0.079	1.906

The economic interpretation of the results is as follows. Firstly, the steady-state income elasticity of import demand is greater than unity [(0.70+0.273)/0.70=1.4], that is, Portuguese imports are "luxury" goods. Secondly, imports are price inelastic as the steady-state price elasticity is -0.43 (-0.33/0.70 = -0.43). Thirdly, as the impact (one year) effect of a change in relative prices is not statistically different from zero we conclude that relative price changes affect import volumes with a one-year lag. It takes just over two years for the quantity adjustment following a price change to be completed (0.43/0.33=1.3 + 1 year lag = 2.3 years). Although imports are price inelastic, in the long-run they are not rigid. Thus, whilst our estimates of the income elasticity of import demand confirm the previous estimates made by Cartaxo we found import demand to be less price-inelastic than previously estimated.

The solved coefficients of the ADL(1,1) estimated are $\beta_0=0$, $\beta_1=-0.33$, $\gamma_0=1.45$, $\gamma_1=-0.48$ and $\alpha_1=0.30$. Accordingly, by substitution in (36) we get the following dynamic steady-state:

$$m = -6.3 -0.43rpm + 1.4y + 0.67g_{pm} \qquad (37)$$

According to equation (37) the steady-state demand for imports depends on the level as well as on the rate of change of relative prices, which affect the steady-state in opposite directions, suggesting again that permanent relative price changes appear to be less effective than once-and-for-all changes. The steady-state demand for imports does not appear to depend on the rate of growth of domestic demand, which, if our interpretation of these dynamic effects is correct, tends to suggest that in Portugal the quantitative and administrative barriers to international trade had a permanent nature, independent of the state of the business cycle.

Although further inquiry would be needed to make our case, the fact is that during most of the sample period, (traditional) Portuguese exports of industrial goods had enjoyed already free access to EFTA and EC markets due to the 1958 and 1972 preferential trade agreements mentioned in section 3.2. Thus, it is not surprising that the export function remained stable after 1986 and that NTBs had only a temporary nature presumably related to the state of the international business cycle. On the other hand, the domestic market remained highly protected from import competition until very recently, and so, it is not surprising both that the import function breaks down after 1986 and that the NTBs in Portugal were not temporary in character.

A rigorous test of these hypothesis is beyond the scope of our thesis. Nevertheless, if our interpretation is correct, we would expect the import function to change in a very particular way after 1986. We would expect first to find in the last years of the sample large and positive domestic demand dynamic effects because that period is marked by the relaxation and elimination of quantitative and administrative barriers to trade. Secondly, we would expect to find a significantly larger price elasticity of import demand because the relaxation of barriers to trade will allow a better econometric identification of relative price changes.

In order to test these hypothesis we proceed in two steps using recent cointegration techniques[17]. The results are shown in table 14. In the first step we establish two preliminary results: firstly, we confirm that imports (m), income (y) and relative prices (rpm) are I(1) variables; and secondly, we confirm that they are cointegrated CI(1,1). Note that these results were already implicit in the previous estimation of the import function. The DW tests reported on the upper half of table 14 show that all variables are indeed I(1). In testing for cointegration we ran the cointegrating regression first, over the 1958-1986 period and then, over the 1958-1989 period. We do this in order to see whether the steady-state elasticities change in the expected direction, with the important caveat in mind that it is impossible to estimate with any degree of

17 - As explained in the main text, we use multiplicative dummy variables in order to test the nature of the EC-1986 structural break (shift and/or slope parameter changes). As our sample is small the estimation of the import function in ADL(1,1) form plus the dummy variables would reduce dramatically the number of the degrees of freedom of the estimation. The two-steps estimation procedure alluded in the main text increases the number of the degrees of freedom of the estimation. For details on the cointegration methodology and references see Annex 2.

accuracy what is the new long-run equilibrium. Two interesting conclusions emerge from the cointegration tests reported in table 14. The first is that during the 1958-1986 period the variables appear to be cointegrated according to all tests reported. Furthermore, the static steady-state given by the cointegrating vector is equal to the static steady-state already estimated. This confirms the equivalence of the two approaches (general-to-simple vs two-step estimation) when the variables are cointegrated. The second conclusion is that, when extending the sample, the variables do not appear to be cointegrated in the light of the ADF tests although the CRDW and DF tests still reject non-cointegration. Furthermore, although we cannot perform formal t-tests on the significance of the changes, the price elasticity of import demand increases 50% (in absolute value) and the income elasticity of import demand remains relatively "stable", though slightly higher. Thus, so far, these results do not reject our hypothesis.

In the second step we estimated an import function over the whole sample. For that purpose we created two dummy variables, DI and DII, which take respectively, the value 1 from 1958 to 1986 and 0 in 1987, 1988 and 1989 and the value 0 from 1958 to 1986 and 1 in each of the three last years of the sample. The import function was then estimated with multiplicative dummy variables as follows:

$$\Delta m_t = \gamma_0 \, \Delta y_t + \gamma'_0 \, (\Delta y_t * DII) - \rho \, (u_{1t-1}*DI + u_{2t-1}*DII) \qquad (38)$$

This means that the import function is:

$$\Delta m_t = \gamma_0 \, \Delta y_t - \rho \, u_{1t-1} \qquad \text{if } 1958 < t < 1987 \qquad (39)$$

$$\Delta m_t = (\gamma_0 + \gamma'_0) \, \Delta y_t - \rho \, u_{2t-1} \qquad \text{if } 1986 < t < 1990 \qquad (40)$$

where u_{it} (i=1,2) are the residuals.

Table 14 - Two-steps estimation of the import function

FIRST STEP

<u>Testing the order of integration of the variables</u>

DW tests for I(0): m (0.05) y (0.02) rpm (0.32) (m-y) (0.26)
DW tests for I(1): Δm (1.99) Δy (1.31) Δrpm (1.58)

<u>Testing for cointegration</u>

<u>The sample period is 1958 to 1986</u>

Cointegrating regression: $m_t=-6.45-0.45rpm_t+1.40y_t+\hat{u}_{1t}$
$R^2=0.98$ CRDW=1.45 DF=-4.27 ADF(1)=-3.73 ADF(2)=-3.37

<u>The sample period is 1958 to 1989</u>

Cointegrating regression: $m_t=-7.26-0.62rpm_t+1.47y_t+\hat{u}_{2t}$
$R^2=0.98$ CRDW=1.22 DF=-3.40 ADF(1)=-3.18 ADF(2)=-2.43

SECOND STEP

<u>Estimation of the import function over the whole sample</u>

$$\Delta m_t = \underset{(3.548)}{1.51\,\Delta y_t} - \underset{(-4.116)}{0.72\,\hat{u}_{1t-1}} \qquad \text{if} \quad 1958 < t < 1987$$

$$\Delta m_t = \underset{(3.184)}{2.95\,\Delta y_t} + \underset{(3.548)}{1.51\,\Delta y_t} - \underset{(-4.116)}{0.72\,\hat{u}_{2t-1}} \qquad \text{if} \quad 1986 < t < 1990$$

$R^2=0.63$ SER=0.070 RSS=0.127 $F(4,26)=11.0$ DW=1.9 n=31 k=5

<u>Model validation tests</u>

Serial Correlation	$F(1,25)=0.00$	$F(2,24)=0.13$
Heteroscedasticity	$F(8,17)=0.60$	
ARCH	$F(1,24)=0.24$	$F(2,22)=0.77$
Normality	$Chi^2(2)=3.00$	

The estimates of (38) are shown in the lower half of table 14. The residuals are neither autocorrelated nor heteroscedastic, no significant departure from normality is noted, and the estimated parameters have the expected signs and plausible magnitudes. The important thing to note is the dramatic increase in the coefficient of Δy_t which trebled after 1986! The solved coefficients estimated are now $\beta'_0=0$, $\beta'_1=-0.43$, $\gamma'_0=4.5$, $\gamma'_1=-2.2$ and $\alpha'_1=0.30$. Accordingly, we get the following dynamic steady-state:

$$m = -7.3 -0.62rpm + 1.5y + 0.87g_{pm} + 1.73g_y \qquad (41)$$

According to equation (41) the "new" steady-state demand for imports depends on the rate of growth of domestic demand in a virtuous way, that is, the higher the rate of growth of demand the higher the steady-state of import volumes. In comparison to equation (37) equation (41) shows higher price elasticity, and higher income elasticity of import demand and also the perverse dynamic effects of relative price changes.

Taken together these results do not reject our hypothesis but perhaps the most important conclusion that we can draw from our estimates is that there is great uncertainty in so far as the import function is concerned: we cannot estimate the new or "true" elasticities with any degree of accuracy.

In the simulation exercises that follow we shall consider that the import function is given by the estimates obtained for the post-1986 period, excluding the recent abnormal effect of Δy_t which we consider as being the transitory impact of the dismantling of NTB's. Thus the retained equation is:

$$\Delta m_t = 1.5\,\Delta y_t - 0.72\,(m_{t-1} - 1.5\,y_{t-1} + 7.26 + 0.62 rpm_{t-1})$$

with all the reservations made on its reliability.

The simulation of the effects of a loss in competitiveness on the volume of imports are shown in table 15 and illustrated in figures 15 and 16. We consider again three scenarios for a 16% (total) loss in competitiveness (decrease in the relative price of imports) and a ten-year horizon (say, the 1990s). The first scenario (rpmI; importI) corresponds to the gradualist approach to ERM entry and the second (rpmII; import II) corresponds to an immediate entry strategy. The third scenario (rpm I; importIII) is also a gradualist one which differs from the first only to the extent that in the third scenario we set domestic demand growing at a constant rate of 4% a year. The main conclusions from these experiments are as follows. First, in the long-run the effect on the volume of imports of a 16% loss in price competitiveness (with domestic demand constant) is the same whether the loss in competitiveness is gradual or not: in the new steady-state we will have a higher import volume (+11%). Second, the transition to the new steady-state is different as the volume of imports along the transition to the new steady-state will be lower when the loss in competitiveness is gradual. Third, the effect of a gradual loss in competitiveness is shown as accelerating import growth relative to the trend when domestic demand is kept growing at a constant rate of 4%.

Table 15 - Simulated effects of a loss in competitiveness

	rpm I	rpm II	import I	import II	import III
0	100	100	100	100	100
1	95.1	84	100	100	108.6
2	91.4	84	102.3	108.1	116
3	88.3	84	104.8	110.5	125.6
4	86.5	84	107	111	136
5	84	84	108	111	146
6	84	84	110	111	158.6
7	84	84	111	111	169.3
8	84	84	111	111	180
9	84	84	111	111	191
10	84	84	111	111	203

Scenario I: rpm I and import I.
Scenario II: rpm II and import II.
Scenario III: rpm I and import III with g_y=4%.

Conclusions

To conclude this chapter we will use the results obtained so far to discuss some issues raised by the potential participation of the Portuguese escudo in the EMS. Let us first re-write our model

Figure 15 Simulated effects of a gradual versus sharp loss in competitiveness on the volume of imports

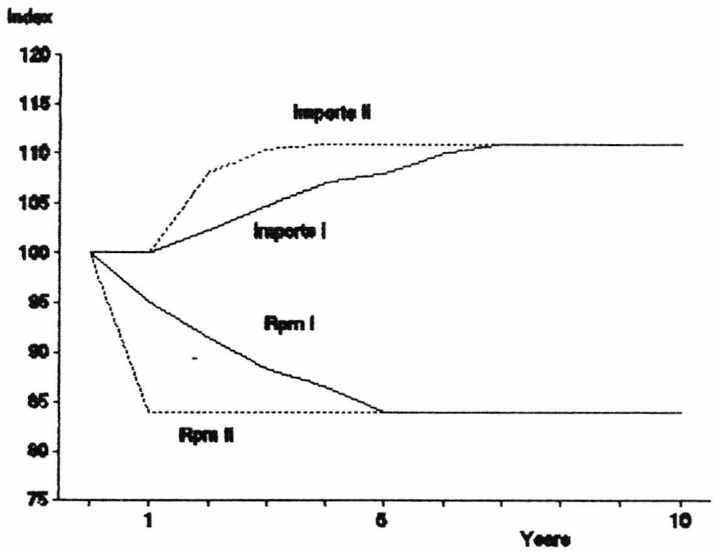
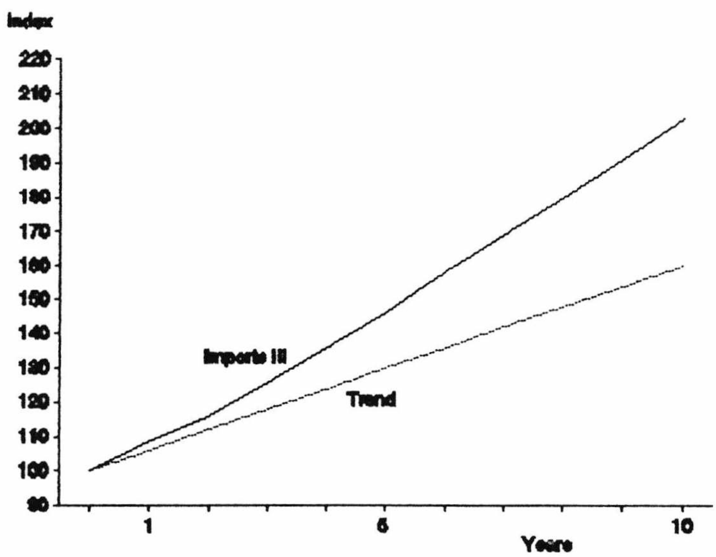


Figure 16 Simulated effects of a gradual loss in competitiveness when domestic demand grows at a constant rate of 4%



of the aggregate balance of trade and services,

$$X=X(WD;\ RULC) \qquad (29)$$

$$M=M(Y;\ (E.PM*)/P) \qquad (12a)$$

$$B = PX.X - E.PM*.M = E.PM*.[P/(E.PM*).X - M] \qquad (42)$$

and assume that $(E.PM*)/P \approx 1/RULC$ and that $PX \approx P$. Then, re-write (42) as follows:

$$B/(E.PM*) = RULC.X(WD;\ RULC) - M(Y;\ 1/RULC) \qquad (42a)$$

where $\partial X/\partial RULC < 0$ and $\partial M/\partial(1/RULC) < 0$.

Differentiating (42a) with B=0 initially, and solving for a long-run balance of trade and services equilibrium along the lines suggested by Thirlwall (1979)[18], we obtain an equation for the rate of change of relative cost competitiveness as follows:

$$Drulc=(\sigma_m.Dy - \sigma_x.Dwd)/(\epsilon_x+\epsilon_m+1) \qquad (43)$$

where σ_m and σ_x are income elasticities of import and export demand, ϵ_m and ϵ_x are price elasticities of import and export demand, y is domestic real income and wd is external demand for exports. Dx denotes rate of growth of a variable [$Dx=dx/dt=(dX/dt).(1/X)$ and $x = \ln X$]. Time subscripts are omitted for simplicity.

Economic convergence defined as the reduction of existing disparities in GDP per capita between EC countries, requires, among other things, that the Portuguese economy grows faster than EC average. Therefore, for some time we must have,

$$Dy = Dwd + g \quad \text{and } g > 0 \qquad (44)$$

and by substitution in (43) we obtain:

$$Drulc=[(\sigma_m - \sigma_x).Dwd + \sigma_m.g]/(\epsilon_x+\epsilon_m+1) \qquad (45)$$

From equation (45) we can see that, with given income elastici-

18 - For a recent critique of this model see Krugman (1989) and the reply by Thirlwall (1990). See also Fagerberg (1988).

ties of import demand and supply, balance of payments equilibrium will require a long-run or equilibrating real exchange rate depreciation if $\sigma_m > \sigma_x$, provided the Marshall-Lerner condition holds. To see what equation (45) implies let us use our estimates of the relevant parameters, that is, σ_m=1.5, σ_x=1, ϵ_x=-0.50, ϵ_m=-0.62 and ask what is the yearly real exchange rate depreciation required to balance trade, when Portugal grows at a constant real rate of 4% and world demand grows at a constant rate of 2% (and therefore g = 2%). By substitution we get Drulc=-33% and, even if we consider ϵ_x=-1.5, relative unit labour costs would have to depreciate at an yearly rate of -4% to keep trade balanced! That is, due to the difference in income elasticities and low price elasticities large and permanent real exchange rate changes would be needed to balance trade. This numerical exercise illustrates two important points. First, that real exchange rate changes are a poor tool to improve competitiveness and second, that at the root of the Portuguese chronic trade imbalance are structural factors (pattern of international specialization) captured within this framework by the difference in the income elasticities of import and export demand, the former being larger than the latter. This is a different way of saying that Portuguese growth has faced a balance of payments constraint, as discussed in Mendes and Thirlwall (1985).

The simulations carried out in sections 3.3 and 3.4 can be readily used to illustrate the points just made. Firstly, we illustrate in figure 17 the effect of a sharp gain in competitiveness (16% devaluation of the escudo at t=1) on the value of exports and imports keeping domestic and foreign demand constant and starting from equilibrium. Using the volume index export II in table 12 and the volume index import II in table 13, assuming that the devaluation is fully and immediately passed into export prices and that the terms of trade deteriorate in proportion to the devaluation, we get the indices of the value of exports and imports expressed in foreign currency, shown in the figure. We can see a clear J-curve effect of the devaluation of the escudo: a balance of trade deficit occurring in the first year, narrowing in the second year and giving rise to a trade surplus thereafter. This is the combined result of the existence of lags in the response of export and import volumes to relative price changes and the result of the difference between the short and the long-run price elasticities. Secondly, keeping the real growth rate of the Portuguese economy at 4% and the real growth rate of world demand at 2%, with constant relative prices, there will be an ever increasing need to finance the trade imbalance, as illustrated in figure 18 by the divergent paths of the value indices, import trend and export trend. Within a 10 year horizon this pattern seems to be unsustainable, even without considering interest and other payments related to foreign debt accumulation. This situation is exacerbated within any of the ERM-entry scenarios considered. For example, in figure 18, we illustrate also the balance of payments effects of scenario III (16% gradual loss in competitiveness and 2% growth differential). Comparing the two situations shown in the figure, the interesting conclusion is that with a gradual loss in competitiveness there will be an initial trade surplus (inverse J-curve effect) followed by a period of moderate deficits, which will give rise in the medium run to a rapidly widening payments disequilibrium. Thus, there will be a shift from a situation that seems to be sustainable, to a period marked by an explosive accumulation of foreign debt. Finally, in figure 19 we contrast the last scenario with another where the authorities, in trying to correct the growing trade imbalance create a recession and devalue the currency. At t=6 there is a recession (real income falls -2%) and at t=7 domestic real growth is nil. Thereafter domestic real growth resumes at 4%. At t=6 there is also a 16% devaluation that sets competitiveness at its initial level. World demand is kept growing at a constant rate of 2%. The important conclusion to be drawn from this exercise is that although there is a substantial reduction in the deficit (the import value falls by more than the export value) the devaluation and the recession will not be sufficient to restore balance of trade equilibrium.

Our analysis thus suggests that nominal and real exchange rate changes are a poor tool either to improve the competitiveness of Portuguese exports or to correct trade imbalances. However, this conclusion does not imply that the level of the real exchange rate is a matter of indifference, because major real exchange rate changes do have a long lasting impact on the equilibrium volumes (and values) of exports and imports. As the actual Portuguese pattern of international specialization tends to generate over time external deficits and/or a trend real depreciation, the sustainability of the escudo's participation in the ERM, under the conditions set out for stage 2 of EMU, might be undermined without a rapid change in the pattern of international specialization.

Figure 17 J-curve when the escudo is devalued 16%

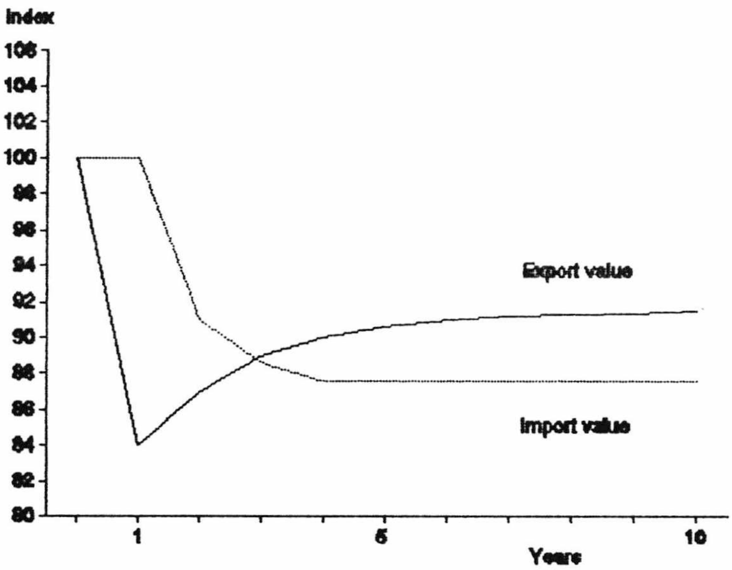


Figure 18 Balance of payments scenarios when there is a constant growth differential of 2%

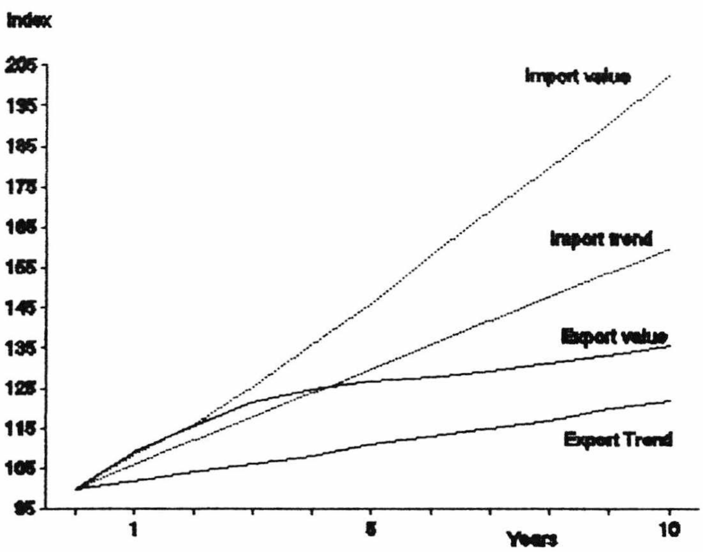
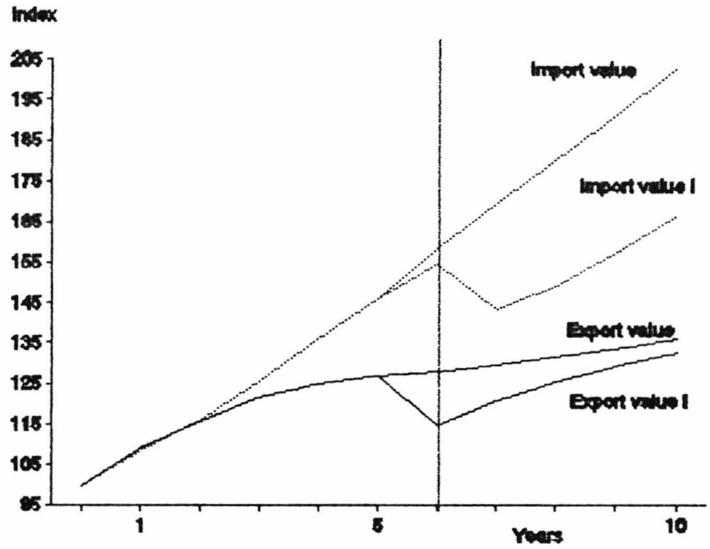


Figure 19 Balance of payments scenarios with recession and devaluation



CHAPTER 3

ANNEX 1

THE ELASTICITIES APPROACH TO DEVALUATION AND THE ROLE OF MARKET STRUCTURE

The international trade model

The simplest way to derive the Bickerdike-Robinson-Metzler (BRM) condition for a devaluation to improve the trade balance is to consider a log-linear model of the trade sector as presented below.

<u>Exports</u>	<u>Imports</u>
$x^s = n_x.e + n_x.px*$	$m^s = n_m.pm*$
$x^d = \epsilon_x.px*$	$m^d = \epsilon_m.e + \epsilon_m.pm*$
$x^s = x^d$	$m^s = m^d$

where: x and m are the logs of the quantities of exports and imports; px* and pm* are the logs of the prices of exports and imports expressed in the foreign currency; e is the log of the exchange rate defined as the domestic currency price of foreign currency, that is, a devaluation means an increase in e; n_x and n_m are price elasticities of export supply and import supply; ϵ_x and ϵ_m are price elasticities of export demand and import demand.

The trade sector model has two supply functions (x^s and m^s), two demand functions (x^d and m^d), and two equilibrium conditions. The (foreign) demand for exports (x^d) is a log-linear function of the export price expressed in foreign currency (px*) and thus the coefficient of the price variable in the demand equation is the price elasticity of export demand and is assumed to be negative ($\epsilon_x<0$). The (domestic) supply of exports (x^s) is a log-linear function of the export price received by the exporter, that is, of the export price expressed in domestic currency (px=e+px*). The coefficient of the price variable in the supply equation is the price elasticity of export supply and is assumed to be positive ($n_x>0$). The (foreign) supply of (domestic) imports (m^s) is a log-linear function of the import price expressed in foreign currency (pm*) and thus the coefficient of the price variable in the supply equation is the price elasticity of import supply and is assumed to be positive ($n_m>0$). The (domestic) demand for imports (m^d) is a log-linear function of the import price paid by the importer, that is, of the import price expressed in domestic currency (pm=e+pm*). The coefficient of the price variable in the demand equation is the price elasticity of import demand and is assumed to be negative ($\epsilon_m<0$).

When both equilibrium conditions prevail ($x^s=x^d$ and $m^s=m^d$) the following identities, which define elasticities, are true:

$$dpx^* = [n_x/(\epsilon_x-n_x)].de$$

$$dpm^* = [\epsilon_m/(n_m-\epsilon_m)].de$$

$$dx/dpx^* = \epsilon_x$$

$$dm/dpm^* = n_m$$

The effects of a devaluation on the value and quantity of exports and on the price of exports are illustrated in figure 1-A1. Consider the initial equilibrium at B with export price OA and export volume OC: the value of exports is equal to the area OABC. A devaluation of the domestic currency will increase the quantity supplied at each export price - the supply function will move downwards by the percentage of the devaluation from x_0^s to x_1^s. In the new equilibrium at F the quantity exported has increased to OG and the export price has decreased to OD - the value of exports is now given by the area ODFG. Two important conclusions can be derived from the graphical analysis of the effects of a devaluation. Firstly, in general, the export price will fall by less than the percentage of the devaluation; secondly, the final effect on the value of exports is ambiguous - the value of exports will decrease by an amount equal to the ABDE area (price effect) and will increase by an amount equal to the EFCG area (quantity effect).

The effects of a devaluation on the value and quantity of imports and on the price of imports are illustrated in figure 2-A1. Consider the initial equilibrium at B with export price OA and export volume OC: the value of imports is equal to the area OABC. A devaluation of the domestic currency will decrease the quantity imported at each import price - the demand function will move downwards by the percentage of the devaluation from m_0^d to m_1^d. In the new equilibrium at E the quantity imported has decreased to OF and the import price has decreased to OD - the value of imports is now given by the area ODEF. Two important conclusions can be derived from the graphical analysis of the effects of a devaluation. Firstly, in general, the import price will fall by less than the percentage of the devaluation; secondly, the value of imports will decrease by an amount equal to the ABDEFG area (price effect and quantity effect).

The main conclusion from this intuitive analysis is that, in general, the terms of trade and balance of trade effects of a devaluation are ambiguous. They depend in a complex way on the magnitude of the various elasticities and on the value of the initial deficit or surplus.

Devaluation and the terms of trade

To quantify the effect of a devaluation on the terms of trade we calculate d(px*-pm*)/de, which is, by definition, the exchange rate elasticity of the terms of trade. Using the identities defined above we obtain, by substitution:

$$d(px^*-pm^*)/de = (\epsilon_x\epsilon_m - n_x n_m)/[(n_m-\epsilon_m)(n_x-\epsilon_x)] \qquad (A1-1)$$

where $(n_m-\epsilon_m)(n_x-\epsilon_x)>0$.

In general, the terms of trade effect of an exchange rate devaluation is ambiguous as it depends on the sign of the numerator of the expression on the RHS of (A1-1). If $\epsilon_x\epsilon_m>n_x n_m$ there will be an improvement in the terms of trade following a devaluation, and, if $\epsilon_x\epsilon_m<n_x n_m$ there will be a deterioration in the terms of trade. If $\epsilon_x\epsilon_m=n_x n_m$ the terms of trade will not change.

Two particular cases where this ambiguity disappears are worth mentioning. In the small-country case, the price elasticity of export demand and the price elasticity of import supply are infinite ($\epsilon_x,n_m\to\infty$). In this case a devaluation will never affect the terms of trade. To see this we calculate:

$$\lim_{\epsilon_x,n_m\to\infty} (\epsilon_x\epsilon_m-n_x n_m)/[(n_m-\epsilon_m)(n_x-\epsilon_x)] = 0$$

In the semi-small country case, both price elasticities of supply are infinite ($n_x,n_m\to\infty$). In this case a devaluation will allways cause the terms of trade to deteriorate in the exact proportion to the devaluation. To see this we calculate:

$$\lim_{n_x,n_m\to\infty} (\epsilon_x\epsilon_m-n_x n_m)/[(n_m-\epsilon_m)(n_x-\epsilon_x)] = -1$$

Devaluation and the trade balance

By definition, the trade balance expressed in foreign currency (B) is equal to:

$$B = X.PX* - M.PM* \qquad (A1-2)$$

where: X and M are the quantities exported and imported; PX* and PM* are the export and the import prices expressed in foreign currency.

By total differentiation of (A1-2) and simple algebraic manipulation we obtain,

$$dB = PX^*.X.(dPX^*/PX^*).[(dX/X)/(dPX^*/PX^*) + 1] - $$
$$- PM^*.M.(dPM^*/PM^*).[(dM/M)/(dPM^*/PM^*) + 1] \qquad (A1-3)$$

Now, using the elasticities defined above when the trade model clears (when $x^s=x^d$ and $m^s=m^d$ not necessarily when B=0) we obtain,

$$dB = (PX^*.X).(\epsilon_x+1).[n_x/(\epsilon_x-n_x)].de -$$
$$- (PM^*.M).(n_m+1).[\epsilon_m/(n_m-\epsilon_m)].de \qquad (A1-4)$$

Starting from a situation of trade balance equilibrium the effect of a devaluation on the trade balance expressed in foreign currency, the BRM condition, can be derived by setting $PX^*.X=PM^*.M$ in equation (A1-4). By simple algebraic manipulation we get,

$$dB/de = (PX^*.X).[(\epsilon_x+1).n_x/(\epsilon_x-n_x) - (n_m+1).\epsilon_m/(n_m-\epsilon_m)] \qquad (A1-5)$$

In general, the balance of trade effect of an exchange rate devaluation is ambiguous as it depends on the sign of the expression between square brackets on the RHS of (A1-5). This expression is, of course, very difficult to interpret but some particular cases are worth mentioning because either the ambiguity disappears or the expression simplifies allowing a suggestive interpretation.

In the semi-small country case, both price elasticities of supply are infinite ($n_x,n_m \to \infty$). In this case a devaluation will improve the trade balance if the sum of the price elasticities of demand for exports and imports is, in absolute value, greater than 1 ($-\epsilon_x-\epsilon_m>1$). This is known as the Marshall-Lerner condition for a devaluation to improve the trade balance. To see this we calculate:

$$\lim_{n_x,n_m \to \infty} [(\epsilon_x+1).n_x/(\epsilon_x-n_x)-(n_m+1).\epsilon_m/(n_m-\epsilon_m)]=-\epsilon_x-\epsilon_m-1>0 \qquad (A1-7)$$

In the small-country case, the price elasticity of export demand and the price elasticity of import supply are infinite ($\epsilon_x,n_m \to \infty$). In this case a devaluation will improve the trade balance unless export supply and import demand are rigid. To see this we calculate:

$$\lim_{\epsilon_x, \eta_m \to \infty} [(\epsilon_x+1).\eta_x/(\epsilon_x-\eta_x) - (\eta_m+1).\epsilon_m/(\eta_m-\epsilon_m)] = \eta_x-\epsilon_m > 0 \quad (A1-6)$$

The effects of a devaluation on the value and quantity of exports and on the price of exports are illustrated in figure 3-A1 for the semi-small country case and are illustrated in figure 5-A1 for the small-country case. The effects of a devaluation on the value and quantity of imports and on the price of imports, which are the same in both cases, are illustrated in figure 4-A1. The interpretation of these figures is similar to the general analysis presented above and we shall not repeat it here. However, it should be noted that in these cases the graphical analysis allow us to make immediately three main points. Firstly, in the semi-small country case the devaluation deteriorates the terms of trade by the percentage of the devaluation (AD in figure 3-A1 as the export price declines from OA to OD and the import price remains at OA). Secondly, in the small-country case the terms of trade will not be affected by the devaluation (both prices remain at OA in figures 4-A1 and 5-A1). Thirdly, in the small-country case the devaluation improves the balance of trade (export value increases by an amount equal to BDCE in figure 5-A1 and the import value decreases by an amount equal to BDCE in figure 4-A1).

Figure 1-A1 Effects of a devaluation on the price and quantity of exports

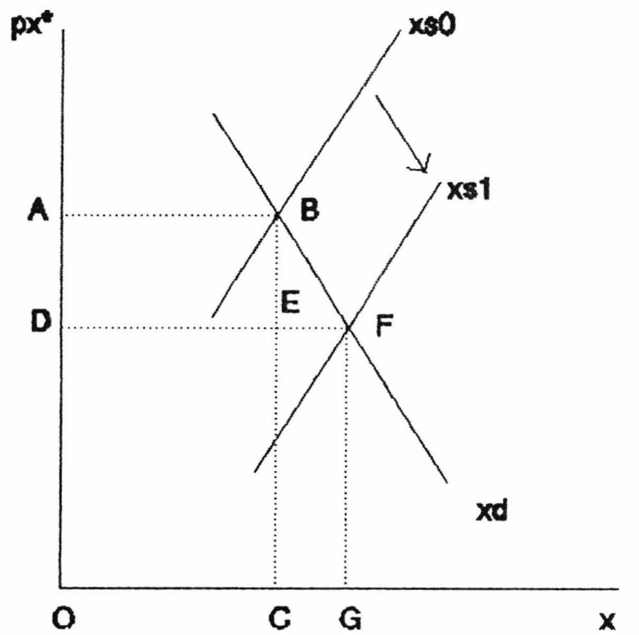


Figure 2-A1 Effects of a devaluation on the price and quantity of imports

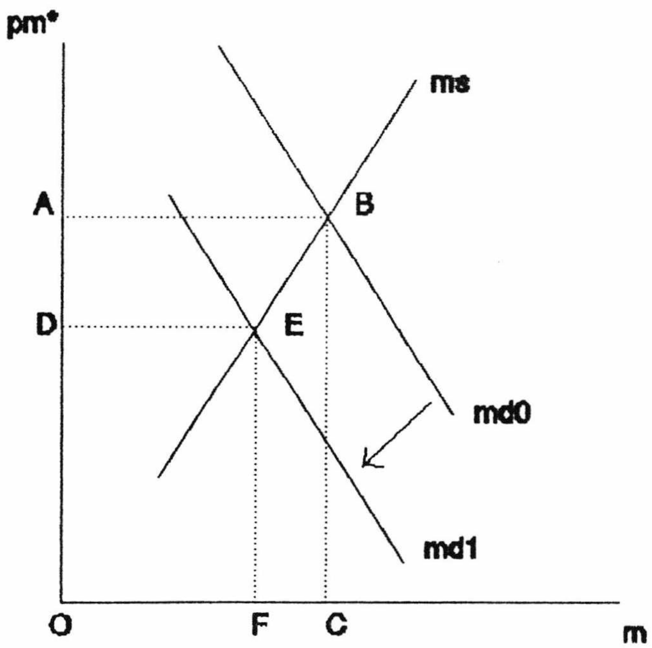


Figure 3-A1 Effects of a devaluation when export supply is infinite elastic

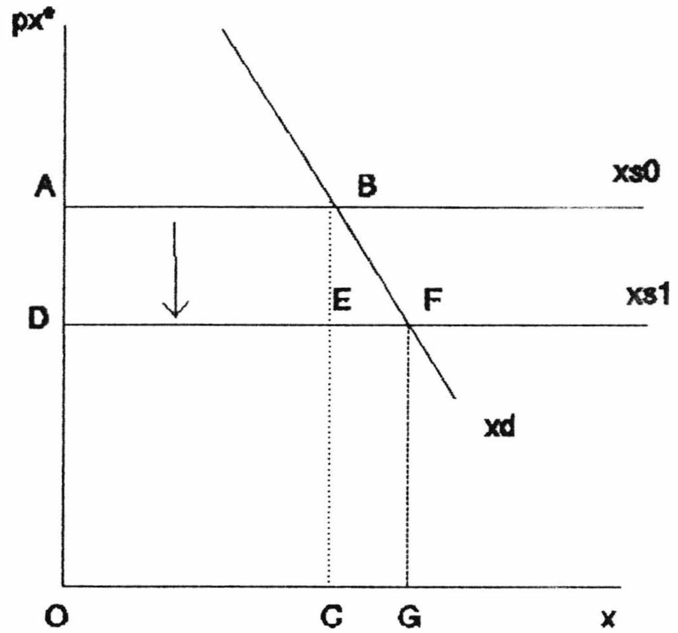


Figure 4-A1 Effects of a devaluation when import supply is infinite elastic

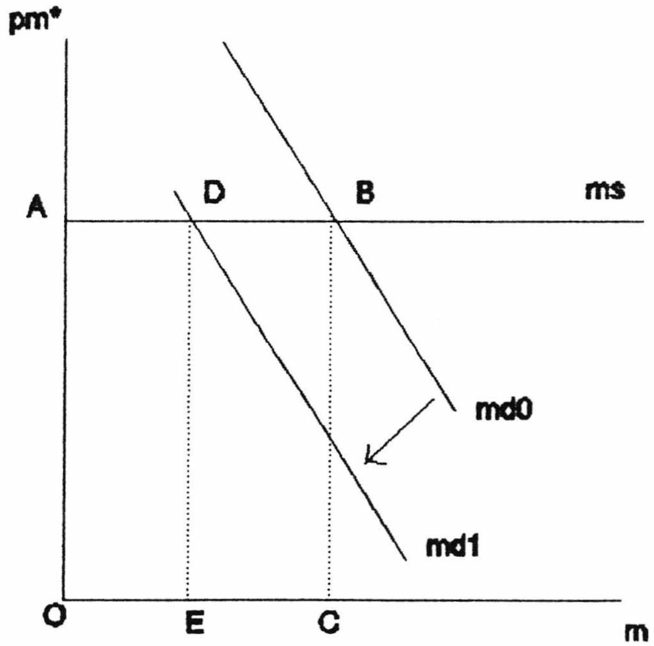
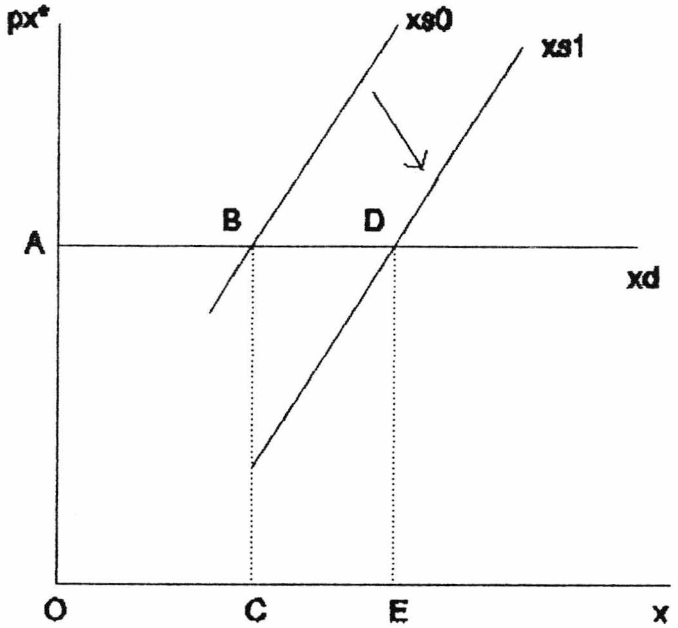


Figure 5-A1 Effects of a devaluation when export demand is infinite elastic



ANNEX 2

ECONOMETRIC METHODOLOGY

Functional form

In chapter 3 as well as in other chapters of this thesis the equations estimated are log-linear. Our preference for this form is not based on any statistical criteria: it follows the overwhelming choice made by empirical researchers as noted, for example, in relation to foreign trade models by Goldstein and Khan (1985). The equations estimated in our thesis are of the Autorregressive Distributed Lag class (ADL) as follows:

$$A(L).y_t = B(L).x_t + e_t \qquad \text{(A2-1)}$$

where A(L) and B(L) are polynomials in L, the lag operator, defined as $L^k.x_t = x_{t-k}$ and e_t is white noise. Small letters denote logs of the variables, that is, $\ln X_t = x_t$. The ADL specification allows us to follow a General-to-Simple modelling strategy, explained in Hendry and Richard (1982, 1983) (see also Gilbert (1986, 1989)). Important steps in the development and application of the methodology are Sargan (1964), Davidson et al. (1978), and Hendry and Mizon (1978).

Consider for example the ADL(1,1) model,

$$y_t - \alpha_1 y_{t-1} = \beta_0 x_t + \beta_1 x_{t-1} + e_t \qquad \text{(A2-2)}$$

This can be re-written in Error Correction Specification (ECS) as:

$$\Delta y_t=\beta_0 \Delta x_t + (\beta_1+\beta_0+\alpha_1-1)\ x_{t-1} -(1-\alpha_1)(y_{t-1} - x_{t-1})+e_t \qquad \text{(A2-3)}$$

where $\Delta=(1-L)=x_t-x_{t-1}$ is the first difference operator. Note that the ECS does not impose any restriction on the general ADL(1,1) model. Besides, in the ECS multicollinearity is less likely to be a problem than it is in the general ADL(1,1) formulation. Furthermore the ECS allows us to test directly some useful restrictions on the general ADL(1,1) model in search for a parsimonious representation of the econometric relationship between the variables. For example, some simplifications used in this thesis and found in most empirical studies are as follows:

The growth rates model

$$\Delta y_t = \beta_0 \, \Delta x_t + e_t \tag{A2-4}$$

if the three linear restrictions on ECS,

$$(\beta_1+\beta_0+\alpha_1-1)=0, \quad \alpha_1=1 \text{ and } \beta_1=-\beta_0$$

are not rejected by the data.

The static log-linear model

$$y_t = \beta_0 \, x_t + e_t \tag{A2-5}$$

if the two linear restrictions, $\beta_1=0$ and $\alpha_1=0$, are not rejected by the data.

The partial adjustment model

$$y_t = \beta_0 \, x_t + \alpha_1 \, y_{t-1} + e_t \tag{A2-6}$$

if the linear restriction, $\beta_1=0$, is not rejected by the data.

The autorregressive error model

$$y_t = \beta_0 \, x_t + u_t \text{ with } u_t = \rho \, u_{t-1} + e_t \tag{A2-7}$$

if the non-linear restriction, $\beta_1+ \beta_0.\alpha_1 = 0$, is not rejected by the data.

The proportional error correctiom model

$$\Delta y_t = \beta_0 \, \Delta x_t - (1-\alpha_1)\,(y_{t-1} - x_{t-1}) + e_t \tag{A2-8}$$

if the linear restriction, $\beta_1+\beta_0+\alpha_1=1$, is not rejected by the data.

Long-run equilibrium and error correction mechanisms

A long-run static equilibrium solution for the ECS may exist. Setting $\Delta y_t=\Delta x_t=0$ and solving for y and Y we obtain, respectively:

$$y = [(\beta_0+\beta_1)/(1-\alpha_1)] \; x \tag{A2-9}$$

or $$Y = X^{a}$$

$$a=[(\beta_0+\beta_1)/(1-\alpha_1)] \qquad (A2\text{-}10)$$

where the term between [ ] is the long-run or equilibrium elasticity and Y and X are the variables in levels.

In general, economic theories entail long-run relations between economic variables like the steady-state proportionality between Y and X when a=1 in equations (A2-9; A2-10). Thus, for example, the estimation of a model in growth rates form (equation (A2-4)) imposes a priori long-run neutrality between the variables. Although it might be theoretically sensible to expect such long-run neutrality in some special circumstances, it seems preferable to test it against the data, which can be done by testing the restricted model against the general ADL model. The static log-linear model (equation (A2-5)) also reproduces a long-run equilibrium between the variables. However, the absence of any dynamics imposes a priori that markets clear instantly and continuously, a very strong hypothesis that should be tested. This can be done again by testing the restricted model against the general ADL model.

If the exogenous variable grows at a constant rate say, g_x, it is easy to show that $\Delta y = g_y = [(\beta_0+\beta_1)/(1-\alpha_1)]g_x$. In this case the steady-state is given by:

$$y=[(\beta_0+\beta_1)/(1-\alpha_1)].x-[1/(1-\alpha_1)][(\beta_1+\beta_0.\alpha_1)/(1-\alpha 1)].g_x \qquad (A2\text{-}11)$$

which defines a long-run dynamic equilibrium (see Currie (1981)).

Linear restrictions on the ECS as, for example, those implied by the various parsimonious representations presented above can be tested using standard t and F-tests. For non-linear restrictions implied by common factors (COMFAC), such as the restriction that generates the autorregressive error model, a Wald-test is required (see Hendry and Mizon (1978) for an application). Note that if a COMFAC exists in (A2-2) the second term on the RHS of (A2-11) vanishes meaning that the steady-state of y is independent of the growth rate of x. Furthermore, and with reference to the proportional error correction model the autoregressive model imposes *a priori* that the short-run and the long-run effects are equal (the proof of this proposition is given in the main text). This again should be tested. The parameter $(1-\alpha_1)$ in equations (A2-3; A2-8) gives the proportion of the disequilibrium that is corrected in each period, should the economy be out of equilibrium. The dynamics entailed by equations (A2-3; A2-8) is very rich and will be discussed further below in relation to the concept of cointegration.

Cointegration and error correction mechanisms

Before the estimation of a model it might be convenient to test whether the variables are cointegrated or not. Recent developments in dynamic modelling of economic time-series have established a link between the concepts of cointegration and error correction mechanisms (for a synthesis and the definitions below, see Engle and Granger (1987)).

A series is said to be integrated of order d, denoted $x_t \sim I(d)$, if it needs to be differenced d times to achieve stationarity. The components of the vector x_t are said to be cointegrated of order d,b denoted $x_t \sim CI(d,b)$ if all components of the vector are I(d) and if there exists a vector $(a \neq 0)$ such that $Z_t = a'.x_t \sim I(d-b)$, $b>0$. The vector a is called the cointegrating vector.

A vector of economic variables is said to be in equilibrium if $a'.x_t = 0$, in which case Z_t is called the equilibrium error. If the components of vector $x_t \sim CI(1,1)$ then $Z_t = a'.x_t \sim I(0)$. If the equilibrium error is I(0) it will rarely drift from its mean and equilibrium will occasionally occur at least to a close approximation. This implies that if the economic variables are CI(1,1) there must be a long-run equilibrium relationship between them.

Testing the order of integration

To determine the order of integration of a series we must test for stationarity. One test for stationarity is the Sargan-Bhargava test (DW). The DW test is based on the regression of x_t on a constant and tests the null hypothesis that the residuals follow a random walk, that is, that x_t is non-stationary. The statistic is the standard Durbin-Watson statistic and the critical values can be found in Sargan and Barghava (1983).

DW test

$$x_t = \text{constant} + u_t \tag{A2-12}$$

Statistic: DW; null hypothesis: non-stationarity; reject for large values of DW: at the 5% confidence level and a small sample (n=31) the critical value is 0.770; for large samples (n=101) the critical value is 0.259.

Other tests are the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) tests. The ADF test is based on the Augmented Dickey-Fuller regression and tests the hypothesis that the residuals follow a random walk. The statistic is the ratio of the coefficient ϕ to its standard deviation (the standard t-statistic) but does not follow a t-distribution. The critical levels can be found in Dickey and Fuller (1981).

ADF test

$$\Delta x_t = \text{constant} - \phi\, x_{t-1} + \sum_{i=1}^{p} b_i.\Delta x_{t-i} + u_t \tag{A2-13}$$

Statistic: ADF(p)=t-statistic of ϕ; null hypothesis: non-stationarity; reject for large values of t: at the 5% confidence level and for a small sample (n=25) the critical value is -3.00; for large samples (n=100) the critical value is -2.89.

The number of lags in the Augmented Dickey-Fuller regression (p) is chosen to ensure that the residuals are white noise. Setting p=0 we have the Dickey-Fuller test and the statistic (ADF(0)=DF) is also the ratio of ϕ to its standard deviation but does not follow a t-distribution. The critical levels can be found in Dickey and Fuller (1981).

Testing for cointegration

Cointegration between y_t and the vector x_t can be tested by applying either the DW test or the ADF and DF tests for stationarity to the residuals of the cointegrating regression ($\hat{u}_t$). The cointegrating regression (CR) is given by:

Cointegrating Regression

$$y_t = \text{constant} + a'.x_t + u_t \tag{A2-14}$$

and the tests are:

DW test for cointegration

The statistic is the DW of the cointegrating regression (CRDW); the null hypothesis is non-cointegration between y_t and x_t which we reject for large values of the statistic. At the 5% level of confidence, for large samples and when the vector x_t has only one component (i.e. the cointegrating vector is $[y_t\ x_t]$) the critical value is 0.386 (see Engle and Granger (1987)). When the cointegrating vector has three components the critical value is 0.367 (see Hall (1986)). As a rule-of-thumb for rejecting non-cointegration Hendry

(1986) suggests a reasonably high R^2 (> 0.95) and a not too low DW in the cointegrating regression.

ADF(p) and DF(p=0) tests for cointegration

$$\Delta \hat{u}_t = -\phi\, \hat{u}_{t-1} + \sum_{i=1}^{p} b_i . \Delta \hat{u}_{t-i} + \epsilon_t \qquad \text{(A2-15)}$$

The statistic is the t-statistic of ϕ but does not follow a t-distribution; the null hypothesis is non-cointegration which we reject for large values of the statistic. Critical values at the 5% level of confidence for large samples and when the cointegrating vector has two components are -3.17 for ADF(p) and -3.37 for DF (see Engle and Granger (1987)). When the cointegrating vector has three components the critical value is -3.13 for ADF(p) (see Hall (1986)). For further reference we reproduce below the critical values of the ADF test at 5% for large samples (n=500) calculated by Phillips and Ouliaris (1988) for various dimensions of the cointegrating vector:

Dimension	2	3	4	5
Value	-2.762	-3.267	-3.737	-4.126

Dynamic modelling

An important result for dynamic modelling of economic time series, proved in Engle and Granger's paper, is that if the components of $x_t \sim CI(1,1)$ there must be an error correction mechanism linking them. To be specific, suppose that y_t and x_t are a set of I(1) variables and also that $y_t - a.x_t = Z_t \sim I(0)$. Engle and Granger show that in this case:

$$\Delta y_t = \sum_{i=1}^{n} \alpha_i \Delta y_{t-i} + \sum_{i=0}^{m} \beta_i \Delta x_{t-i} - \rho Z_{t-1} + e_t \qquad \text{(A2-16)}$$

In the long-run static equilibrium the changes in the variables will be zero and there will be no innovations. When this steady-state occurs $Z_{t-1}=0$ and we have the long-run equilibrium $Y=X^*$. Note that we can re-write (A2-3) as follows:

$$\Delta y_t=\beta_0\Delta x_t - (1-\alpha_1)\{y_{t-1}-[(\beta_1+\beta_0)/(1-\alpha_1)]\ x_{t-1}\} + e_t \qquad (A2-17)$$

We can see that the long-run equilibriums implied by (A2-16) and by (A2-17) have the same form and are identical when $\rho = 1-\alpha_1$ and $a=(\beta_1+\beta_0)/(1-\alpha_1)$. Although the dynamics in (A2-16) are potentially more complex the main point is that there exists statistical support to include in a regression with I(0) variables (i.e. I(1) variables differenced once) a set of variables in levels (non-stationary, I(1)) that provides the long-run solution of the model. The parameters ρ and/or $(1-\alpha_1)$ give the proportion of the disequilibrium that is corrected in each period, should the economy be out of equilibrium.

Engle and Granger propose a two-steps procedure to estimate equation (A2-16). In the first step we test for cointegration running the cointegrating regression, if we have concluded that all variables are of the same order of integration, I(1). If we reject the null hypothesis of non-cointegration the static CR gives us "super-consistent" estimates of the true parameters.

In the second step the lagged residuals of the CR ($\hat{u}_{t-1}$), that must be I(0), are used as the error correction mechanism in the estimation of the dynamic model. The lags in the polinomials, m and n, are chosen to ensure that the residuals are white noise.

As recent empirical research has shown the application of this method has to proceed with caution, in particular when dealing with small samples (see Carruth (1987) and Carruth and Schnabel (1988)). In this thesis, when appropriate, both restricted (Engle and Granger two-steps method) and unrestricted estimation of ADL models is carried out.

Model validation tests

(n observations and k regressors)

Serial Correlation - Godfrey's test for autocorrelation. Lagrange multiplier test for qth-order residual autocorrelation distributed as F(q, n-k-q) or $Chi^2(q)$; computed by regressing the residuals on all regressors of the original model and the lagged residuals for lags 1 to q, and testing the joint significance of the latter (Godfrey (1978)).

Heteroscedasticity - White's test for Heteroscedasticity. Lagrange multiplier test for heteroscedasticity associated with squares of the explanatory variables (q quadratic terms) distributed as F(q, n-k-q-1); computed by regressing the squared residuals on the original regressors and all their squares and testing their joint significance (White (1980)).

ARCH - Engle's test for Autorregressive Conditional Heteroscedasticity. Lagrange multiplier test for qth-order autorregressive conditional heteroscedasticity distributed as F(q, n-k-2q) or $Chi^2(q)$; computed by regressing the squared residuals on the lagged squared residuals up to lag q and testing their joint significance (Engle (1982)).

Normality - Jarque-Bera's test for Normality. $Chi^2(2)$-test based on the estimated skewness and kurtosis of the residuals compared with their counterparts for the normal distribution (Jarque and Bera (1980)).

Chow test - Chow's test for predictive failure over a subset of q observations distributed as F(q, n-k-q) or Chow's test for parameter constancy over subsamples distributed as F(k, n-2k) (Chow (1960)).

Specification - Sargan's test of whether the q overidentifying instruments are independent of the equation error distributed as $Chi^2(q-k)$ (Sargan (1964)).

Software

The empirical results of this thesis were obtained with TSP and PC-GIVE.

CHAPTER 4

Capital Controls: the Portuguese experience [1]

Introduction

As we have seen in chapter 1 one of the most important features of the ERM is (was?) its flexibility. In fact, the experience of the last decade has shown that, with periodic realignments, even countries with substantial inflation differentials could tie their currencies for some time. Whilst not allowing any major real exchange-rate misalignments to develop, high inflation countries could still enjoy some of the discipline imposed by the "hard currency" peg. However, around the time of the realignments large onshore-offshore interest rate differentials emerged suggesting that capital controls or dual exchange-rates insulated the domestic financial systems of the high inflation countries from the full scale of speculative pressures. We have also seen that the width of the fluctuation band and marginal and intra-marginal foreign exchange market interventions have also been important for the stability of the ERM. As far as policy coordination is concerned, the evidence reviewed suggests that it has not played any major role in stabilising the ERM. Be that as it may, the participating countries either reduced (gradually) their inflation rates towards the "German standard" or substantially narrowed their inflation differentials.

In chapter 2 we reviewed the literature on the causes and effects of speculative attacks on fixed exchange-rate regimes or, in

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1 - Part of the material included in this chapter (section 4.2.2 and Annex 2) was presented to the 5th Annual Conference of the European Economic Association, Lisbon, September 1990. Sections 4.2 and 4.4 appear in our contribution to Heather D. Gibson and E. Tsakalotos (eds.) <u>Economic Integration and Financial Liberalization</u>, London, Macmillan, 1992, ch 5, pp. 138-172.

general, of the occasional occurrence of "balance of payments crisis". We have seen that formal models of such crisis offer ingenious ways of modeling the exact timing of the occurrence of speculative attacks. These models have several shortcomings but provide a useful benchmark to start thinking about the problems facing countries which, having followed for some time widely-understood exchange-rate rules, then engage in external financial liberalisation. In fact, one of the most disturbing conclusions of the literature and yet, one that is quite intuitive and plausible, is the possibility of a speculative attack driven entirely by self-fulfilling expectations (i.e. without any fundamental factor driving it, such as, for example, a fiscal expansion). Such self-fulfilling equilibria are likely to occur when the realignment rule followed by the authorities is one that restores or enhances price competitiveness (i.e. real exchange-rate depreciation). If the realignment rule is one that less than fully offsets past inflation differentials, such self-fulfilling attacks do not occur (only those justified by fundamentals will eventually happen). Thus the literature provides an interesting rationale for the policy of non-accommodating parity realignments followed by the participants in the ERM.

As mentioned in chapter 1 since 1977 the escudo has been following a crawling-peg regime and, in addition, the escudo was devalued five times.[2] Furthermore, since 1977, exchange-rate policy has been oriented mainly towards maintaining or improving price competitiveness. Thus, we may say that for most of the recent past the

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2 - In February 1977, against the dollar (15%), and against the basket of currencies in May 1978 (7%), June 1982 (9.4%), and July 1983 (12%). A "technical" devaluation against the basket of currencies (2%) followed the ERM realignment of March 1983.

exchange-rate policy followed by the various Portuguese governments is the kind of policy that invites self-fulfilling speculative attacks.[3]

In this chapter we focus on the role of capital controls in insulating the Portuguese economy from the full strength of speculative attacks, which occurred mainly in anticipation of exchange-rate devaluations. The chapter is organized in six main parts. In section 4.1 we review the institutional framework of foreign exchange controls in Portugal. In section 4.2 we look at political and currency premia. The evidence presented in this section allows us to make four main points: the first is that, in Portugal, real interest rates have not been (systematically) below international levels, particularly after 1985. This is important because it shows that Portugal starts its financial liberalisation process from a situation where domestic savings (bank deposits) are already remunerated at market rates. Second, evidence from the offshore forward exchange market suggests that the path of the escudo has been anticipated quite accurately. This implies that capital controls were needed to prevent speculative attacks. Third, significant deviations from covered (and uncovered) interest rate parity can be found, particularly around the time of the large devaluations of the escudo mentioned above. This provides evidence of the effectiveness of capital controls in insulating domestic financial conditions from potential and actual speculative pressures on the escudo. Finally, purchasing power parity (PPP) has not held and the real exchange

3 - With two exceptions. The first is the revaluation of the escudo against the basket of currencies, in February 1980, as part of an anti-inflationary package and the second is the recent (1987-89) "shadowing" of the ERM.

rate depreciation of the escudo is highly correlated with deviations from covered (and uncovered) interest rate parity. This provides evidence on the implicit competitiveness targets being pursued by the Portuguese authorities, with the protective assistance of comprehensive exchange controls. In section 4.3 we illustrate the idea that the political premium in Portugal is (was?) very high and volatile. This is done by studying two balance of payments crisis which were motivated by political crisis. They affected Salazar's conservative government (1961-62) and weak left-wing governments, during the 1974-75 period. These episodes allow us to draw the attention to an apparently neglected aspect of the feasibility of external financial liberalisation: the role of political stability. In sections 4.4 and 4.5 we look at some aspects of the macroeconomic performance of the Portuguese economy during the 1979-83 period. The experience of this period is important because it highlights the circumstances and the timing of the development of speculative pressures on the escudo and may give us some clues about future developments in the 1990s. For this reason we put our emphasis on the evolution of exchange rate expectations and on the role of capital controls. It is argued that speculative attacks occurred because of fundamental factors and, presumably also because of the competitiveness targets followed by the authorities. As the evidence from the forward exchange market suggests that the path of the escudo has been anticipated quite accurately, section 4.3 concentrates on the analysis of the off-shore forward exchange market. But as expectations and market sentiments are never directly observable or measurable it is important to test the robustness of the results. Thus, as anticipations of devaluations are reflected in the black market premium, in section 4.5 we concentrate on the analysis of the black market for foreign exchange. The main conclusions are presented at the end of the chapter.

4.1 - The institutional framework of foreign exchange controls in Portugal

The legal framework of the exchange control regime in Portugal was relatively simple and remained almost unchanged from the 1960s until very recently. Here we sketch its main features and evolution.[4]

The foreign exchange market had been an administered market with spot quotations fixed daily by the Banco de Portugal, the central bank. Dealings in foreign exchange had to be conducted with the central bank and were restricted to commercial banks, which were prohibited from dealing in foreign currencies among themselves. Bank's foreign asset positions and gross foreign exchange holdings were subject to ceilings, a proper domestic forward exchange market did not exist, arbitrage operations were forbidden and dealings in foreign exchange with banks abroad were allowed only at the rates prevailing in the official market. It is difficult to imagine a more stringent set of constraints on the portfolio choices of commercial banks and other firms or individuals.

Virtually all export and import activities were subject to registration and/or licensing. A "Bulletin" issued by the Direcção-Geral do Comércio Externo performed a dual role. On the one hand

4 - This section is based on IMF Annual Report on Exchange Restrictions and Banco de Portugal Annual Report.

they were equivalent to a license, enforcing certain industrial and trade policy objectives; on the other hand they specified the terms under which import payments were allowed or export receipts had to be surrendered (currency denomination, the amount involved and the payment/surrender period). Trade credits with short maturities were not subject to prior authorization if related to commercial transactions duly authorized. Allowances for tourism were subject to limits on a per capita, per annum basis. Transfers of income from imported capital could also be subject to ceilings.

All capital account transactions were subject to prior authorization and foreign investment in certain branches of the economy was prohibited. Foreign investment by residents was very restricted and arbitrage operations involving foreign securities and flow of funds across the exchanges was forbidden. In general, the use of the Escudo as means of settlement was discouraged.

The principle that "everything is forbidden unless explicitly authorized" began to change after 1986, with Portugal's entry into the EC. The system of licensing of imports and exports is functioning now on a basis of declaration and has been brought in line with EC regulations and policies. Banks are now authorized to deal in foreign exchange among themselves and with their foreign correspondents and the exchange rate has begun to be determined in a daily fixing session in the spot interbank foreign exchange market in which the central bank participates. A forward exchange market was established and the escudo is now accepted freely as currency of settlement for exports and capital transfers to Portugal. Tranfers of income from imported capital are free of restrictions and long and medium-term capital movements into Portugal were liberalized (foreign direct investment, portfolio investment and real estate, with few exceptions). Between 1991 and 1993 long and medium-term capital operations by residents will also be liberalized.

It is important to emphasize that this swift move towards external liberalisation is in sharp contrast with the traditional interventionist stance of the Portuguese authorities.

4.2 - Political and currency premia

4.2.1 - Analytical framework

A convenient framework to organize our discussion and present the evidence alluded in the introduction is the following decomposition of the real interest rate differential proposed by Frankel and MacArthur (1988) (see also Macedo (1988)):

$$r-r^* = (i-i^*-fp) + (fp-\epsilon) + [\epsilon-(\pi-\pi^*)] \qquad (1)$$

where i and i^* are the nominal returns on domestic and foreign deposits, fp is the forward premium on the foreign currency, ϵ is the expected nominal exchange-rate change (in %), and $(\pi-\pi^*)$ is the expected inflation differential. The star denotes foreign variables and the spot exchange-rate is measured as the price of the foreign currency expressed in units of domestic currency; π and π^* are expected inflation rates. The logarithms of the spot and forward exchange-rates will be denoted by s and f respectively. For simplicity we omit time subscripts unless they add significant information.

The first term on the right hand side of (1) is the covered interest rate differential (cd). It has been widely used in the literature as a measure of the effectiveness of capital controls and it is also called political premium in the tradition of the pioneering work of Aliber (1973).[5] In a liberalised financial environment, such as, for example, an offshore market, covered interest rate parity prevails and therefore we must have:

$$cd = i - i^* - fp = 0 \qquad (2)$$

if capital controls or the risk of their imposition are absent. In practice, due to transaction costs, cd is likely to remain within a narrow band (± 0.5%) around 0 (see Frenkel and Levich (1975, 1977, 1981). As a rule of thumb, if cd>0 capital controls are preventing the flow of capital into the country and if cd<0 they are preventing the outflow of capital.

The second term on the right hand side of (1) is the exchange-rate risk premium (rp). As the literature suggests its main determinants are the volatility of the exchange-rate, the attitude of the investor towards risk and the relative weight of the forward position undertaken (see Annex 3 and references therein). A useful formalisation of these ideas can be presented as follows:

$$rp = fp - \epsilon = (F/W) \cdot R_A \cdot Var(\epsilon) \qquad (3)$$

where F is the speculative demand for domestic currency forward contracts, W is the wealth of the investor expressed in domestic currency, R_A is the coefficient of relative risk aversion and $Var(\epsilon)$ is the conditional variance of expected exchange-rate changes. In deriving (3) we assume that, speculative forward positions are open only to non-residents, the authorities do not intervene in the forward market and the spot exchange-rate is managed. The justification for these assumptions will be discussed further when presenting the empirical evidence.

Equation (3) gives three reasons for the existence of a small or zero risk premium: risk neutrality ($R_A \to 0$), exchange-rate near-certainty ($Var(\epsilon) \to 0$), and small weight of the speculative forward

5 - See, also, Dooley and Isard (1980) for an application to Germany, and more recently Giavazzi and Pagano (1985) for an application to the EMS case and Gibson (1989) for an application to the UK case.

position in the portfolio of the investor ($(F/W)\rightarrow 0$). If, for any of the reasons mentioned $rp\approx 0$, then it follows that $fp\approx\epsilon$ and the forward rate is a good proxy for the expected future spot rate. As we shall argue this is indeed the most likely situation for the forward rate of the escudo. Furthermore, if the reason why we have a negligible risk premium is the near-certainty of the path of the spot exchange-rate then actual and expected exchange-rate changes must be equal ($\Delta s\approx\epsilon$), at least in the long-run. A test of the joint null hypothesis, $rp=0$ and $\Delta s=\epsilon$, based on cointegration techniques, is presented below.

Consider a liberalised financial environment such as a Euromarket and assume also that we have $fp=\epsilon$. The difference between the Euro interest rate (i) and the domestic interest rate (id) can be written as follows:

$$i-id = i^* + \epsilon - id \qquad (4)$$

If markets anticipate a devaluation of the domestic currency, i must rise by the same extent to ϵ, unless i^* is adjusted downwards. By using capital controls the monetary authorities can prevent the domestic interest rate from adjusting in order to keep financial conditions at home as stable as possible. Under such circumstances a large differential between offshore and onshore interest rates will appear ($i-id>0$). This is, of course, another way of measuring the effectiveness of capital controls.

The third term on the right hand side of (1) is the expected real exchange-rate change (θ) or the expected deviation from PPP. A positive value ($\theta>0$) means that the domestic currency is expected to depreciate in real terms, that is, the nominal depreciation of the currency is expected to more than offset future inflation differentials ($\epsilon > \pi - \pi*$). A negative value means that the currency is expected to appreciate in real terms. We have $\theta=0$ if relative PPP is expected to prevail in the long-run.

The last two terms on the right hand side of (1) can be combined to yield the currency premium, the sum of the exchange-rate risk premium and the expected deviation from PPP. If rp=0 then fp=ϵ, it follows that the political risk premium is the uncovered interest rate differential ($i-i*-\epsilon$) and the currency premium is the expected deviation from PPP ($\theta=\epsilon-\pi+\pi*$).

Another useful taxonomy based on equation (1) can be offered. The sum of the covered interest rate differential and the exchange-rate risk premium gives a measure of the degree of financial market integration (fi=cd+rp). The expected deviation from PPP gives a measure of the degree of real market integration. Note that departures from real interest rate parity can be due to the lack of real market integration rather than lack of financial market integration. Furthermore, real interest rate parity can result from the combination of two market imperfections, that is, a lack of both real and financial market integration compensating each other. This is an interesting application of the "second-best" principle which states that the elimination of just one distortion is not necessarily welfare improving if others remain. Having presented the analytical framework we turn now to the empirical evidence.

4.2.2 Empirical evidence for Portugal (1978-88)

4.2.2.1 - Real interest rate differential (r-r*)

In figure 1 we show the real interest rate differential between

Portugal and the USA from 1978(3) until 1988(4).[6] Simple observation of the figure reveals that the real interest rate differential has narrowed between 1978 and 1988: the average level has fallen and it is much less volatile. For the whole period we have an average differential of -1.59 falling to just -0.9 if we consider, for example, the period from 1982(3) until 1986(4). This sub-period corresponds to the sample used in Frankel and MacArthur's study and thus, will allow us to make some international comparisons. For the entire sample the variance of the differential is 18; it is 14 for the 1982(3)-1986(4) sub-sample. From observation of figure 1 it is also apparent that, since 1985, the real interest rate in Portugal has been kept mainly above international levels. This is striking if we bear in mind the relatively high levels of international real interest rates observed during that period. This evidence shows that Portugal starts its financial liberalisation process from a situation where private savings are already remunerated at rates close to international levels.

4.2.2.2 - Exchange-rate risk premium (rp)

During most of the time under consideration the escudo domestic forward exchange-rate market was discontinued. In fact, between 1977 and 1987, residents in Portugal were prohibited from entering into any kind of forward committment. At the same time, as we have seen in section 4.1, comprehensive exchange controls regulated every aspect of external payments by and receipts of residents in Portugal. In particular, international arbitrage operations dealing in

6 - See Annex 1 for details of data used throughout this chapter.

Figure 1

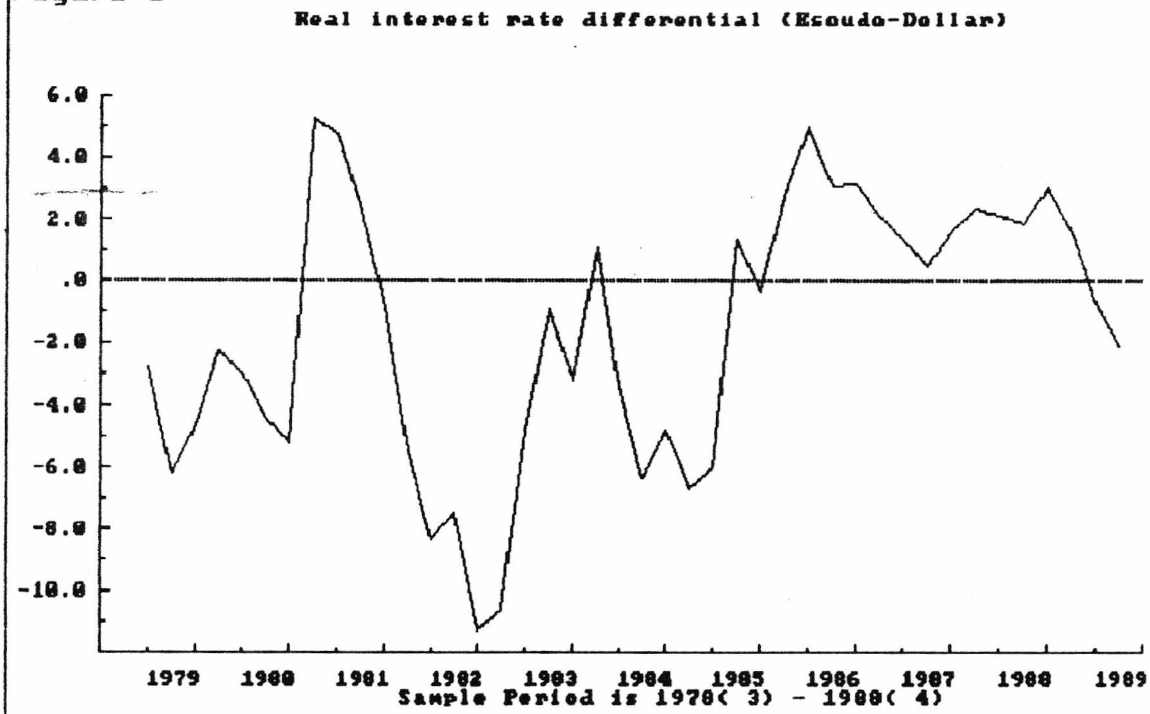
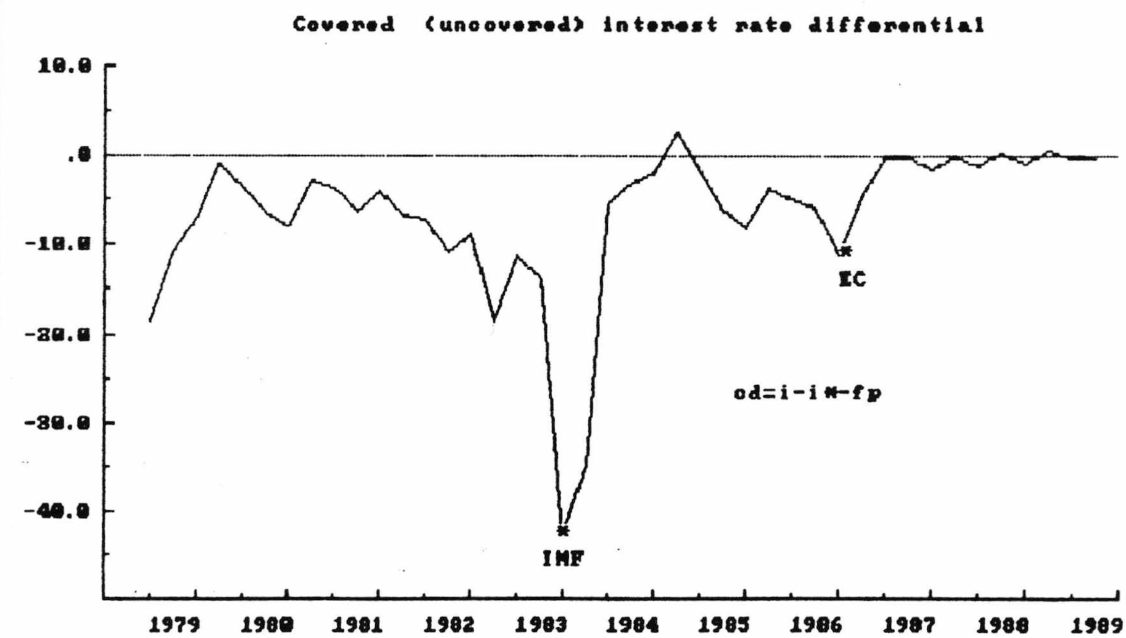


Figure 2



escudos across the exchanges were either prohibited (deposits) or strictly regulated (trade credits). Under these circumstances the forward exchange-rate market of the escudo has been essentially an offshore market. Forward quotations used in our study (escudo/dollar rates on 3 month forward contracts, at or near end-of-quarter) are those reported by City of London dealers and published in the Financial Times since 1978. It is the total absence of official intervention in the market and also its offshore nature that makes these forward quotations an interesting source of information on exchange-rate expectations.

In order to test the joint hypothesis of the absence of exchange-rate risk premium and near-certainty of the path of the escudo, we use cointegration techniques and proceed as follows: we start by showing that the forward rate satisfies three necessary conditions to be a rational forecast of the future spot rate. Then, we test the validity of a model of expectations formation that implies the long-run fulfilment of expectations. Its validity is interpreted as the non-rejection of the null hypothesis.

The forward rate lagged one period (f_{t-1}) is tested to determine whether it can be considered as the expectation of the spot-rate in period t (s^{*}_{t}), formed at time t-1. The necessary conditions for rationality are based on Granger's definition of forecast optimality. First, the lagged forward rate (f_{t-1}) and the actual spot rate (s_t) have the same order of integration and are cointegrated. Both variables are I(1) and are cointegrated C(1,1). Second, the spot rate (s_{t-1}) Granger-causes the forward rate (f_{t-1}). Third, if forward rates (f_{t-2}) do not Granger-cause spot rates (s_{t-1}) and the other conditions are verified, then changes in exchange-rate expectations (Δf_{t-1}) must have adaptive influences (see Annex 2 for more details of the methodology followed and also references to the literature). The results are summarized in table 1. The first two columns present the tests for order of integration of the variables. The results indicate that after differencing once the variables achieve stationarity. Accordingly, both the spot and the forward rates are I(1). Furthermore, the third column shows that the variables are C(1,1). Thus the first necessary condition is not rejected. The final column shows two causality tests. According to the test in the upper half, the hypothesis that the spot rate does not Granger-cause the forward rate is rejected, whereas the lower half shows that the hypothesis that the forward rate does not Granger-cause spot rates is not rejected. Therefore, the second and third conditions are not rejected.

Table 1. Rationality tests

Tests for I(0)	Tests for I(1)	Test for cointegration	Causality tests
spot-rate ADF= -1.5 forward-rate ADF= -1.6	spot-rate ADF= -2.9 forward-rate ADF= -2.3	ADF= -3.2	$s \rightarrow f$ $F(5,25)= 63$ $f \rightarrow s$ $F(4,26)= 0.57$

We are now entitled to move to the next step to test whether the data does not reject the long-run fulfilment of expectations, using the change in the forward rate as our measure of the change in the expected spot rate. A starting point for modeling the formation of exchange-rate expectations is the estimation of a general error correction representation of the form:

$$\Delta f_t = -\gamma_1 Z_{t-1} + \sum_{i=1}^{n} \phi_i \, \Delta f_{t-i} + \sum_{i=0}^{p} \psi_i \, \Delta s_{t-i} + \epsilon_t \tag{5}$$

where

$$Z_{t-1} = f_{t-2} - \alpha - \beta\, s_{t-1}$$

Model (5) encompasses various popular specifications of expectations formation. We have static expectations, if the parameters are jointly non-significant, extrapolative expectations if only ψ's are statistically significant and positive; regressive expectations if only ψ's are statistically significant and negative; and adaptive expectations if the coefficients of the variables in changes are jointly not statistically significant or, if being significant, the linear restrictions ψ_i + ϕ_i = 0 (ϕ_i<0) (i=1,...,n) are not rejected by the data. Combinations of some of the basic specifications are also possible. After estimating the general error correction model (5) we tested the validity of our preferred parsimonious representation. It is Frenkel's extrapolative-adaptive model whose main feature is the distinction that it draws between the determination of the short-term and the long-term expectations (see Annex 2 for references). The results obtained are as follows:

$$\underset{}{\Delta f_t} = \underset{(8.943)}{0.69\, \Delta s_t} + \underset{(2.200)}{0.11\, \Delta f_{t-1}} - \underset{(-2.764)}{0.21\, (f_{t-1} - s_t)_{t-1}} + \hat{e}_t \qquad (6)$$

R^2=0.95 SER=0.014 $Chi^2(4)$=3.504 t-stat between ( )

$Chi^2(4)$ is the Lagrange Multiplier test on the validity of four linear restrictions on (5) when n=2 and p=1. The null hypothesis is $\phi_2=\psi_1=0$ and, $\alpha=0$ and $\beta=1$ and the critical value at 5% is 9.488 (reject for larger values of the statistic).

For our purposes the important features of model (6) are firstly, that the linear restrictions are not rejected by the data and secondly, that the adaptive term is statistically significant. Furthermore, the adaptive term is the forecast error and thus, the long-run static equilibrium implied by the model is $f_{t-1}=s_t$. The conclusion is one of long-run fulfillment of exchange-rate expectations. The joint hypothesis that the escudo has followed a near-certain path and the exchange-rate risk premium is negligible is not rejected by the data.

4.2.2.3 - Political premium, degree of financial market integration and effectiveness of capital controls ($i-i^*-fp \approx i-i^*-\epsilon$)

Since we have shown that the exchange-rate risk premium in our case appears to be negligible we have a situation where the covered (uncovered) interest rate differential is both a measure of the effectiveness of capital controls and of the degree of financial market integration. In figure 2 we show the covered (uncovered) interest rate differential between domestic escudo deposit rates and Euro-dollar deposit rates. For the whole sample period, 1978(3)-1988(4), we have an average differential of -3.3. It increases to -5.45 if we consider the sub-sample period 1982(3)-1986(4). For the entire sample the variance of the differential is 55 and for the sub-sample it increases to 104. Thus, in sharp contrast to the case of the real interest rate differential, we have large and volatile deviations from covered (uncovered) interest rate parity. The stars in figure 2 denote two moments when large devaluations of the escudo were expected: the first just before the implementation of the second IMF Adjustment Programme; and the second when Portugal joined the EC. The first episode is discussed further below. What is important now is to see how the domestic interest rate failed to adjust in order to offset the anticipation of exchange-rate changes.

For international comparisons we show Frankel and MacArthur's results for EC countries in figure 3 to which we have added our own calculations for Portugal. As expected, countries which are known to have used capital controls show higher mean and variability of the covered interest interest differential and, in particular, Portugal and Greece present the lowest degrees of financial market integration. The U.K. and Germany, as well as Holland, provide good examples of financial market integration. The conclusion is that Portugal starts its financial liberalisation process from a situation of low financial market integration which, in our case, is equivalent to saying that we start from a situation where capital controls seem to have been effective in insulating the domestic financial system from speculative pressures.

4.2.2.4 - Currency premium and degree of real market integration (θ)

In figure 4 we show an index of the escudo/dollar real exchange-rate from 1978(3) to 1988(4). From 1978(3) to 1988(4) we have an average annual expected real depreciation of 1.7%. For the sub-sample period 1982(3)-1986(4) the average expected real depreciation of the escudo rises to 4.5%. For the whole sample the variance is 69 and for the sub-sample it is 129. To complement these results we tested the hypothesis of non-stationarity of the real exchange-rate and the data did not reject it, which confirms the failure of PPP (tests for PPP are discussed in Annex 4). These results reflect, in part, the real appreciation of the dollar against other currencies that occurred in the first half of the 1980's. This happened, of course, independently of any competitiveness target being pursued by the Portuguese authorities. But the

Figure 3 Deviations from covered interest rate parity: EC countries against USA (1982–1986)

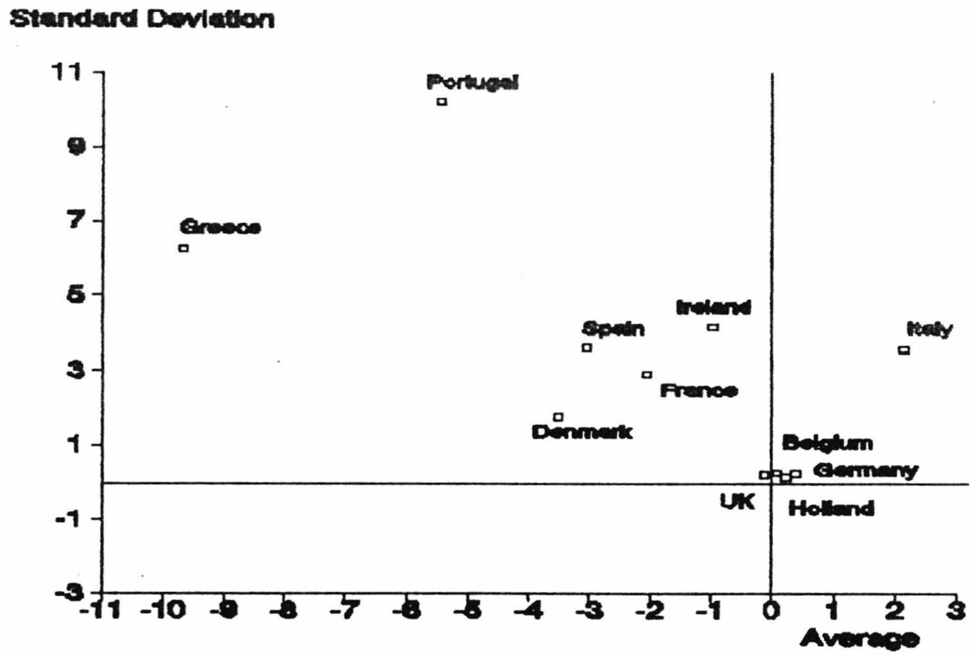
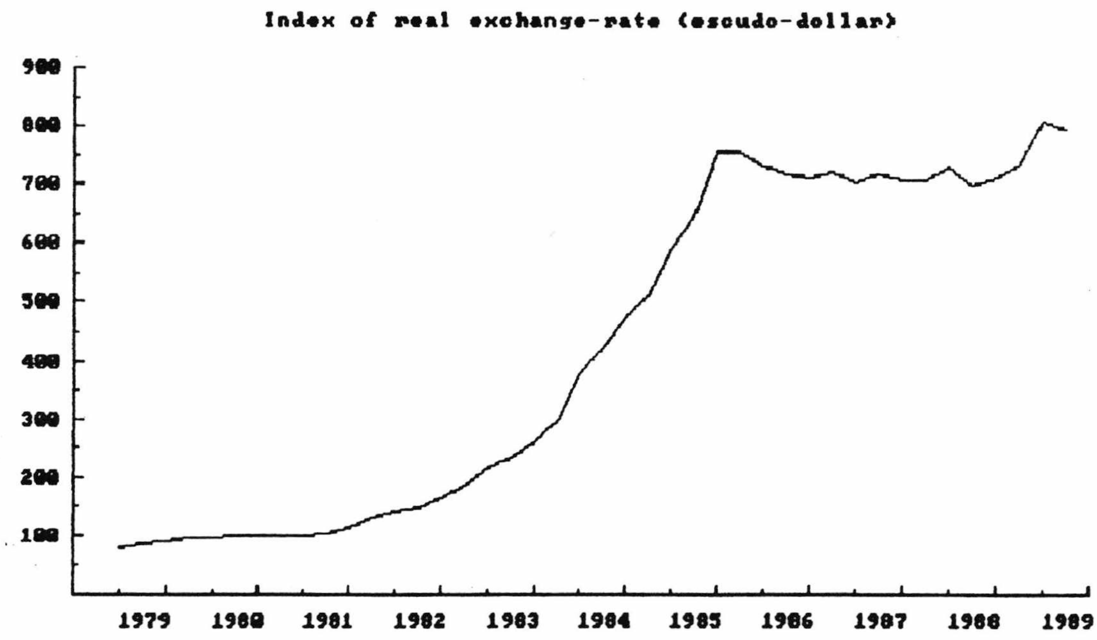


Figure 4



main argument stands even if we use an index of effective rather than bilateral rates: in fact the real depreciation of the escudo reflects also the autonomous option of the Portuguese authorities which was, during most of the time covered by our study, to improve or maintain price competitiveness. Thus, in the case of the escudo the currency premium is the result of real depreciation and not of exchange-rate risk premium. The results also indicate a lack of real market integration.

4.2.3 - Synthesis

A nice synthesis of the combination of real and financial market imperfections which permitted financial stability and real exchange-rate targeting whilst, by compensating each other, resulted in real interest rate parity, is given by the correlation matrix between the real interest rate differential, the expected real exchange-rate depreciation and the uncovered interest rate differential.

Correlation matrix

	$r-r^*$	$\epsilon-\pi+\pi^*$	$i-i^*-\epsilon$
$r-r^*$	1	0.46	-0.15
$\epsilon-\pi+\pi^*$		1	-0.95
$i-i^*-\epsilon$			1

Note, first, the weak correlation between the real interest rate differential and the degree of financial market integration (-0.15). Second, there is a strong correlation between real depreciation and departures from uncovered interest rate parity (-0.95). In other words, the real depreciation of the escudo ($\epsilon>\pi-\pi^*$) was almost exactly offset by a covered (uncovered) interest rate differential against domestic assets ($i<i^*+\epsilon$) creating real interest rate parity. Thus we had neither financial market nor real market integration, but still had real interest rate parity.

Our interpretation of the evidence is that capital controls were used to stabilize financial conditions. As the authorities followed certain "well-understood" exchange-rate targets their behaviour allowed the development of expectations of nominal devaluations, from time to time and during certain periods. This in turn created large arbitrage opportunities which were curbed by exchange controls. Recall our earlier account of the theoretical literature on speculation and its likelihood in a regime setting where the authorities are known to operate real exchange rate depreciation rules. Our account here suggests that such rules in Portugal did indeed lead to speculation, but also that it was limited by effective exchange controls.

A final point should be added. Looking back to figures 2 and 4 we can see that, in the last three years of the sample (1986-88) covered (uncovered) interest rate parity seems to have prevailed and that, in general, the period is not marked by expectations of real exchange-rate depreciation. This situation is already compatible with a financial liberalised environment and suggests that the (administered) nominal interest rate and the (managed) exchange rate are consistent. Furthermore, there seems to be a close correlation between the disinflationary process of 1985-87 and the real appreciation of the escudo, a topic discussed at length in chapter 7. The question is whether this situation is sustainable in the medium run. In 1979-80 Portugal had similar circumstances. During this period, covered (uncovered) interest rate parity prevailed, or even favoured escudo deposits, and the escudo appreciated in real terms. Inflation came down and in 1980 real interest rates in Portugal were above international levels. At the same time, from 1979 until 1982, external finance became readily available and the country experienced a period of relatively high economic growth whilst foreign markets were contracting under the impact of the 1981-82 world recession. In 1983 a serious balance of payments crisis emerged when Portugal was subject to credit rationing by the international financial community. Then, the "patient" was sent back to the IMF. This experience cautions against an over-sanguine assessment of the more recent successful period, 1986-88, and thus suggests caution in moving quickly towards Stage 1 of Delors.

4.3 - Exchange controls and domestic political crisis

In section 4.2 we have seen that the political premium in Portugal is (was?) very high and volatile. In this section we illustrate this idea by studying two balance of payments crises which were motivated mainly by political crisis. These foreign exchange crisis affected both right and left-wing governments. The first episode to be studied caused problems for Salazar's conservative government (1961-62) and the second, more protracted episode, affected weak left-wing governments during the 1974-75 period. These episodes, which may be seen as extreme cases, allow us to draw attention to an apparently neglected aspect of the medium-term feasibility of external financial liberalisation: the need for continued political stability.[7]

4.3.1 - The crisis of 1961/62

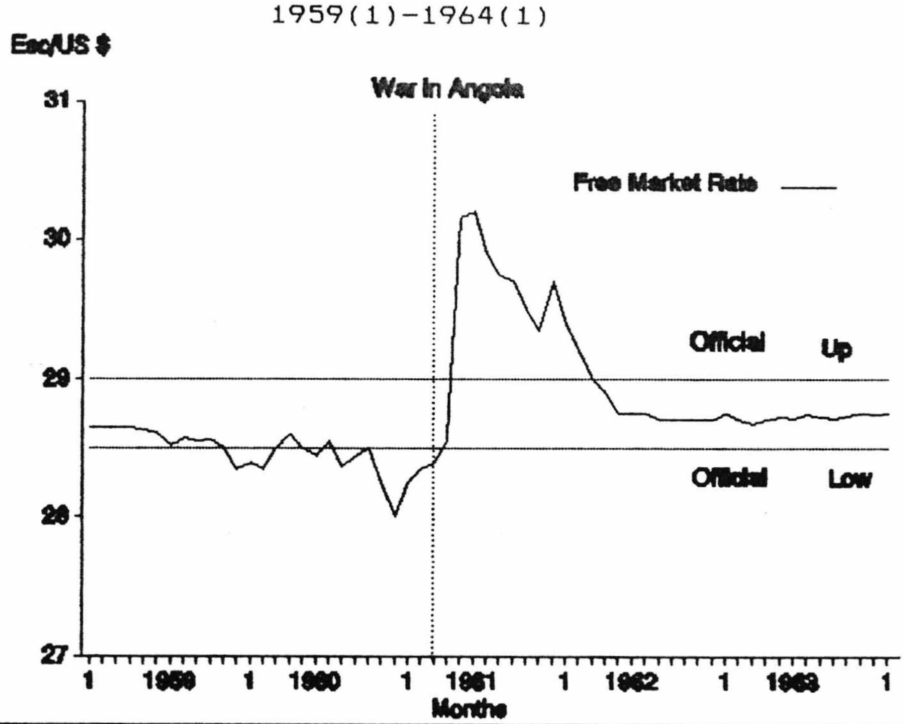
In 1961 the government of the Portuguese dictator, Salazar, faced a serious balance of payments crisis as the escudo came under strong pressure. Foreign exchange controls were tightened and gold reserves were used to defend the escudo.

In figure 5 we show the end-of-month escudo/dollar free market rate and the 1% Bretton-Woods fluctuation band around the official parity, covering the period 1959(1)-1964(1). The official parity corresponds to the rate that was declared at the time when Portugal joined the I.M.F. (in 1962) which was 28.75 escudo/dollar and the free market rate is taken from Pick's Currency Yearbook. From May until December of 1961 there was a premium on the dollar. Confidence in the escudo was not fully re-established until one year later.

This sudden loss of confidence in the Portuguese currency appears mysterious in the light of the performance of the Portuguese economy as the 1960s were "golden age" years. For example, from 1961 to 1970 the yearly growth rate of real GDP averaged almost 7% and gold reserves more than doubled in volume. The loss of confidence in the escudo seems even more mysterious if we bear in mind that inflation in Portugal in the early 1960's was very low (2%) and that Salazar was a fiscal conservative. For example, in 1962, the Public Debt/GDP ratio was only 1% (it rose to just under 11% in 1964

7 - This apparently neglected aspect is considered explicitly in Alesina (1988) and in Giovannini (1988) in relation to the Italian experience with high public debt and capital controls.

Figure 5 Esc/Dollar Free Market Rate
1959(1)-1964(1)



Source: Pick's Currency Yearbook

and declined steadily thereafter until 1972).

As we have seen in chapter 2, in most models of rational speculative attacks on fixed exchange rates, fiscal laxity and the printing of money are the underlying factors causing the exhaustion of foreign exchange reserves, which, in turn, triggers the speculative attack. Clearly, the escudo crisis of 1961 and its timing cannot be explained by that kind of analysis: its timing was determined by politics and the decisive factor that triggered the crisis was the outbreak of the colonial war in Angola (February-March, 1961). It is possible to argue that at the outset of the war, fears of capital levies and increases in taxation (to finance the anticipated debt burden) caused capital flight. But if that was the case, it is difficult to understand why the crisis subsided so rapidly.

In our opinion this episode is a vivid illustration of how political crisis may generate a run on central bank's reserves, through its effects on expectations. Here we have a breakdown in business confidence which occurred in spite of the well-established reputation of the government for sound finance and strong currency. The crisis happened because for a period of time there was a small chance of major change in the "fundamentals" as it was feared that the collapse of the empire would bring economic and political chaos. Salazar's resolve to fight for the preservation of the colonies with the cohesion of the armed forces behind him soon re-established confidence in the escudo.

4.3.2 - The crisis of 1974/75

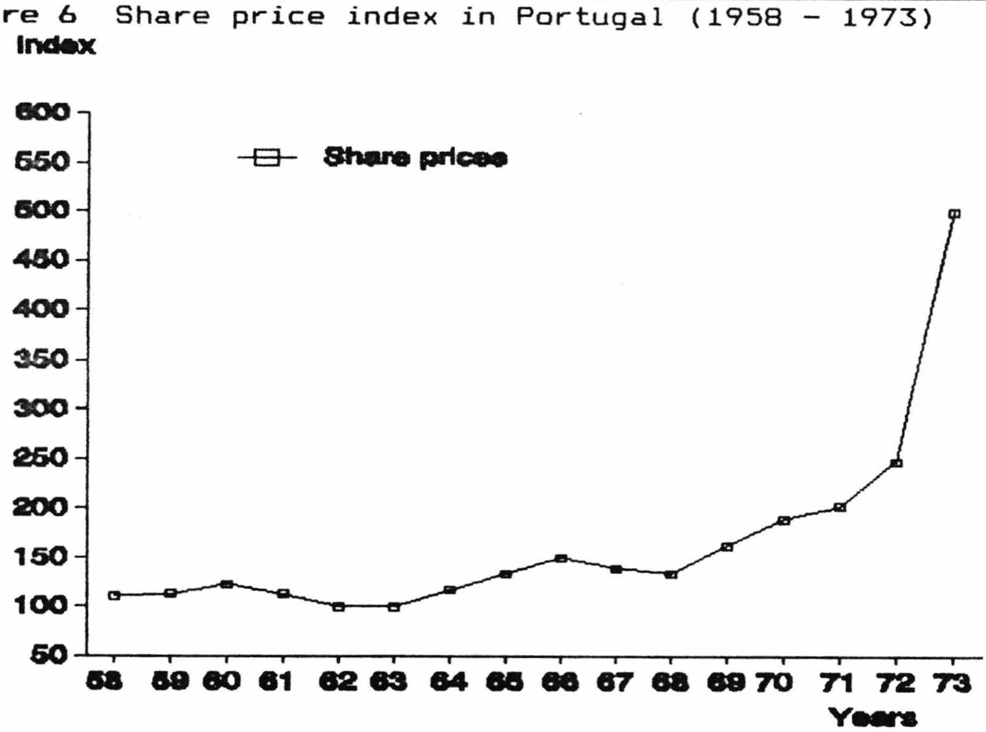
On the 25th of April 1974, a military coup led by the captains of the Movimento das Forças Armadas (MFA) and the massive support given to it by the Portuguese people put an end to almost 50 years of dictatorship. One year later (25/4/75) the Portuguese voted in freedom for the first time in almost half a century. With a turnout of 92% the Assembleia Constituinte was elected with the mandate of writing a new Constitution. On the day of the second aniversary of the Revolution (25/4/76) the first Assembleia da República (Parliament) was elected. The Socialist Party (PS) won with a relative majority (35%) and its Secretary-General, Mário Soares, became Prime-Minister. Two months later (27/6/76) the candidate of the Socialists and of the Social-Democratic Party of the late Sá Carneiro, general Ramalho Eanes, was elected President of the Republic. The period of constitutional normalisation had begun leaving behind two years of great political turmoil.

A detailed economic and political history of the 1974-75 period is beyond the scope of this thesis. Here we focus only on the evolution of business confidence during that period and on some aspects of the reaction of the authorities.

The collapse of the dictatorship and of the colonial empire came as a surprise. In figure 6 we show an index of share prices in Portugal, from 1958 to 1973, taken from OECD <u>Main Economic Indicators</u>. Whatever the cause of the rise of the share price index in the early 1970s it is clear evidence that the unfolding of the economic and political crisis of 1974/75 was totally unexpected.

It is useful to use the Swan diagram to give a schematic characterization of the macroeconomic shocks that hit the Portuguese economy in 1974/75 and of the adjustment process followed by the authorities (see, Krugman and Macedo (1979) for a similar approach). Figure 7 shows the Swan diagram. On the vertical axis there is a

Figure 6 Share price index in Portugal (1958 - 1973)

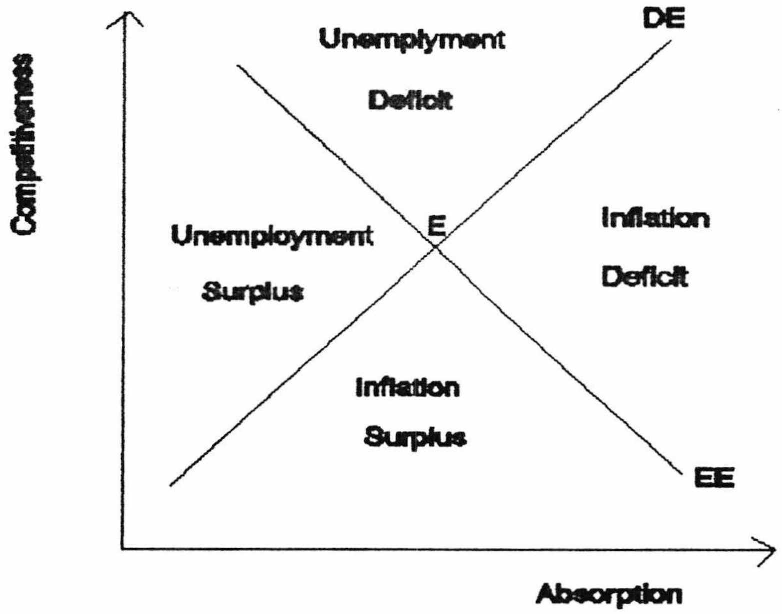


Source: OECD - Main Economic Indicators

measure of price competitiveness or real exchange rate (rer). A decrease in rer makes the economy more competitive and tends to improve the current account. On the horizontal axis there is a measure of domestic absorption (A). Two equilibrium conditions are defined in the diagram. External equilibrium (EE) represents the combination of competitiveness and absorption levels for which the current account is in equilibrium. When competitiveness improves, the current account improves and, in order to maintain external equilibrium, the level of absorption must increase. Thus EE is negatively sloped. All points above the EE curve correspond to situations of current account deficit and all points below the EE curve represent surpluses. The domestic equilibrium (DE) represents combinations of competitiveness and absorption for which there is a level of unemployment that does not lead to an accelerating rate of inflation (NAIRU). A level of unemployment below NAIRU leads to an upward pressure on the price level. Starting from a situation of domestic equilibrium an increase in price competitiveness will reduce the unemployment rate below NAIRU and will trigger inflationary pressures. In order to maintain domestic equilibrium the level of absorption must decline. Thus DE is positively sloped. Points to the right of DE correspond to situations of inflationary pressure in the economy. Points to the left of DE correspond to unemployment exceeding the NAIRU. The Swan diagram allows us to distinguish four types of macroeconomic disequilibria shown in figure 7 around the point of external and internal equilibrium at E.

In terms of the Swan diagram the Portuguese economy was hit by two major shocks. One was the loss of the protected overseas market which we interpret as a downward shift of the EE curve. For the

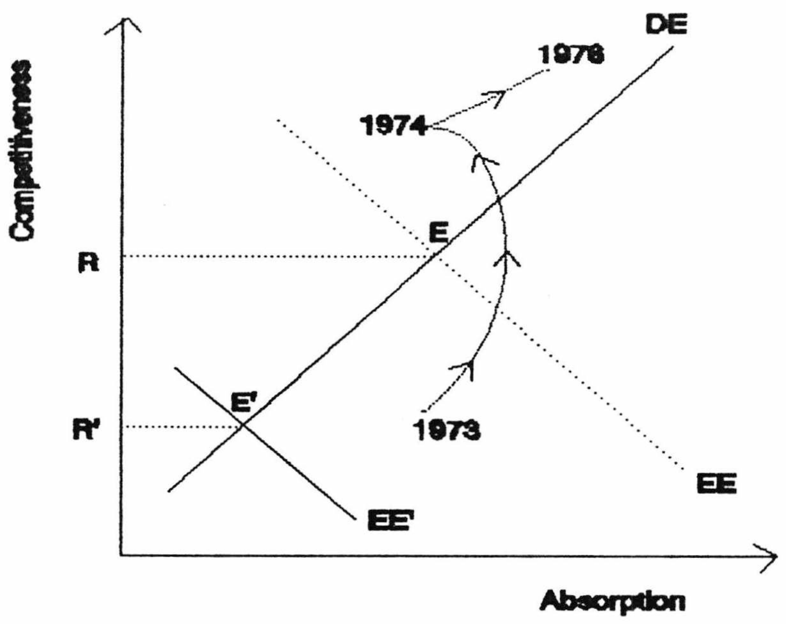
Figure 7 The Swan diagram



same level of absorption the economy had to become more competitive to achieve external equilibrium. This would warrant a change in the real exchange rate, illustrated in figure 8 as an equilibrating real depreciation from R to R'. The second was the wage explosion that followed the downfall of the dictatorship: in the second quarter of 1974 alone, real wages increased 14%. This caused a loss in competitiveness which moved the economy into the region of current account deficits and unemployment. It should be mentioned that these "specific shocks" were compounded by other "global shocks": the oil shock of 1973, the raw materials price surge of the early 1970s, and the world recession of 1974-75.

The path of the economy from 1973 to 1976 is illustrated in figure 8 by the arrows. Firstly, the shocks mentioned above moved the economy from a situation of current account surpluses (3% of GDP in 1973) and inflationary pressures (real growth of 11% in 1973) to a situation of current account deficits (-6% of GDP in 1974) and unemployment (in 1975 real GDP slumped by -4.3%). Secondly, from 1974 to 1976 the authorities gave priority to the achievement of domestic equilibrium over external equilibrium and the economy moved further into external disequilibrium.

Figure 8 Macroeconomic shocks of 1974/75 in the Swan diagram

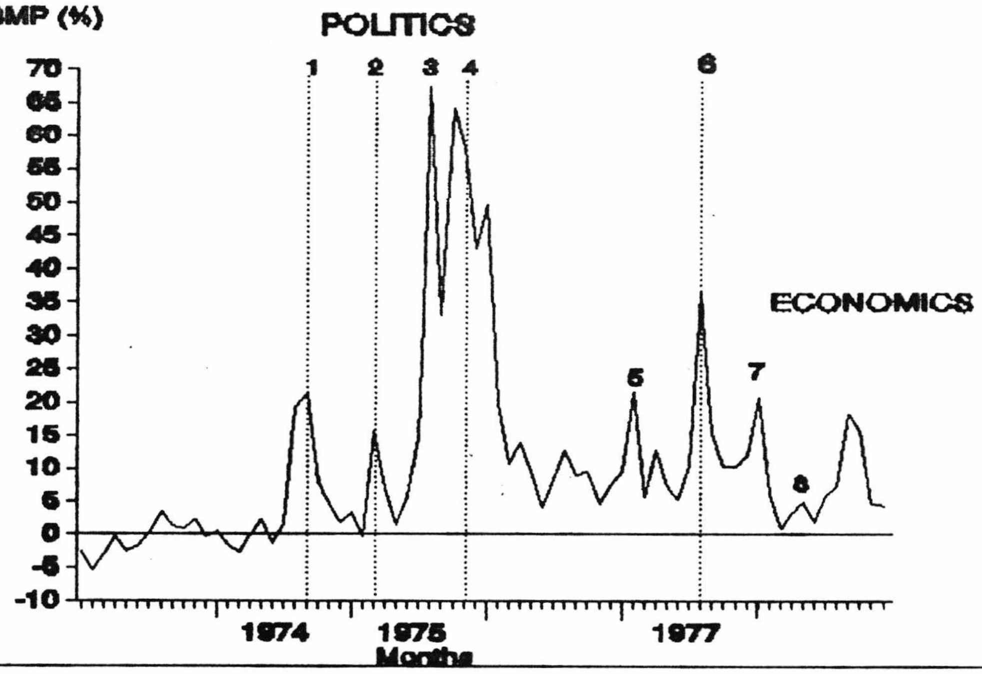


The exchange rate policy adopted was directed at the stabilisation of the nominal effective exchange rate in order to curb inflationary pressures. In practice, the escudo was pegged to the "snake" and appreciated over 30% in real terms in just two years (see Banco de Portugal <u>Annual Report</u>, 1976). The accumulated current account deficits implied a continuously declining stock of international reserves which rapidly became unsustainable.

It should be stressed that a substantial outflow of capital compounded the problems created by the large current account deficit. The total amount of capital that flowed out of the country in

1975 alone (over 300 million US dollars) corresponded to 22% of GDP, four times as large as the current account deficit in that year. The authorities responded to this situation by tightening exchange controls: import surcharges were introduced, allowances for tourism were drastically reduced and transfers of income from imported capital were subject to ceilings. But perhaps more decisively, the bureaucratic machinery dealing with exchange controls delayed external payments by purely administrative procedures. Under these circumstances the development of a black market for foreign exchange was almost inevitable. When a relatively stable political situation finally emerged after the 1976 Parliamentary election, the Escudo had already lost its reputation. Inflation was above the European average, internal and external public debt was growing and the large balance of payments deficits of the previous years had exhausted foreign exchange reserves and eroded the gold stock, sold or given as collateral against foreign credits. Having lost its protected overseas markets and its exclusive access to cheap sources of energy and raw materials the Portuguese currency became the natural candidate for a large (re-equilibrating) real devaluation. Accordingly, it can be argued that a "repressed" demand for foreign currency emerged after April 1974 reflecting the rational anticipation of an escudo devaluation. A formal model of the black market premium emphasizing the role of exchange controls, real exchange rate misalignment, and expectations, is presented and tested in section 4.5; however, it is possible that during the period under analysis in this section, political factors overwhelm any possible economic determinants of the premium. In other words models based on economic factors may not be appropriate to explain the variance of the black market premium during the 1974-75 period.[8]

Figure 9 Black market premium (January 1973 - December 1978)



Source: Pick's Currency Yearbook

8 - Macedo (1982) estimated a model of the escudo/dollar free market exchange rate using a sample covering the 1973-1978 period but the econometric testing is not very convincing due to severe parameter instability. See section 4.5.1.

In figure 9 we show the end-of-month black market premium on the dollar, from the beginning of 1973 until the end of 1978, based on the free market rate taken from Pick's Currency Yearbook. The black market premium (BMP) is calculated as follows:

$$BMP = 100.(S_{bm} - S_o)/S_o \qquad (7)$$

where: S_{bm} is the free market exchange rate; and S_o is the official exchange rate. Both are escudo/dollar rates. Time subscripts are omitted for simplicity.

Within the institutional context described in section 4.1 it can be argued that the premium is picking up the effects of exchange controls and capital market impediments.[9] We divide the sample into three periods. The first period covers the final months of the dictatorship [1973(1)-1974(3)]; the second period goes from the fall of the old regime until the beginning of what we called the constitutional normalization process [1974(4)-1976(7)]; the third covers a period which, though still marked by some political instability is dominated by two large devaluations of the escudo (February 1977 and May 1978), the beginning of the crawling-peg (August 1977) and the implementation of the first IMF Adjustment Programme (May 1978).

During the final months of the dictatorship there is no black market premium, confirming the idea already expressed that the Revolution was an unexpected event. It is during the second period that a black market premium becomes visible. To see why economic

9 - Looking back to equation (1) we may view a situation of domestic political instability as affecting (mainly) the political premium. If the political premium becomes negative the risk-adjusted real interest rate differential moves against holding domestic financial assets which tends to generate an outflow of capital from the country. If foreign exchange controls are binding this portfolio shift (increase in the stock-demand for foreign assets) is "repressed" and then will tend to be channeled into (or foster the development of) parallel or illegal markets.

factors are not appropriate to explain the variance of the black market premium during the turbulent 1974-75 period we have marked on figure 9 the four major political events of the 1974(4)-1976(7) period (politics) as follows: (1) the crisis of 28 September 1974 which triggered the resignation of General A. Spínola as President of the Republic[10]; (2) the military coup of 11 March 1975 attempted by forces loyal to the right-wing General A. Spínola[11]; (3) the "Hot" Summer of 1975 when the (policies of the) 5th Provisional Government of the General Vasco Gonçalves came under attack from an anti-communist coalition of forces led by the Socialists and the Catholic Church[12]; (4) the military confrontations of 25 November 1975 and subsequent curfew in Lisbon, which culminated in the marginalization of the Communists and of the radical-wing of the MFA. Note that on each occasion the black market premium increases sharp-

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10 - António de Spínola, a right-wing general and ex-commander-in-chief of the Portuguese armed forces in Guinea-Bissao during the colonial war, became the first President of the Republic (by nomination) after the Revolution. He was known, during the final years of the old regime, to favour a political rather than a military solution to the 13 years long colonial wars. However, he favoured a kind of Portuguese-speaking "Commonwealth" solution, rather than the outright independence implied by the surrender of power to the left-wing liberation movements (PAIGC in Guinea-Bissao, FRELIMO in Mozambique, and MPLA in Angola). His resignation after the crisis of September 1974 reinforced the position of the radical wing of the MFA, whose most well-known figure is Otelo Saraiva de Carvalho, which favoured complete independence.

11 - The coup failed and the general escaped to Spain on the day of the coup. He is thought to have supported, if not directly organized from exile, the wave of "white terror" against the communists during the "Hot Summer" of 1975. After March 11, the industrial and financial groups were nationalized and the large farms of the southern province of Portugal (Alentejo), known as latifúndios, were occupied by landless workers. The nationalizations and the land reform, frozen by constitutional law, became known as the "irreversible conquests of April". It took almost fifteen years to water down such "barriers to entry" when a new constitutional law was finally approved in 1989.

12 - The 5th Provisional Government and the general Vasco Gonçalves had the support of the Communist Party (PCP) and of the radical wing of the MFA. The Communist Party took 14% of the votes in the first parliamentary election (1976).

ly falling back afterwards as the political tension lessens. It is unlikely that there is any variance left to be explained by other (economic) factors.

During the third period of the sample a sustained black market premium emerges. After the dramatic reduction of the premium around the parliamentary and presidential elections of 1976, the sample period is dominated by the intervention of the IMF and the policy regime shift it implied. In late 1976 a mission from the Fund visited Portugal. By April 1977, an IMF Report on the Portuguese Economy was handed to the Portuguese government and in early 1978 (January) an IMF Adjustment Programme was announced. The Adjustment Programme was implemented in May 1978.[13]

During this third period two large devaluations of the Escudo occurred. The first in February 1977 and the second at the time of the implementation of the IMF Adjustment Programme (May 1978). These dates are marked on figure 9 (nos. 5 and 8 respectively) as well as the time of the announcement of the project of "Letter of Intent" (no. 7). We can see that the black market premium increases on each of these occasions. Nevertheless, the largest increase in the premium is still due to "politics" as it soars on the downfall of the first Socialist government (August 1977; no.6)[14].

The main conclusion to be drawn from the episodes reviewed in this section is that, as mentioned in chapter 2, political instabil-

13 - See Brito <u>et al.</u> (1985) for a succint description of political and economic events and their interaction during this period.

14 - The first Constitutional Government led by Mário Soares was a fragile government, as the Socialist Party (PS) had only a relative majority in Parliament (35%). Subsequent Socialist led governments were based on coalitions either with centre or right-wing parties.

ity has in general negative effects on entrepreneurs' expectations and may generate capital flight and exchange rate depreciation. Thus the medium-term feasibility of external financial liberalisation seems to imply the need for continued political stability.

4.4 - Macroeconomic disequilibrium, exchange-rate expectations and capital controls: the Portuguese experience of 1979-83

In this section we look at some aspects of the macroeconomic performance of the Portuguese economy in particular during the 1979-1983 period. The experience of this period is important because it highlights the circumstances and the timing of the development of speculative pressures on the escudo under more stable political circumstances. For this reason we put our emphasis on the evolution of exchange-rate expectations and on the role of capital controls.

4.4.1 - Macroeconomic performance

The macroeconomic performance of the Portuguese economy from 1974 to 1988 is summarised in figure 10 where we plot the log of an index of price competitiveness (relative unit labour costs) against the level of absorption as a % of GDP. The figure can be seen as a Swan diagram. We have the 1974-75 period of external disequilibrium and large real exchange-rate misalignment. From 1977 until 1979 we have a period of adjustment and external equilibrium is achieved at the cost of some unemployment, despite the good performance of the Portuguese economy in terms of growth. The rate of unemployment, virtually nil in 1973, rose to 7.2% in 1979 whilst real growth during this period averaged 5.5%. After the second oil shock, from

Figure 10

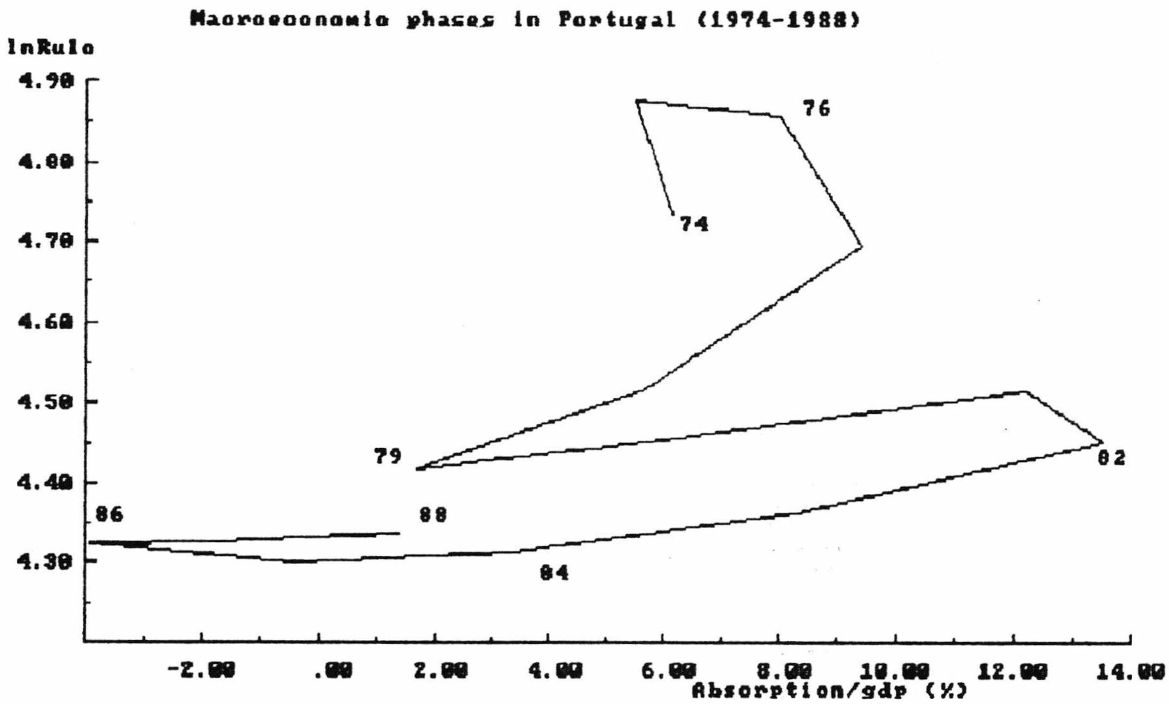
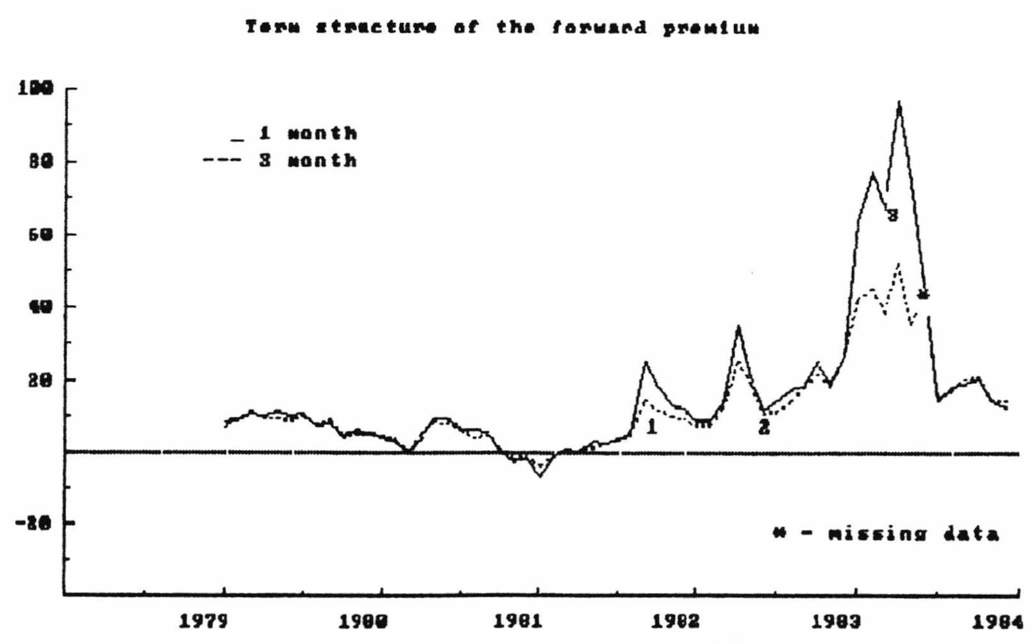


Figure 10



1979 to 1982, the Portuguese economy slipped again into external deficit with strong inflationary pressures building up and some deterioration of price competitiveness. In 1982 the current account deficit reached the record level of -13% of GDP. From 1983 to 1986 there is a remarkable improvement of the current account and some competitiveness gain is also achieved. However, the rate of unemployment rose to over 8% and the economy went through a period of recession and slow growth. As a rule of thumb we see the equilibrium position of the Portuguese economy (external and internal balance) in the region around the years 1979, 1984 and 1988 that is, with a current account deficit between -1 and -3% of GDP and competitiveness at the level of 1988. We shall look now at the evolution of exchange-rate expectations between 1979 and 1982, when the Portuguese economy was moving into disequilibrium, and in 1983 when the second IMF Adjustment Programme was implemented.

4.4.2 - The term structure of the forward premium

In figure 11 we show the term structure of the forward premium on the dollar for 1 month and 3 month forward contracts at or near end-of-month. The data is taken from The Financial Times and goes from January 1979 until December 1983. The data for June 1983, which is an important turning point, are not available.

According to the expectations theory of the term structure[15] if the crawling peg is expected to continue at a constant monthly rate of depreciation the term structure is flat, that is, the annualised forward premia on 1-month and 3-month forward contracts are

15 - Useful references on the expectations theory of the term structure are Modigliani and Sutch (1966, 1967) and Modigliani and Shiller (1973).

equal. When the crawling peg is expected to continue smoothly but at a decreasing rate of depreciation the term structure is downward sloping, that is, the annualised forward premium on 1-month contracts is larger than the annualised forward premium on 3-month contracts. When the crawling peg is expected to continue smoothly but at an increasing rate of depreciation the term structure is upward sloping, that is, the annualised forward premium on 1-month forward contracts is smaller than the annualised forward premium on 3-month forward contracts. If a devaluation is expected to occur within a month the term structure becomes steeply downward sloping. This is so because, as we argued, the forward rate is a good proxy for the expected future spot rate and the exchange-rate risk premium is negligible. Under these circumstances, at any point in time, the expected path of the escudo within three months is an average of what is expected to happen in each of the three following months. With these ideas in mind let us look at figure 11.

Three comments are worthwhile. First, we can see that the term structure remained approximately flat from the beginning of 1979 until August 1981, becoming steeply downward sloping thereafter, with the premium on 1 month contracts much more volatile than the premium on 3-month contracts. As the deteriorating situation of the balance of payments became apparent, the market discounted expected future devaluations of the escudo. Second, we can see the forward premium on both maturities increasing around the time when major ERM realignments occurred (three, within the sample period, marked on the figure). This suggests the idea that the market expected the escudo to follow the weak currencies of the ERM. In fact, the timing of three out of five devaluations of the escudo is related to the timing of ERM realignments. Third, note the very interesting reaction of the premium on both maturities after the ERM realignment of March 1983. Leaning against the wind the Portuguese government devalued the escudo by 2% only in terms of a basket of currencies, calling it a "technical" devaluation. It seems that the market remained unconvinced as the premia rose even further. The behaviour of the authorities can be explained by political factors: with general elections in April the centre-right coalition government did not want to devalue the escudo further just at the start of the electoral campaign. In fact, the premia collapsed only when the large devaluation was finally implemented by the new government, in July 1983, when the second IMF Adjustment Programme was executed.

The analysis of this section confirms our previous conclusions. The large and volatile deviations from covered (uncovered) interest rate parity reflect the anticipation of devaluations and indicate also that capital controls were effective in insulating the domestic financial system from the full effect of speculative pressures. These pressures developed because fundamental factors such as current account deficits were present. But it is also important to realize that they developed because for most of the time the Portuguese authorities followed competitiveness targets which implied occasional large devaluations.

4.5 - A simple model of the black market premium and its application to the Portuguese experience during the 1979-83 period

As we have seen in section 4.3 the black market for foreign exchange indicates the direction and the evolution of market sentiments during periods of political turbulence. Under more stable political circumstances anticipations of devaluations are reflected in the black market premium if exchange controls are biting. As expectations and market sentiments are never directly observable or measurable, it is important to test the robustness of the results found in section 4.4 which are based on the reasonable though questionable idea that the forward rate is a good proxy for the expected spot rate. This is what is done in this section using the available data on the escudo/dollar free market rate. Firstly, we present the theoretical framework and then we proceed to the empirical analysis and econometric testing.

4.5.1 - The theoretical model

The pioneering study on the escudo/dollar free market rate is Macedo (1982). The author presents a theoretical, general equilibrium approach to modelling the escudo/dollar free market exchange rate but the econometric testing is not very convincing due to severe parameter instability, as the author acknowledges. In fact, the model was estimated using a sample covering the 1973-1978 period, a period that, as we argued, is marked by political turbulence and three policy regime shifts. It is thus unlikely that we would find any stable econometric relationship during this period. Here we suggest a different approach based on a partial equilibrium model due to Dornbusch <u>et al.</u> (1983).

The model has a very simple structure involving stock and flow equilibrium conditions as set out in equations (8) and (9).

$$Dx/x = g(x.B/E) - (i* + d_o - i) \qquad g'>0 \tag{8}$$

$$DB = f(x;rer) \qquad f_x>0 \, , \, f_{\bullet}>0 \tag{9}$$

where: B is the existing stock of black market dollars; DB is the net flow of black market dollars; S_{bm} is the escudo price of dollars in the black market; $B.S_{bm}$ is the supply of black dollars measured in escudos; E is the value of escudo assets; $W=E+B.S_{bm}$ is total wealth measured in escudos; i* and i are the foreign and domestic nominal interest rates; d_{bm} is the rate of depreciation of the escudo in the black market; x is the black market premium (one plus the premium) defined as $x=S_{bm}/S_o$; S_o is the official exchange rate; $E*=E/S_o$ is the dollar value of escudo assets valued at the official rate; rer is the official real exchange rate. Dx/x is the rate of change of the premium defined as $Dx/x = d_{bm} - d_o$, the difference between the rates of depreciation of black dollars and of the official rate. Dx denotes the right-hand side time derivative of a variable; g(.) and f(.;.) denote functions and g′ and f_i (i=x,e) denote, respectively, derivative and partial derivatives of the functions.

Equation (8) describes a stock-equilibrium condition derived from an inverted portfolio equilibrium condition (see Annex 3). The portfolio equilibrium is given by:

$$B.S_{bm}/W = y(i* + d_{bm} - i) \quad y'>0 \qquad (8')$$

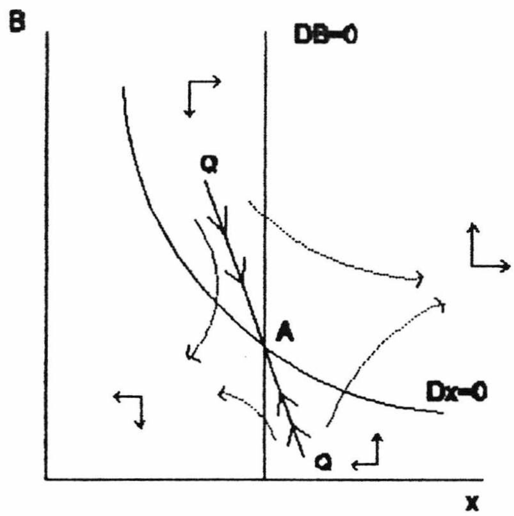
where the demand for black dollars as a proportion of wealth depends positively on the relative yield. Inverting the portfolio equilibrium condition, using $d_{bm}=Dx/x+d_o$ and solving for the rate of change of the premium we obtain (8). Stock equilibrium requires that any increase in the supply of black dollars (x.B/E) must be accompanied by an increase in the relative yield. The rise in the relative yield may come from a higher interest rate differential adjusted for the official depreciation ($i*+d_o-i$) or from a rising black market premium (Dx>0). Conversely, a rise in the yield differential creates an excess demand for black dollars that needs to be offset by a rise in supply, through a higher level of the premium or through an offsetting decline in demand due to a falling premium.

Equation (9) describes a flow-equilibrium condition. The flow supply of black dollars comes from exporters (underinvoicing) and importers (overinvoicing) as well as from foreign tourists. The flow demand for black dollars comes from importers (underinvoicing) and smugglers as well as from Portuguese tourists. For a given level of exchange controls, the net addition to the stock of black dollars is a function of the premium and of the official real exchange rate (rer). A rise in the premium raises the net rate of inflow of black dollars for two reasons: it reduces smuggling, underinvoicing and Portuguese tourism abroad, thus dampening the demand for black dollars whilst fostering the use of the black market by traders and foreign tourists. A real depreciation of the official rate increases the net inflow of black dollars for similar reasons.

The model thus implies that the premium on black dollars at any point in time depends on the existing stock of black dollars, the yield differential, the stock of escudo assets, exchange controls and the real exchange rate.

The phase diagram of the model is set out in figure 12. Along the schedule Dx=0 the premium is constant. The schedule is drawn for a given yield differential and value of escudo assets. Points above (below) the schedule imply an excess supply (demand) of (for) black dollars and the black market premium must be increasing (decreasing) in order to restore equilibrium pushing the system further away from the schedule as indicated by the horizontal arrows. This is the element of instability in the model. Along schedule DB=0 the current account for the black market is balanced. The schedule is drawn for given exchange controls. Points to the right (left) imply a premium so high (low) as to make for a surplus (deficit) in the black market and thus a growing (declining) stock, as indicated by the vertical arrows. The model has a saddle-path structure and as indicated by the QQ trajectory there is only one path along which the market converges to the steady-state (point A). Assuming perfect foresight the economy will always find its way towards the stable branch of the system.

Figure 12 Phase diagram of the black market premium model



To illustrate the working of the model we study the adjustment process to the anticipation of a future devaluation. To single out the short-run dynamics we consider that DB=0 is not affected. This means that the degree of tighteness of exchange controls does not change and that real exchange rate changes affect the market only in the medium/long run. The dynamics of the adjustment are set out in figures 13 and 14.

Consider an initial equilibrium such as A. The anticipation (at t=0) of a future devaluation (to occur at t=T) leads to an immediate shift in demand towards dollars and, given the available

Figure 13 Black market premium and anticipated devaluations

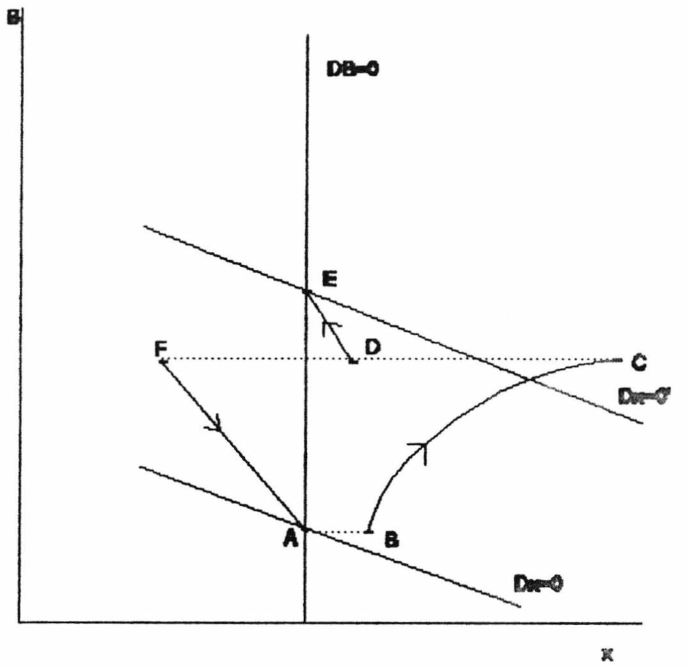
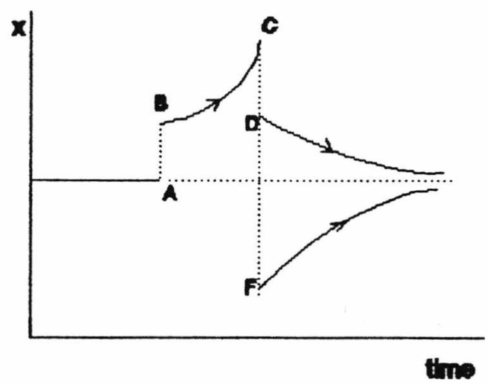


Figure 14 Time path of the black market premium

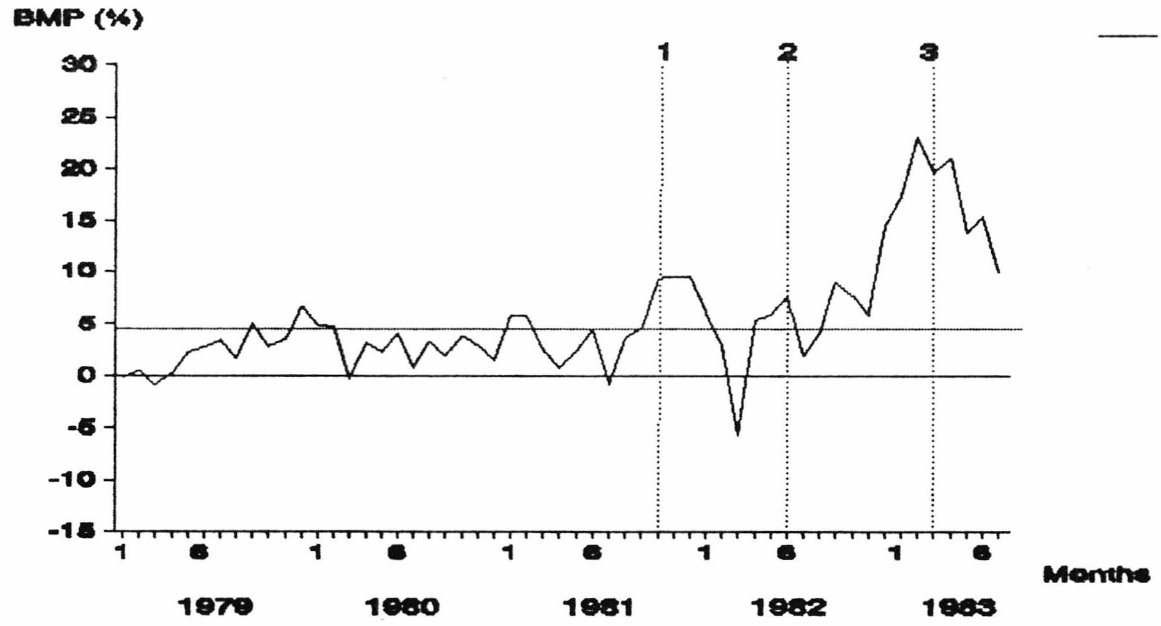


stock, to an immediate jump in the premium: the system jumps from A to B. As the official rate is still unchanged both DB=0 and Dx=0 remain in their position and so the black market premium follows a divergent path such as B->C in figure 13. Along this path there will be a rising premium combined with a (slow) growing stock of black dollars. At t=T, the devaluation occurs and the premium declines moving the system from C to F if the official rate changes by the amount expected. The reduced premium will encourage the reversion of the previous accumulation of black dollars, and the economy will return to the steady-state along the QQ trajectory or, in figure 13, along the F->A path. If the official depreciation falls short of the anticipated change and the market remains convinced that further devaluations are likely to occur the new stock equilibrium schedule moves upwards (to Dx=0'). This is so because, if the expectation of a devaluation persists and if, as we assume, the authorities do not raise the domestic nominal interest rate, the schedule Dx/x=0 must shift upwards according to equation (8). In this case, on the day the devaluation occurs the premium falls back, though by less than in the first case, and the economy goes from C to D. The high though diminishing premium will ensure that the black market pool is filled up, and the economy will move to the new steady-state along the trajectory D->E.

4.5.2 - Empirical evidence: the black market premium during the 1979-83 period

In figure 15 we show the black market premium on the dollar from the beginning of 1979 until July 1983. It continues the previous figure (no. 9) on the black market premium with monthly data

Figure 15 Black market premium (January 1979 - July 1983)



Source: Pick's Currency Yearbook

taken from the same source.

Simple observation of figure 15 reveals three interesting things that confirm the analysis of the evolution of market sentiments presented in section 4.4. Firstly, note that for almost three years, from the beginning of 1979 until late 1981 the black market premium remains, on average, very small having the dimension of a normal transaction cost. However, towards the end of the sample period and particularly after mid-1982 the premium picks-up quite sharply. Secondly, note that the premium picks-up around the time when major ERM realignments occurred (three, within the sample period, marked on the graph). Thirdly, note the non-reaction of the black market premium after the ERM realignment of March 1983 (no. 3). The premium collapses only when the large devaluation of the Escudo was finally realised, that is, when the second IMF Adjustment Programme was implemented. Thus, the conclusions that we can draw from the analysis of the evolution of the black market premium are identical to those derived in section 4.4 and we will not repeat them here. It is clear that using either the black market premium or the forward premium we reach the same conclusions. This is not surprising, as the former depends, among other factors, on the yield differential (i.e., anticipated devaluations) for which the latter is a good proxy. A formal test of the ideas put forward can now be performed.

4.5.3 - Econometric modelling

The hypothesis to be tested are first, that we have a constant premium due to exchange controls and second, that the deviations of the premium from the average value are transitory (within the sample period). The latter can be explained by two factors: by changes in the expected nominal devaluation and by actual devaluations. The expected devaluation is proxied by the forward premium, an assumption which has some plausibility, as we have argued in sections 4.2 and 4.4.

The econometric work is divided in two parts. Firstly, we look at the time series properties of some important variables and secondly, we estimate a dynamic model of the black market premium along the lines suggested by the theoretical model presented above.

According to the Augmented Dickey-Fuller (ADF) tests reported in table 2 we reject the hypothesis that the black market premium is a non-stationary variable, thus x is I(0), and we do not reject the null hypothesis for the other variables, which therefore are I(1). These results lend some support to the constant premium hypothesis, the departures from its average level being only transitory, because there can be no long-run relationship between the black market premium and these other variables.

Table 2 - Unit root tests

On the levels of the variables:			
x (-3.542)	rer (-0.229)	s_{bm} (0.577)	fp (0.166)
On the first difference of the variables:			
Δrer (-6.433)	Δs_{bm} (-7.189)	Δfp (-4.378)	

x is (one plus) the black market premium; rer is the log of the real exchange rate (escudo/dollar; cpi deflated); s_{bm} is the log of the free market escudo/dollar rate; fp is the forward premium on dollar.

Note: between brackets, after the variable, we indicate the value of the ADF test. Critical value at 5% ≈ -3. Reject non-stationarity for larger values of the statistic. Two lags were used in the auxiliary regression. The number of observations is 129 for x, rer and s_{bm} and 58 for fp.

Source: monthly observations of escudo/dollar free market rate are taken from Pick's Currency Yearbook; the forward premium is taken from Financial Times, the official exchange rate is taken from Banco de Portugal, Annual Report, and the rer is calculated using cpi's taken from IMF, International Financial Statistics.

In order to test whether the deviations of the black market premium from the average value can be explained by changes in expected and actual devaluations we estimated equation (10):

$$\Delta x_t = \alpha_o + \sum_{j=0}^{n} \beta_j \Delta rer_{t-j} + \sum_{j=0}^{n} \gamma_j \Delta fp_{t-j} + \alpha_1 x_{t-1} + e_t \qquad (10)$$

where the variables are as defined and e_t is white noise.

Note that all variables in equation (10) are stationary, according to the ADF tests reported above, and, that the average value of the black market premium is given by $x = -\alpha_o/\alpha_1$.

In our econometric work we followed a general-to-specific modelling strategy where equation (10) was estimated without any restrictions. Here we report only a parsimonious representation which is "F-acceptable" and is consistent with the theoretical model presented in section 4.5.1. The results are reported in table 3.

Table 3 - Estimation of the black market model

Estimation by OLS
The sample is August 1978 to May 1983 less 5 forecasts

$$\Delta x_t = \underset{(3.231)}{0.0178} + \underset{(4.108)}{2.025}\,\Delta fp_t + \underset{(2.051)}{1.138}\,\Delta fp_{t-1} + \underset{(2.829)}{1.613}\,\Delta fp_{t-2} -$$

$$- \underset{(-2.564)}{0.307}\,\Delta rer_t - \underset{(-4.352)}{0.384}\,x_{t-1} + \hat{e}_t \qquad \text{(t-statistics)}$$

R^2=0.52 SER=0.028 RSS=0.041 F(5,52)=11.287 DW=2.1 k=6 n=58

Model validation tests

Serial Correlation	$Chi^2(6)$=0.365
ARCH	$Chi^2(2)$=1.996
Normality	$Chi^2(2)$=1.450
Chow test	F(5,52)=0.472

The model explains 50% of the monthly variance of the black market premium, the parameters are statistically significant at the 5% level and the residuals are neither autocorrelated nor heteroskedastic, according to the Lagrange Multiplier tests reported. The model does not show parameter instability in the last five months of the sample.

The main conclusions that can be drawn are as follows. Firstly, the average black market premium has the dimension of a transaction cost, approximately equal to 5% (x = 0.0178/0.384 = 4.6%). Secondly, a change in exchange rate expectations has a strong positive impact effect on the black market premium. For example, if the expected large devaluation minus the previous rate of monthly depreciation (the rate of the crawling-peg) is 10% the premium increases nearly 6 times (with x_t=4.6% => x_{t+1} = 0.046 + 0.2025 = 24.86%).[16]

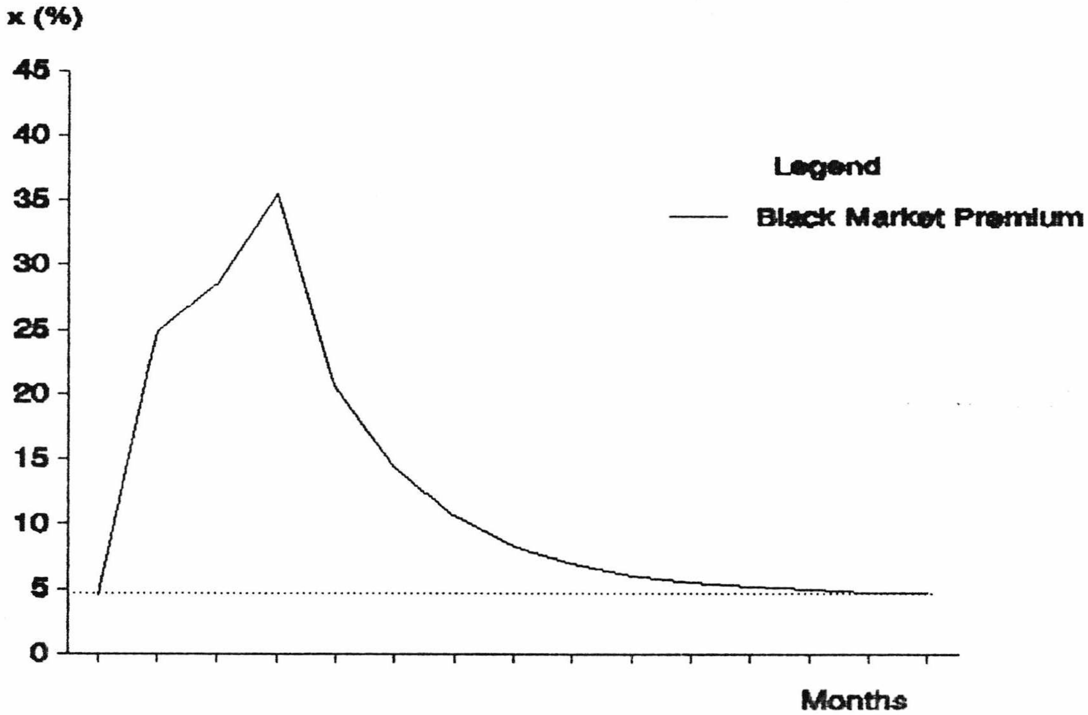
16 - Note that by definition
Δfpt = (ft-st) - (ft-1-st-1) = (ft-ft-1) - (st-st-1).
Suppose that ft = set+1 and ft-1 = set where se denotes the expected level of the (log) exchange rate. When the monthly rate of the crawling peg is constant (st-st-1 = Δs) and expectations are fulfilled (ft-1 = set = st) we have:

Thirdly, after the impact effect the premium continues to rise at an increasing rate for another two months (with x_{t+1} = 24.86% => x_{t+2} = 0.0178 + (1-0.384) x 0.2486 + 1.138 x 0.10 = 28.47% => x_{t+3} = 0.0178 + (1-0.384) x 0.2847 + 1.613 x 0.10 = 35.5%). Fourthly, within three months after the change in expectations occurred the premium falls back and starts a monotonic (convergent) movement towards the average level. Fifthly, the impact effect of an actual devaluation is substantially smaller than the total effect of the change in expectations (with x_{t+3} = 35.5% a 10% devaluation => x_{t+4} = 0.0178 + (1-0.384) x 0.3545 - 0.307 x 0.10 = 20.5%).

The estimated path followed by the black market premium following a change in expectations is illustrated in figure 16. As we observe it resembles the theoretical dynamics shown in figures 13 and 14, in the case when the official devaluation falls short of the anticipated change. This is not surprising because, as we have seen, during the sample used in the econometric modelling, official devaluations of the escudo fell short of expected devaluations and, in particular, remember that the last devaluation of the escudo was postponed until the April 1983 general election. Thus, as the model outlined in section 4.5.1 suggests, the necessary balance between the demand and supply of black dollars had to be achieved by the existence of a premium higher than average throughout the sub-period.

Δfpt = (ft - st) - Δs = (set+1 - st) - Δs.
Thus Δfpt=10% means that the expected devaluation minus the rate of the monthly crawling peg is 10%.

Figure 16 Black market premium after change in expectations



Conclusions

In this chapter we have looked at the role of capital controls in insulating the Portuguese economy from the full strength of speculative attacks.

Firstly, we have seen that the path of the escudo has been anticipated quite accurately. This implies that the exchange rate risk premium is (was ?) negligible and that capital controls were needed to prevent speculative attacks.

Secondly, we have shown that the large and volatile deviations from covered (uncovered) interest rate parity reflect the anticipation of devaluations and indicate also that capital controls were effective in insulating the domestic financial system from the full effect of speculative pressures. This means that the political risk premium is (was ?) high and volatile. These speculative pressures developed because fundamental factors such as current account deficits were present. But it is also important to realize that they developed because for most of the time the Portuguese authorities followed competitiveness targets, which implied occasional large devaluations. In fact, purchasing power parity has not held and the real exchange rate depreciation of the escudo is highly correlated with deviations from covered (uncovered) interest parity. This provides evidence on the competitiveness targets pursued by the Portuguese authorities and means that in the case of the escudo the currency premium is the result of real depreciation and not of exchange rate risk premium. Taken together these results indicate a lack of real and financial market integration.

Thirdly, as we have seen (in chapter 2) in most models of rational speculative attacks on fixed exchange rates, fiscal laxity and the printing of money are the underlying factors causing the exhaustion of foreign exchange reserves, which, in turn, triggers the run on the foreign exchange reserves. However, speculative runs can also be caused by other events, such as, for example, the occurrence of domestic political crisis like those reviewed in this chapter. Thus, political instability might affect business confidence, the well-established reputation of the authorities for sound finance and strong currency notwithstanding. The main conclusion is that fixed exchange rates and external financial liberalisation seem to imply the need for continued political stability.

Fourth, we have argued that when "real shocks" hit the economy, like those that affected the Portuguese economy in the early 1970s (loss of markets, ressources and adverse shift in the terms of trade) re-equilibrating real exchange rate changes are warranted. With nominal wage and price stickiness, nominal exchange rate changes were unavoidable. Thus, the authorities followed competitiveness targets that did indeed lead to speculation, but that was limited by effective exchange controls.

Fifthly, we have seen that in 1979-80 interest rate parity prevailed, the escudo appreciated in real terms, inflation came down and in 1980 real interest rates in Portugal were above international levels. At the same time, until 1982, external finance became readily available and the country experienced a period of relatively high economic growth whilst foreign markets were contracting under the impact of the 1981-82 world recession. By contrast, 1982-83 was a period marked by increasing current account deficits, a steadily declining level of foreign exchange reserves, and speculative pressures on the escudo as reflected on the black market and forward premia.

The analysis presented in this chapter highlights a number of concerns as to the speed and to the extent of the adjustment required for the full participation of the escudo in the ERM, under the conditions set out for Stage 1 of EMU. Portugal joined the EC in 1986 against the background of 15 years of "stop-go" policies, competitiveness targeting and political instability. The stubbornness of the inflation process (to be discussed in chapter 7) makes the "hard currency" policy unsustainable in the medium-run. With the government's budget and debt not yet under control (see chapter 2) moderate inflation, high growth and stable interest rates seem to be preferable to the alternative (i.e. recession). With monetary policy losing its effectiveness (because of the opening up of the capital account and ERM shadowing) and with fiscal policy inflexible, it is increasingly difficult to control demand and cost inflationary pressures. The lack of control of demand conditions translates very rapidly into a deterioration of the current account, further aggravated if the domestic business cycle is not coordinated with the international business cycle. This suggests caution in moving too quickly towards full liberalisation without a more fundamental transformation of the economy.

ANNEX 1

POLITICAL AND CURRENCY PREMIA: SOURCES OF DATA AND BASIC CALCULATIONS

Real interest rate differential

The real interest rate differential ($r-r*$) was calculated as the difference between the nominal interest rate differential ($i-i*$) and the expected inflation differential ($\pi-\pi*$). Actual inflation differentials were used as a proxy for expected inflation differentials. This procedure is one of two methods proposed in Frankel and MacArthur(1988) to tackle the problem of the measurement of expectations of inflation in the absence of survey data. One can appeal to the rational expectations hypothesis and argue that the difference between expected and actual inflation rates must be random.

The nominal interest rates used in the calculations are, respectively, the escudo 6 month deposit rate, taken from Banco de Portugal, Annual Report, Lisboa, various years, and the euro dollar 3 month deposit rate, taken from IMF, International Financial Statistics, various issues. The use of interest rates of close though different maturity, should be seen as a proxy for transaction costs, which we assume are larger for escudo deposits.

The inflation differential was calculated from CPI's, taken from IMF, International Financial Statistics, various issues.

Covered interest rate differential

The covered interest rate differential was calculated according to equation (2) in the main text. The forward premium on the dollar was taken from Financial Times, London, various issues. Observations are at or near end-of-period. Nominal interest rates are the same mentioned above.

Real exchange rate

To calculate the real exchange-rate the nominal escudo/dollar exchange rate was deflated by the ratio of CPI's (Portugal/USA). The nominal exchange rate was taken from Banco de Portugal, Annual Report, various issues. Observations are at end of period. The CPI's are taken from IMF,International Financial Statistics, various issues.

CHAPTER 4

ANNEX 2

RATIONALITY TESTS AND MODELLING THE PROCESS OF EXPECTATIONS FORMATION

As mentioned in section 4.2.1 we develop in this annex the test of the joint null hypothesis that the escudo/dollar exchange rate risk premium is neglegible and that the exchange rate has followed a near-certain path.

Several necessary conditions for (survey) data which rationally forecast economic variables with unit roots, based on Granger's definition of forecast optimality, are stated in Fischer (1989). If x_t is I(1) and x_t^* is a rational forecast of x_t based on the information set J_{t-1} (which includes x_{t-i} for i>0), then several necessary conditions must hold.

Proposition 1: If x_t is I(1) and x_t^* is a rational forecast of x_t based on the information set J_{t-1} at time t-1, then (i) x_t^* must be I(1) and (ii) x_t^* must be cointegrated with x_t.

Proposition 2: If x_t^* is a rational forecast of x_t based on J_{t-1} then x_{t-1} Granger-causes x_t^*.

Proposition 3: If x_t^* is a rational forecast of x_t and x_{t-1}^* does not Granger-cause x_t, then Δx_t^* must have adaptive influences.

Integration, cointegration and causality

These three necessary conditions can be tested against the data. We proceed in three steps. First, we determine the order of integration of the series. Second, cointegration between x_t^* and x_t (if both variables are I(1)) is tested. Third, to test for Granger-causality we estimate augmented unrestricted vector autoregressions (AUVAR) of the form:

$$\Delta x^*_t = \alpha_0 + \beta_1 x^*_{t-1} + \beta_2 x_{t-1} + \sum_1^n \phi_i \Delta x^*_{t-i} + \sum_0^n \psi_i \Delta x_{t-i} + e_{1t} \qquad \text{(A2-1)}$$

$$\Delta x_t = \alpha_1 + \beta_3 x^*_{t-1} + \beta_4 x_{t-1} + \sum_1^n \kappa_i \Delta x^*_{t-i} + \sum_1^n \lambda_i \Delta x_{t-i} + e_{2t} \qquad \text{(A2-2)}$$

The causality tests involve conventional F-tests on the significance of x and Δx in (A2-1) and on the sigificance of x^* and Δx^* in (A2-2).

Modeling the process of expectations formation

If the data does not reject the hypothesis of rationality we proceed further in order to model the process of expectations formation. If x_t and x_t^* are I(1) without trend in mean and are cointegrated, then Engle and Granger (1987) prove that there always exist an error correction mechanism (ECM) of the form:

$$\Delta x^*_t = -\gamma_1 Z_{t-1} + \sum_1^n \phi_i \Delta x^*_{t-i} + \sum_0^n \psi_i \Delta x_{t-i} + e_t \quad \textit{where} \quad Z_{t-1} = x^*_{t-1} - \alpha - \beta x_{t-1} \qquad \text{(A2-3)}$$

The error correction representation (A2-3) is important for our purposes because it encompasses various popular specifications of expectations formation. If all parameters are jointly non-significant we have the static expectations case. If only ψ_i's are statistically significant and positive we have the extrapolative expectations case. If only ψ_i's are statistically significant and negative we have the regressive expectations case. If the coefficients of the variables in changes are not jointly statistically significant or if being significant the restrictions $\psi_i+\phi_i=0$ (ϕ_i < 0) (i=1,...,n) are "F-acceptable" we have the adaptive expectations case. Combinations of some of these basic cases are also possible. Of particular interest here is the extrapolative-adaptive model proposed by Frenkel (1975) (see also Pesaran (1989)). The main feature of Frenkel's model lies in the distinction that it draws between the determination of short-term and long-term expectations. Long-term expectations adjust slowly according to the rule:

$$\Delta x_t^{le} = \lambda (x_t - x_t^{le}), \quad 0 < \lambda < 2 \tag{A2-4}$$

If the actual value of the variable is above the expected long-run value the long-run expected equilibrium level is revised upwards by a small amount.

The short-term expectations adjust according to the rule:

$$\Delta x_t^{e} = \mu_1 (x_t - x_t^{e}) - \mu_2 (x_t - x_t^{le}), \qquad \mu_1, \mu_2 > 0 \tag{A2-5}$$

Rule (A2-5) relates changes in short-term expectations to the deviations of the actual values from short-term and long-term expectations. If the actual value of the variable is above the expected short-term value, the short-term expectations are revised upwards. However, if the actual value of the variable is above the long-term expected value, short-term expectations are revised downwards. In this sense the state of long-term expectations may dampen short-term changes in expectations. The superscripts "le" and "e" denote respectively long-term and short-term expectations.

After some algebra it is possible to show that rules (A2-4) and (A2-5) imply that short-term expectations are formed according to the rule:

$$\Delta x_t^{e} = (1 - \lambda - \mu_1) \Delta x_{t-1}^{e} - \lambda \mu_1 (x_{t-1}^{e} - x_{t-1}) + (\mu_1 - \mu_2) \Delta x_t \tag{A2-6}$$

It is clear that the error correction model (A2-3) nests Frenkel's model (A2-6) when α=0 and β=1. If the three necessary conditions for rationality are not rejected by the data, there must be adaptive influences and, if we also have n=1, the parsimonious error correction representation is Frenkel's model.

In modeling exchange-rate expectations we set $x_t = s_t$ and $x_t^* = s_t^* = f_{t-1}$ in the relevant formulas presented above.

The results found are as follows:

Table 1: Tests for a unit root in the levels of the variables

Testing for I(0)	spot-rate	forward-rate
DF	−1.670	−1.708
ADF(1)	−1.499	−1.600

Table 2: Tests for a unit root in the changes of the variables

Testing for I(1)	spot-rate	forward-rate
DF	−3.563	−3.081
ADF(1)	−2.864	−2.295

Critical value at 5% is −1.95. Reject non-stationarity for larger values of the test. Only one lag was used in the auxiliary regression.

The results indicate that after differencing once the variables achieve stationarity. Accordingly both the spot and the forward rates are I(1) variables. Table 3 presents the tests for cointegration between spot and forward rates.

Table 3: Tests for cointegration between the spot and the forward rates

Cointegrating regression: $f_{t-1} = \alpha + \beta\, s_t + Z_t$

R^2= 0.99 DW= 1.13 DF= −3.859 ADF(1)= −3.223

$\hat{\alpha}$= −0.14 βhat= 1.03

Critical values at 5% for DF= −3.37 and for ADF= −3.17. Reject non-cointegration for larger values of the satistics.

The results show that the variables are C(1,1). Furthermore, the estimates suggest that $\alpha \approx 0$ and $\beta \approx 1$, that is, that the exchange-rate risk premium is nil or neglegible and that the forward-rate is an unbiased predictor of the spot-rate.

The Granger-causality tests are reported in table 4.

Table 4: Testing for Granger-causality in the AUVAR

H_o: s_{t-1} does not cause f_{t-1} $F(5,25) = 63.08$	H_o: f_{t-2} does not cause s_{t-1} $F(4,26) = 0.57$

Reject the null hypothesis for larger values of the test.

The results indicate the presence of causality running from the spot-rate to the forward-rate but not vice-versa. Thus, according to the results reported in tables (1)-(4) we have established that the three necessary conditions for rationality are not rejected by the data.

In modeling the process of expectations formation we followed a general to simple procedure. First, we estimated a general error correction representation (see equation (A2-3)). As the model passed a variety of diagnostic tests (serial correlation, homoscedasticity, mis-specification, normality and parameter stability) we, then, estimated Frenkel's model (see equation (A2-6)) and tested whether the restrictions implied by this parsimonious representation are "F-acceptable". As the restrictions are not rejected by the data Frenkel's model is our preferred specification. The results are reported in table 5.

Table 5: Extrapolative-adaptive model of expectations formation

Modelling Δf_t by OLS.
The sample is 1979(3) to 1988(4).

$$\widehat{\Delta f_t} = \underset{(2.200)}{0.110}\, \Delta f_{t-1} + \underset{(8.943)}{0.688}\, \Delta s_t - \underset{(-2.764)}{0.205}\, (f_{t-1} - s_t)_{t-1} + \underset{(3.139)}{0.022}\, Dum$$

R^2=0.95 F(4,34)=172.48 SER=0.014 RSS=0.0068 N=38 k=4

Model validation tests:

Parameter Stability (1986(1)-1988(4))	F(12,22)=0.34
Serial Correlation (4th order)	F(4,30)=1.22
Heteroscedasticity (squares of regressors)	F(7,26)=1.97
Normality	Chi^2(2)=2.01
Mis-specification (RESET)	F(1,33)=3.63

The model was estimated with a dummy variable. The dummy takes the value 1 from 1982(2) to 1983(3) and the value 0 for other quarters. Its introduction improves the quality of the fit and ensures that the normality of the residuals is not rejected. In fact, the rejection of normality when we run the model without the dummy is probably due to the so-called Peso problem. The peso problem arises when there is a small probability of a large change in the exchange-rate each period (see, for example, Frankel and Froot (1987)). Suppose that economic agents know that an IMF Adjustment Programme is being prepared and that a large devaluation will be due some time in the near future. Under these circunstances the forward premium on the dollar vis à vis the escudo will reveal an expected devaluation of the escudo larger (or smaller) than what could be expected from recent past changes in the exchange-rate. Thus, the dummy variable captures the "IMF problem" (as well as the EMS realignments problem alluded in sections 4.2.2 and 4.4.2).

Our findings can be summarised as follows. Exchange-rate expectations are formed based on, though not exclusively, a weighted average of extrapolative and adaptive elements. Expectations of devaluation are revised upwards depending on the most recent exchange-rate devaluation (0.688 Δs_t) and if expectations were revised upwards in the recent past (0.11 Δf_{t-1}). The forecast error is the adaptive term (-0.205 $(f_{t-1}-s_t)_{t-1}$). This means that expectations are fulfilled in the long-run as the static long-run equilibrium implied by the model is $f_{t-1}=s_t^*=s_t$. In this sense the exchange-rate has followed an equilibrium path. When an IMF Adjustment Programme is due to be implemented expectations of devaluation are revised upwards by a factor of about 9% (p.a.) well before the large devaluation finally materi-alises (4 x 0.022 x Dummy).

ANNEX 3

A NOTE ON PORTFOLIO THEORY OF SHORT-TERM CAPITAL MOVEMENTS AND THE FOREIGN EXCHANGE RISK PREMIUM

Portfolio theory of short-term capital movements

Under certain simplifying assumptions the demand for assets based on Markowitz-Tobin portfolio selection theory can be derived as the solution of an intertemporal consumption and portfolio selection problem. An excellent survey of the literature within an open economy environment can be found in Branson and Henderson (1985). The authors show that in the two-country, two-assets case when both the exchange rate and the home price indexes are stochastic (follow Brownian motion processes) the solution of the problem is given by the rule expressed in equation (A3-1):

$$S.F/W = (1/R_A).(1/\sigma^2).(i^*+\epsilon-i) + (1-1/R_A).(1/\sigma^2).\rho \qquad \text{(A3-1)}$$

where $(S.F/W)$ is the proportion of wealth (W) allocated to foreign securities (F) expressed in home currency; S is the exchange rate; i^* and i are the foreign and the domestic nominal returns on short-term deposits or bonds; ϵ is the expected exchange rate change (in %); σ^2 is the conditional variance of exchange rate changes; ρ is the conditional covariance between exchange rate changes and domestic inflation and R_A is the coefficient of relative risk aversion.

Equation (A3-1) emphasizes four aspects of the portfolio selection process. Firstly, the demand for foreign bonds (deposits) expressed as a proportion of wealth is a function of the relative yield, the interest rate differential adjusted for expected exchange rate changes. Secondly, the demand for foreign bonds (deposits) is a function of the exchange rate risk, measured by the conditional variance of the expected exchange rate change. Exchange risks, if very large ($\sigma \to \infty$) will eliminate the incentive for portfolio diversification and conversely if exchange rate changes are near-certain ($\sigma \to 0$). Thirdly, the demand for foreign bonds (deposits) depends on the covariance between exchange rate movements and inflation. If the domestic currency is expected to depreciate (appreciate) in real terms the covariance term is positive (negative) and, other things being equal, investing in foreign (domestic) bonds (deposits) will give some protection against inflation (inflation hedge). Fourthly, the demand for foreign bonds (deposits) depends on the attitude towards risk, measured by the coefficient of relative risk aversion. Risk neutrality ($R_A \to 0$) implies an infinitely large response should any arbitrage opportunity arise, the investor switching all his/her wealth to foreign bonds (deposits) all his/her wealth if the return on domestic bonds (deposits) is expected to fall. A very risk-averse investor ($R_A \to \infty$) would still seek to hold a diversified portfolio. However he/she would disregard the relative yield and would concentrate his/her attention only on the inflation hedge part of the portfolio rule. If the investor's assessment of exchange risks, attitude towards risk and perception of real exchange rate movements does not change, we can rewrite the portfolio rule as:

$$S.F/W = b_0 + b_1.(i^* + \epsilon - i) \qquad \text{(A3-2)}$$

or

$$S.F = b_0.W + b_1.(i^* + \epsilon - i).W \qquad \text{(A3-2')}$$

Total differentiation of equation (A3-2') yields:

$$d(S.F) = [b_0 + b_1.(i^* + \epsilon - i)].dW + b_1.W.d(i^* + \epsilon - i) \qquad \text{(A3-3)}$$

We can see that, according to portfolio theory, short-term capital flows [d(S.F)] result from, the process of wealth accumulation, given by the first term on the RHS of (A3-3); and changes in the yield differential given by the second term in the RHS of (A3-3).

In certain circumstances it might be useful to consider the portfolio rule (A3-1) as giving the desired allocation of wealth and then model the adjustment process that brings the actual composition of wealth in line with the desired level which, due to costs of adjustment and/or barriers to the flow of funds, may be reached only in the long-run. To simplify the exposition assume that $R_A=1$. A possible adjustment rule is given by:

$$\Delta(S.F/W)_t = \beta_0\Delta(i^*+\epsilon-i)_t + (\beta_0+\beta_1+\alpha_1-1)(i^*+\epsilon-i)_{t-1}$$
$$- (1-\alpha_1)[(S.F/W)_{t-1} - (i^*+\epsilon-i)_{t-1}] \qquad \text{(A3-4)}$$

Equation (A3-4) states that the investor adjusts his/her portfolio by a proportion of the change in the components of portfolio desired holdings and a proportion of the last period's deviation of the actual from the desired holdings. In the long-run we have the portfolio rule given by the theory, $(S.F/W)=[(\beta_0+\beta_1)/(1-\alpha_1)](i^*+\epsilon-i)$ but in the short-run we have capital flows being determined not only by changes in the level of the relative yield but also by the interest rate differential itself, lagged one period. Thus with some barriers to the mobility of capital we may have a model which combines elements of both the stock and the flow theories of short-term capital movements.

Exchange rate risk premium

Following the pioneering work of Frankel (1982) assume instantaneous market clearing and a floating exchange rate. Under these conditions equation (A3-1) can be solved for the adjusted interest rate differential in order to obtain the determinants of the foreign exchange risk premium (rp), as follows:

$$rp = [\epsilon - (i-i*)] = (S.F/W).R_A.\sigma^2 - (R_A-1).\rho \qquad (A3-5)$$

The foreign exchange risk premium which is, by definition, the difference between the expected exchange rate change (ϵ) and the forward premium ($fp=i-i*$), is a function of the relative supply of bonds ($S.F/W$), risk aversion (R_A), exchange rate volatility (σ) and deviations from relative PPP (ρ).

ANNEX 4

A NOTE ON THE ECONOMETRIC TESTING OF PPP

Econometric testing of the Purchasing Power Parity theory of exchange rates (PPP) has taken two different forms (see Levich (1985)). The first form is to estimate the model:

$$\ln S_t = a + b \ln P_t + u_t \qquad \text{(A4-1)}$$

where S is the nominal exchange rate; P is the ratio of two price indices; and u is white noise. The test of the joint null hypothesis that b=1 and a=0 has been considered as a test of the absolute version of PPP, that is, a test of whether $\ln S_t = \ln P_t + u_t$. The second form is to estimate the model:

$$\Delta \ln S_t = b\ \Delta \ln P_t + u_t \qquad \text{(A4-2)}$$

The test of the null hypothesis that b=1 has been considered as a test of the relative version of PPP. In practice, in order to adjust for simultaneity and autocorrelation, an Instrumental Variables technique with first-order autocorrelated residuals has been used.

Consider the following autorregressive distributed lag model ADL(1,1) written in error correcting form:

$$\Delta \ln S_t = a + b_0\ \Delta \ln P_t + (b_0 + b_1 + a_1 - 1)\ln P_{t-1} - (1 - a_1)[\ln S_{t-1} - \ln P_{t-1}] + u_t \qquad \text{(A4-3)}$$

A test of the set of linear restrictions on (A4-3) $b_0=1$, a=0 and $a_1=b_1=0$ can be interpreted as a test for absolute PPP. A test of the set of linear restrictions $a_1=1$, a=0 and $b_0+b_1=0$ can be interpreted as a test for relative PPP. From a different perspective, we may wish to test whether PPP can be seen as a long-run equilibrium, whilst allowing for short-run departures from PPP. In principle this can be done by testing the set of linear constraints on (A4-3) a=0 and $(b_0+b_1+a_1-1)=0$. The problem with this kind of approach is that the above regressions are likely to be misspecified either because they lack dynamics (A4-1), or because they lack an error correction term (A4-2), or because of misspecification (A4-3) if variables other than relative prices influence the dynamics of the nominal exchange rate. However, we can test directly whether lnS and lnP are tied up in a long-run equilibrium using (A4-1) as the cointegrating regression in a standard test for cointegration. If the variables are not cointegrated we can reject PPP. However, the failure to reject non-cointegration does not imply PPP. What we can say in that case is that $(\ln S-a-b.\ln P)_t=u_t$ is stationary or I(0). Cointegration and PPP imply that the real exchange rate in level is stationary that is we must have in this case $\ln RER_t = (\ln S - \ln P)_t = u_t$ integrated of order 0 I(0). Therefore, if we cannot reject the non-stationarity of the real exchange rate we reject PPP.

Gubitz (1988) and Corbae and Ouliaris (1988) present the first PPP tests in the light of cointegration theory. Covering the post-1973 experience of the main international currencies they reach the unanimous conclusion that, except for intra-ERM currencies, PPP does not hold.

As alluded in the main text the escudo/dollar real exchange rate (rer) is I(1) and thus PPP can be rejected. The tests carried out are reported Table A4-1.

Table A4-1: Unit root tests

In the level of rer (rer)	ADF(2) = -0.229
In the first difference of rer (Δrer)	ADF(2) = -6.433
sample size: n=129	

CHAPTER 5

Inflation and the Exchange Rate Mechanism of the EMS: can disinflation be achieved without costs?

Introduction

The disinflation in the countries participating in the exchange rate mechanism of the EMS (ERM) since the early 1980s has been substantial. Whilst this decline of the inflation rate is not exceptional when we compare it with the disinflation that has occurred in the rest of the industrialized world during the same period, there is a widespread belief that there is a disciplining feature in the ERM arrangement that facilitates disinflation and that participating countries benefit from a credibility bonus (see, for example, Giavazzi et al. (1988)).

The idea that exchange-rate policy can be used to curb domestic inflation is certainly not novel. In several historical episodes the exchange-rate was used quite successfully, together with other macroeconomic policy measures, to stop high or hyperinflationary processes. A recent study of some European experiences in the 1920s and 1940s can be found in Dornbusch and Fischer (1986). In their review of the stabilization experiences in Germany (1923), Poland (1924 and 1926/27), Austria (1922) and Italy (1945), the authors identify three key issues in the stabilization plans: budget deficits, the exchange-rate and money. Budget deficits were reduced in each of the stabilizations with the exception of Italy where a large deficit remained (10% of GNP). The exchange-rate was pegged or kept within a narrow band, but all successful programs started from a situation of substantial real devaluation. After the stabilizations, monetary growth accelerated but real interest rates remained very high. In several programmes legal restrictions on money issue and/or budget deficits were introduced and in each case foreign loans were made available. In all but one experience, foreign exchange controls were in place. However, each stabilization caused a sharp increase in unemployment and output losses. As the authors remark "it is not credible to promise painless disinflation even when it is a stabilization from economic disorder".

Modern thinking about disinflation, associated partly, though not exclusively with the new-classical school, puts forward a very attractive idea: if policies are credible from the outset, the unemployment and output costs of tight monetary and fiscal policies can be substantially reduced, or even eliminated altogether, and inflation will stop almost immediately.

Sargent (1986) argues that costless disinflations are not only possible in theory, but have also occurred in practice. He concludes this following a review of the historical european experiences of the 1920s, evidence which the author claims supports his views. His conclusions though are subject to controversy as Dornbusch and Fischer (1986) demonstrate (see also Garret (1987)).

In this chapter we review some old and new ideas about exchange rates and inflation and we set the background for the empirical analysis presented in the chapter that follows. The chapter is organized as follows. In the first section we present the traditional ideas of the links between inflation and exchange rates and in section two we introduce the modern framework of analysis. Section three contains a critical survey of the theoretical analysis of the exchange rate mechanism of the European Monetary System

(ERM). The work reviewed suggests that much of the incentive to join the ERM results from the increased variability of the real exchange rate which results from the rules of the arrangement. We think that this analysis is neither empirically nor theoretically satisfactory. In sections four to six we present an alternative framework for the analysis of the incentives to join the ERM. Section four draws on Buiter and Miller's well-known analysis of the output costs of bringing down inflation: we extend their original analysis by studying how a shift in the exchange-rate regime affects the output costs of disinflation. Both anticipated and non-anticipated policies and regime changes are considered. The role of real exchange rate rules and incomes policies in reducing the output costs of disinflation is also discussed. The final section presents the main conclusions of the chapter. Within our framework the ERM choice appears to be preferable to floating not because it leads to greater real exchange rate variability but for the opposite reason: it stabilizes competitiveness thereby reducing the output costs of disinflation. Details of the solutions of the models and of the formal proofs of the propositions are presented in the Annex.

5.1 - Traditional ideas about exchange rates and inflation

The exchange-rate can be instrumental in a disinflationary process for two basic reasons. In the first place it directly affects the domestic currency price of imported goods. Thus, an exchange-rate appreciation can have an immediate impact on the cost of living through the reduction of the domestic price of the imported goods included in the consumption basket of wage earners. It will also reduce the costs of production of those firms which use imported intermediate inputs. If producers pass these cost reductions on to consumers we have a further moderating influence on domestic prices. Secondly, the tempering impact of an appreciation on the cost of living affects wage demands and so will indirectly affect production costs and prices. It is even possible that the cost and price reductions achieved induce further exchange-rate appreciation and so forth in a cumulative process. These arguments are known in the literature as the virtuous circle hypothesis. The problem with using exchange-rate appreciation in the way suggested above is that it stimulates demand in general and, in particular, the demand for imported and non-traded goods against the demand for import substitutes and export goods. If we assume the Marshall-Lerner condition holds, then the virtuous cycle oriented exchange-rate policy will run into trouble if it is not supported by other (expenditure reducing) policies as the balance of payments deteriorates. Thus, this strategy has some disinflation costs and we return to the problem of whether it is possible to disinflate without costs and how it can be achieved.

One of the traditional arguments used against flexible exchange rates in the older debate on the merits of fixed versus flexible exchange rates is that flexible rates reduce the discipline to fight inflation.[1] The main argument of the discipline hypothesis case for fixed exchange-rates runs as follows: if a country choses a fixed (ajustable) exchange rate regime and is inflating at a rate

1 - A useful and comprehensive review of the older debate on the virtuous circle and on the discipline hypothesis, as well as of the other arguments for and against flexible exchange rates can be found in Goldstein (1980).

higher than that of its main trade competitors, it will lose competitiveness and market shares. This process will almost certainly generate a balance of payments crisis, and a speculative run on the currency will force the authorities to devalue the currency. If devaluations are seen by the public as a signal of political failure, governments will be biased against devaluations and will not be willing to accommodate excessive wage claims or, in general, they will follow (tight) monetary and fiscal policies consistent with the goal of reducing inflation differentials - with fixed exchange rates, inflation will be lower on average. The problem with the discipline hypothesis is that it seems to rely on an arbitrary ordering of the political preferences of the public. Why should the "median voter" be concerned with devaluations and not with the unemployment costs of bringing down inflation? In fact, if inflation differentials between countries reflect mainly their preferred inflation-unemployment mix (along their domestic Phillips curves) voters in countries with higher inflation-lower unemployment rates should also expect and indeed demand, under fixed exchange-rates, occasional devaluations of the domestic currency in order to sustain their preferred unemployment-inflation mix.

5.2 - Modern thinking about exchange rates and inflation

New thinking about disinflation and exchange rates concentrates on expectational effects and on the strategic interaction between the government and the private sector.

5.2.1 - Expectations

There is a voluminous literature on the formation and effects of inflationary expectations. Frisch (1983) contains a useful survey of the literature that emerged from the Friedman-Phelps "natural rate" critique of the Phillips curve. The older idea of the existence of a stable trade-off between inflation and unemployment was challenged by the events of the late 1960's and 1970's. As both inflation and unemployment were increasing it appeared that the inverse relationship had broken down. The intellectual challenge of Friedman-Phelps was to argue that a stable long-run relationship between inflation and unemployment can be possible only if wage earners are systematically fooled. As this seems unlikely, if the authorities want to keep output above the "natural rate", actual inflation must always exceed expected inflation and so must be accelerating. However, a short-run trade-off between inflation and unemployment still exists since expectations of inflation are slow to adjust. Adaptive expectations (or indeed any other mechanism based on a slow learning) process would allow policy-makers to trade-off temporary employment gains against permanently higher inflation rates. Money would still be neutral but only in the long-run.

The rational expectations and continuous market-clearing ideas put forward by Lucas and Sargent, among others, in the mid 1970's, led to a more radical critique of the Phillips curve. According to these authors if inflation is deliberately created by the authorities in order to increase output above the "natural rate" rational economic agents using available information on the authorities's policy stance will forecast future inflation rates and will promptly incorporate those forecasts into their utility maximizing behaviour, neutralizing the actions of the authorities. Forecast errors cannot be systematic for, otherwise, they could be used to improve the forecast. The message is that the public cannot be fooled by anticipated policies, and only unanticipated policies can affect output and employment. Thus deviations from the "natural rate" must be random and not even a short-run trade-off between inflation and unemployment exists. Anticipated changes in money supply are neutral even in the short-run.

The theoretical debate on the Phillips curve, the neutrality of money, the specification of the aggregate supply and on the informational requirements of the rational expectations hypothesis is far from being settled but, as the 1980s have shown, it is possible to find empirical evidence supporting the existence of an inverse relation between inflation and unemployment. Friedman (1988) in a critical review of monetary policy in the 1980s points out that the economic regularities expected to prevail did not (the stability of the demand for money) and those not expected to prevail did (the Phillips curve) (see also Goodhart (1989)). Be that as it may, the fact is that some short-run inverse relation between inflation and unemployment continues to be one of the essential components of most current models and discussions about the output costs of disinflation.

To elaborate our discussion we use the following specification of the Phillips curve which has been extensively used in the literature:

$$y = y^* + b.\ (\ \pi - \pi^e\ ) \qquad (1)$$

where π is the actual rate of inflation, π^* is the private sector's expected rate of inflation, y is aggregate output, y^* is the "natural rate" of (or full employment) output and $b>0$ is a parameter, discussed further below.

According to this specification, unanticipated inflation has temporary positive effects on the distribution of output around its "natural rate". Two different interpretations of that formulation have been offered. One is a Lucas market-clearing-price misperceptions model in which private agents, located in spatially separated markets and endowed with only incomplete information, confuse relative and aggregate price movements. In this case equation (1) is also known as the Lucas surprise-supply function. A second interpretation is a Fischer-Taylor model of long-term nominal wage contracts that are drawn up prior to the realization of inflation with employment determined ex-post along labour's marginal productivity curve.[2]

At this stage we can say that one important upshot of the controversy about the formation and effects of inflationary expectations seems uncontroversial. As long as wages and prices are set with some view to the future, expectations of the future will play a role in the pricing process. As long as firms and trade unions are governed somewhat by the anticipated behaviour of the authorities, then a useful part of a disinflationary strategy would be to peg the domestic currency to that of a (main) trade partner. The idea is to influence the formation of price expectations by focusing the attention of the private sector on the need to keep wage and price settlements low; otherwise, the resulting real exchange-rate appreciat-

2 - For a clear exposition of these interpretations, as well as other possible rationalizations of (1) see Stevenson et al. (1988).

ion would cause output losses and unemployment. It is precisely the supposed central role played by expectations in the inflationary process that opens the way for a disinflationary process without pain. But can agents be sure that the government stick to the "hard currency" policy under any circumstances?

This question leads us to the strategic interaction between the government and the private sector and to the problem of the time inconsistency of optimal policies.

5.2.2 - Strategic interaction

A policy is said to be dynamically inconsistent when a future policy decision that forms part of an optimal plan formulated at an initial date is no longer optimal from the viewpoint of a later date, even though no relevant new information has appeared in the meantime.

The problem was first formulated by Kydland and Prescott (1977) and is best understood using their non-economic example, stated by Hoover (1990; p.81) as follows:

> Suppose that the government believes that it is undesirable to build houses in the flood plain of a river. In order to discourage such building, its optimal policy is to announce that no disaster relief will be available to those who build close to the river. Once the river actually floods, however, most governments would wish to aid the victims, regardless of its previous announcement. People who expect the government to behave in this way will not be discouraged from building in the flood plain no matter what the government declares its policy to be.
> Kydland and Prescott see this problem of the dynamic inconsistency of optimal plans as favouring rules over discretion. If the government were able to bind its own actions with a rule forbidding it ever to give relief to the victims of the flood, the problem would be solved. Such a policy would seem to be suboptimal and hard-hearted after a flood, but, if people foresaw that a suboptimal policy would be followed according to the rule, they would not build in the flood plain at the start. The rule ther-

efore achieves a better policy than discretion would.

Although Kydland and Prescott apply their analysis to monetary and fiscal policy, Barro and Gordon (1983) consider the expectations-augmented Phillips curve example, and it is their paper which forms the basis for much of the subsequent work on this topic. A comprehensive survey can be found in Blackburn and Christensen (1989). The subject is also discussed in Blanchard and Fischer (1989) and in Fischer (1990) which, using a relatively simple framework, derive most of the relevant conclusions of the analysis as follows.

Suppose that the single-period loss function of the policymaker L(.) is quadratic in the rate of inflation (π) and in the deviation of output (y) from a target level (y^*).

$$L(\ ) = a.\pi^2 + (y - k.y^*)^2 \tag{2}$$

where $a>0$ and $k>1$.

The first term on the right-hand side of (2) represents the inflation objectives of the policy maker, reflecting rising costs associated with deviations of actual inflation from the target value (set at zero). The costs of inflation include the administrative costs of posting new prices (menu costs) and the costs of economizing on money balances (shoe-leather costs). Included in the costs of inflation may also be the distributional consequences of inflation in the absence of full indexation. The second term on the right-hand side of (2) is most important, representing the employment objectives of the policymaker. Here, y^* can be interpreted as full employment output. It is assumed that the target level of output ($k.y^*$) exceeds the natural rate (y^*). The assumption that $k>1$ is crucial and the basic justification for that are the various labour market distortions or imperfections that cause the natural rate of employment to be too low. This downward bias to potential output arises for example from income taxation, unemployment compensation, the presence of trade unions and minimum wage laws.

The expectations-augmented Phillips curve (1), reproduced below for convenience, describes the relationship between output and inflation in each period. The important assumption is that some trade-off exists. Blanchard and Fischer see it resulting from wage and price stickiness rather than from imperfect information and therefore π^* reflects expectations of inflation as embodied in predetermined nominal wages. This interpretation is consistent with the existence of labour market distortions.

$$y = y^* + b.(\pi-\pi^*) \qquad (1)$$

The decision problem of the policymaker is to minimize (2) subject to (1) taking π^* as given. This problem has the structure of a one-period noncooperative game and there are two possible solutions depending on whether the policymaker is able to precommit itself to anounced policies. If such commitment is possible, then in this example with perfect information $\pi^*=\pi$ and this is treated as an additional constraint in the optimization problem. In this case the solution is exactly the zero inflation equilibrium: the precommitment solution gives a value of the loss function equal to

$$L_p = (k-1)^2 . \ y^{*2} \qquad (3)$$

In the absence of precommitment the solution to the constrained maximization problem gives the reaction function of the government to the private sector's decisions. This implies that the actual inflation rate is a function of the expected inflation rate as follows:

$$\pi = b \,.\, [(k - 1).\, y^* + b.\pi^e] \,/\, (a + b^2) \tag{4}$$

With rational expectations the only equilibrium of the game is obtained when $\pi^e=\pi$ in (4) which implies a positive rate of inflation. Using $\pi^e=\pi$ in (4) and rearranging we get the discretionary solution:

$$\pi_d = b \,.\, (k-1) \,.\, y^* \,/\, a \tag{5}$$

From equation (5) we can see that the greater the output gain from unanticipated inflation (the larger b), the larger the distortion (k-1), and the less costly the inflation (the smaller the a), the higher the inflation rate that will result from discretionary policy.

The implied value of the loss function is:

$$L_d = (k-1)^2.\, y^{*2}.\, (1 + b^2/a) \tag{6}$$

The basic insight of this analysis is that in the absence of precommitment the equilibrium is characterized by an inflationary bias with output still at its natural rate because inflation is fully anticipated. Furthermore, this equilibrium is worse for the government than a zero inflation equilibrium as $L_d > L_p$. But, why does not the government choose an inflation rate of zero?

Under the rules of the game, in which the private sector chooses π^e first, $\pi = \pi^e = 0$ is not an equilibrium. In fact, if the private sector has committed itself to a zero inflation rate, the government will choose the positive rate of inflation implied by (4) thereby fooling the private sector. Rational agents understanding this behaviour will take it into account when forming inflationary expectations. The consequence is that expected and actual inflation will rise until there is no incentive for surprise inflation. The inflation rate in (5) is a Nash equilibrium that, if expected by the private sector, will be implemented by the government.

A further insight can be obtained by solving the optimization problem when individuals expect the government to create zero inflation, but it instead acts opportunistically. In this case we have the fooling solution. With $\pi^e=0$ in (4) we have a positive rate of inflation given by:

$$\pi_f = [b \cdot (k-1) \cdot y*] / (a + b^2) \tag{7}$$

The implied value of the loss function in this case is:

$$L_f = (k - 1)^2 \cdot y*^2 / (1 + b^2 / a) \tag{8}$$

Thus we have the following identities:

$$L_f = L_p / (1 + \delta) \tag{9}$$

$$L_d = (1 + \delta) \cdot L_p \tag{10}$$

where $\delta = b^2/a$, gives a rough measure of the utility gain from unexpected inflation (the square of the increase in output divided by the utility loss from higher inflation).

It is easily seen that $L_f < L_p < L_d$. The discretionary solution produces the largest loss resulting in a higher rate of inflation without any output gain. However, as the loss function is lower when the government succeeds in fooling the private sector

> the government is tempted to violate expectations if the private sector should be lulled into expecting zero inflation. In striving to obtain output gains by fooling the public, the government succeeds only in raising the inflation rate and producing the worst of the three outcomes (Fischer (1990; p.1173)).

The Phillips curve example illustrates in a very simple way the nature of the credibility problem facing a government at the outset of a disinflationary programme: the implication of the analysis is that without precommitment the policy announcement (zero inflation) will be ignored because the private sector knows that the authorities have an incentive to cheat. As the failure of expectations to adjust is at the root of the output costs associated with the reduction in inflation a solution to the credibility problem will be beneficial.

Rogoff (1985) points out that the inflationary bias of the Phillips curve example can be reduced by appointing a "conservative" policymaker. To see how, let a_c be the policymaker's weight on inflation in its personal loss function. Given such an individual full discretion results in a loss of:

$$L_c = (1 + b^2 / a_c) \, . \, L_p \tag{11}$$

The more conservative the policymaker (the larger a_c) the closer the society comes to achieving the precommitted equilibrium. Further reasons for appointing a conservative relate to reputational issues to be discussed below.

As we have seen the credibility problem in anti-inflationary monetary policy identified above is a consequence of the nature of the game played: one-period, full information, non-cooperative and without precommitment. If the same game is repeated indefinitely far into the future the zero inflation equilibrium can now be sustained by reputational forces operating through private sector threats that punish the government for "bad" behaviour.

Reputation is the most interesting and persuasive explanation of how governments avoid dynamic inconsistency and solve the credibility problem. Governments hope, by acting consistently over long periods of time, to build up a reputation that will cause the private sector to believe their announcements. To see how reputation sustains the optimal policy it is necessary to specify how the private sector reacts to broken promises (threat strategies). There are many types of trigger mechanisms describing how private sector inflationary expectations are revised in response to the actual inflationary strategy played by the policy maker which raises the problem of the existence of multiple equilibria (see Blackburn and Christensen (1989)). As an example of a trigger mechanism, Blanchard and Fischer suppose that the private sector views the policy-maker as either reliable or opportunistic. If the inflation rate has been the positive rate of inflation which results from the discretionary equilibrium, the expected inflation rate from then on will be π_d. If the government has hitherto produced the precommitted inflation rate (zero) it is expected to continue doing so. Given these expectations consider a government that has always produced zero inflation but is now considering whether to fool the public instead. Within the framework presented above, the gain from cheating (temptation) is a one-period gain given by the reduction in the value of the loss function obtained in that period, as follows:

$$\text{Temptation} = L_p - L_f = \delta \cdot L_p / (1 + \delta) \qquad (12)$$

However, the government will be punished for its cheating. Thereafter, the private sector will expect the government to produce the discretionary solution forever. In each of the following periods the penalty to be paid (loss) from discretionary policy relative to the precommited equilibrium is given by the increase in the value of the loss function, as follows:

$$\text{Loss} = L_d - L_p = \delta \cdot L_p \qquad (13)$$

The gain from acting opportunistically is then equal to the one-period gain (temptation) minus the present discounted value of the loss that starts a period later:

$$\text{Temptation} - (\text{Loss} / \theta) =$$

$$= \delta \cdot L_p \cdot [(\theta - (1 + \delta)] / [\theta \cdot (1 + \delta)] \qquad (14)$$

where θ is the discount factor, the government's rate of time preference. From equation (14) it can be seen that the government will act opportunistically if it has a very high discount rate. The intuition is that the penalty incurred in the future matters much less than today's gain. The government will keep the inflation rate at zero if the discount rate is low or if δ (≈utility gain from unexpected inflation) is high. In this case the short-run gain from unanticipated inflation is high but since both the gain and the loss are increasing in δ the net effect is a priori indeterminate. The main result of this analysis is that the cooperative (precommitment) equilibrium of the one-shot game can be sustained as a noncooperative Nash equilibrium in a repeated game provided that the rate of discount is not too high, which is a general result from game theory (see Blackburn and Christensen (1989)).

As Goodhart (1989a) points out Barro and Gordon's (1983) analysis leads on to a number of positive predictions about the behaviour of the authorities. Inflation will tend to rise at times of political disturbance and before elections, i.e. when the authorities's time rate of discount is high; and when the natural rate of unemployment is high, during a recession, during a period when government expenditures rise sharply, when the deadweight losses from distortionary conventional taxes are high and when the outstanding real stock of nominally-denominated public sector debt is large, i.e. when the benefit from lower unemployment and higher unanticipated inflation is higher.

Despite its extreme simplicity the general theoretical framework described above has been used to study the incentives that governments and/or central banks might have in choosing between fixed and flexible exchange rates. In particular, Barro and Gordon's original ideas have been extended in order to understand the incentives that EC countries might have to join the exchange rate mechanism of the EMS (ERM). By joining the ERM the government or the central bank of the entrant will benefit from Bundesbank's long established reputation of being tough on inflation: pegging the domestic currency to the DM will not only provide a nominal anchor to the price level and the rate of inflation but it will also contribute to the resolution of the credibility problem facing a government which has decided to bring down inflation at minimum cost. It could be said that this line of research revives and extends the older discipline and virtuous circle hypothesis although they tend to rely on more keynesian theoretical foundations.

5.3 - Application of Barro-Gordon model to the EMS

A series of papers have used Barro-Gordon ideas to model the incentives for joining the ERM.[3] Here we refer to Giavazzi and Giovannini (1989). The authors consider two alternative exchange rate regimes. In one of the regimes (the flexible regime) the real exchange rate is kept constant and in the alternative regime (the ERM) the real exchange rate is allowed to change between realignments. As realignments occur every T periods (where T is exogenously given) and as the nominal exchange rate is fixed for intervals of length T the country with higher inflation will experience a

3 - Giavazzi and Giovannini (1987; 1989) and Giavazzi and Pagano (1988).

gradual real exchange rate appreciation between each realignment. Taking the foreign country's inflation rate as given (set at zero) Giavazzi and Giovannini ask whether a country caught in a "high inflation deadlock" can gain from pegging its exchange rate to the low-inflation foreign country and realigning the exchange rate every T periods. Note that the question that the authors ask is not whether the inflation rate will be reduced under the pegged regime: trivially it must be. The question they want to answer is whether the pegged regime is welfare improving. If it is then central bankers and/or governments will have an incentive to "tie their hands".

The central bank's problem is to minimize the present value of the sum of future losses, where the loss function (L) is quadratic in the inflation rate and in the deviation of output from a target level. Setting the discount rate equal to zero, the problem of the central bank can be formalized as follows:

$$\min \ (1/2) \int_{t=0}^{T} L_t \, dt \qquad (15)$$

where

$$L_t = a.(\pi_t)^2 + (y_t - k)^2$$

where $a, k > 0$. Note that the loss function (15) is the dynamic equivalent to the one period loss function (2) in the expectations-augmented Phillips curve example already discussed. The target level of output k is positive and exceeds the natural rate which for simplicity is set equal to one ($y* = 1$). The loss function is minimized by choosing a path for the inflation rate subject to a set of constraints. Assuming a log-linear relationship between output (y), deviations of actual inflation (π) from expected inflation (π^e), and the real exchange rate (z), described by an expectations-augmented Phillips curve, the first constraint is given by:

$$y_t = b\ (\pi_t - \pi_t^{*}) - g\ z_t \tag{16}$$

where b, g > 0 and z is the level of the real exchange rate, measured as the relative price of foreign output in terms of domestic output. Note the equivalence between this formulation and the supply function of the expectations-augmented Phillips curve equation (1). With pre-set nominal wages, an increase in the price level lowers real wages and raises output. A real appreciation (decrease in z) reduces the relative price of imported inputs and also raises output. At the beginning of every interval of length T, a nominal exchange rate realignment sets the real exchange rate back to a preassigned level z_o. The level of the real exchange rate at the beginning is determined by the sustainability condition, and is not chosen by the central bank. The sustainability condition can be written as:

$$\int_{t=0}^{T} (dR_t\ /dt)\ dt = \int_{t=0}^{T} m.z_t\ dt = 0 \tag{17}$$

where R is the stock of foreign exchange reserves. It is assumed in (17) that the change in reserves depends on the level of the real exchange rate. The initial value of z must be such that over the interval of time T the net accummulation of reserves is zero. This is a crucial assumption. In fact, the real exchange rate at time 0 is undervalued and the country runs a balance of payments surplus. As the change in the real exchange rate over time is given by:

$$dz_t/dt = - \pi_t \tag{18}$$

the initial undervaluation will be eroded and the real exchange rate will become overvalued after some point in time and, thereafter, the country will run a balance of payments deficit. However, the initial surplus will net out the final deficit and so the real exchange rate will be, on average, in equilibrium. This sustainability condition allows Giavazzi and Giovannini to eliminate the real exchange rate as a main determinant of the demand for output: note that it appears in equation (16) on the supply side only, as the price of imported inputs. Another feature of the model is that it rules out international trade in assets (i.e., it assumes capital controls that are binding) for, otherwise, the policy of realignments with competitiveness restored at the end of every interval of length T would cause speculative runs on the currency (see chapters 1 and 2).

The choice between "flexible" and pegged rates is determined by the difference between the value of the loss function in the two regimes. In the "flexible" case the real exchange rate is constant. Setting z=0 there are no state variables in (15) (i.e., there is no path of the real exchange rate to be chosen) and the optimization problem of the central bank is simply the minimization of L subject to (16). With rational expectations the solution of the problem is identical to the solution of the expectations-augmented Phillips curve example already discussed. As we have seen, in the absence of reputational effects the precommitment or zero inflation solution is not feasible and so, the country will remain with a positive rate of inflation. In the pegged case the central bank choses the path of the real exchange rate that minimizes (15) subject to (16) and (18) with the initial level of the real exchange rate being given by (17). The graphical solution of this problem, using the phase-diagram technique, is relatively simple and is sufficient to capture the analysis' main conclusions. The Hamiltonian of the optimization problem is:

$$H = (-1/2)\ \{a.\pi^2 + [b.(\pi-\pi^*) - g.z - k]^2\} - \lambda\pi \qquad (19)$$

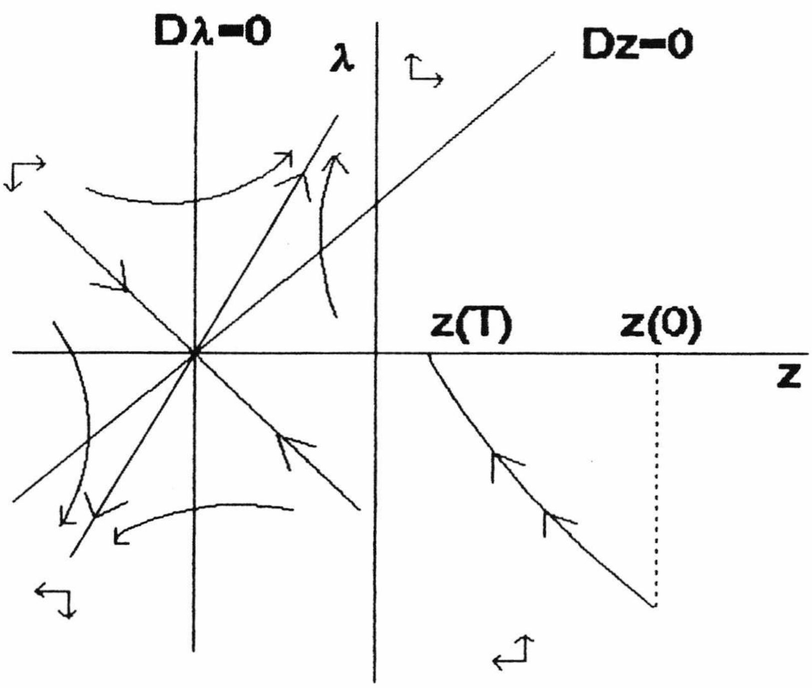
where λ is the dynamic multiplier associated with constraint (18). For simplicity time subscripts are omitted. The first order conditions for optimality are as follows (Beavis and Dobbs (1990)):

$$Dz = (b^2/a).(\pi-\pi^*) - (bg/a).z + (1/a).\lambda - (b/a).k \qquad (20)$$

$$D\lambda = -bg.(\pi-\pi^*) + g^2.z + g.k \qquad (21)$$

Equations (20) and (21) form a dynamic simultaneous equation system where Dx denotes rates of change of a variable over time (Dx = dx/dt) and, again, time subscripts are omitted for simplicity. Rational expectations, within the perfect information set up of this problem, means that $(\pi-\pi^*) = 0$. This eliminates the first terms in (20) and (21). As the determinant of the homogeneous system is negative (Det = $-g^2/a$) the equilibrium is saddlepoint. The phase diagram is represented in figure 1 where the arrows sketch the trajectory paths.

Figure 1 Phase diagram of the optimal control problem



Setting $Dz = 0$ in equation (20) (with $(\pi-\pi^*) = 0$) we get

$$\lambda = b.k + bg.z \tag{20 a}$$

and from equation (20) we can see that above (below) this locus $Dz>0$ ($Dz<0$). This is shown by the horizontal arrows in the phase diagram.

Setting $D\lambda = 0$ in equation (21) (with $(\pi-\pi^*) = 0$) we get

$$z = -k/g \tag{21 a}$$

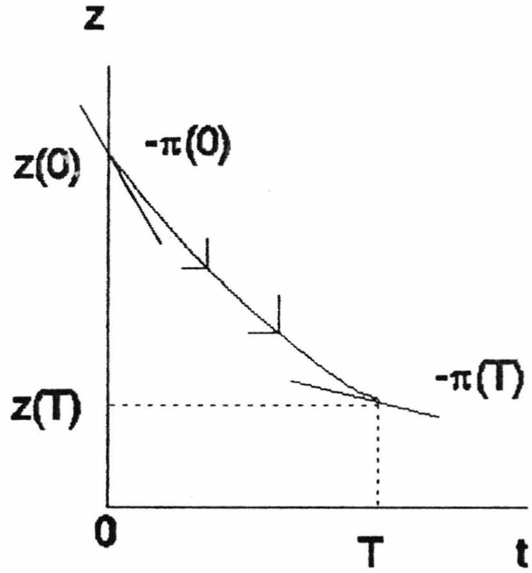
and from equation (21) we can see that to the right (left) of this locus $D\lambda>0$ ($D\lambda<0$). This is shown by the vertical arrows in the phase diagram. The graphical analysis confirms that the equilibrium $(-k/g,\ 0)$ is saddlepoint.

An optimal trajectory for the real exchange rate is drawn in the figure imposing the initial condition that $z_t = z_0$ at $t=0$ and the terminal condition that $\lambda=0$ at $t=T$ (the shadow-price of real exchange rate changes/inflation is zero at T). Note that, as illustrated in figure 1, the initial level of the real exchange rate must be such that the system is off the stable manifold.[4] This means that the law of motion of z_t will be determined both by the positive and by the negative eigenvalues of the homogeneous system, setting the real exchange rate onto a divergent path. As the phase diagram shows, the real exchange rate appreciates between time 0 and T. This means that the rate of inflation, which is equal to the absolute value of the time derivative of z_t, declines over time, gradually, from π_0 to π_T as illustrated in figure 2.

It is important to note that the inflation rate will never

4 - The initial value of z must not be on the saddle-path because we consider only positive levels of the real exchange rate (z). If the system begins on the saddle-path the terminal condition ($\lambda=0$) would imply a negative real exchange rate level at time T ($z(T)=-k/g$).

Figure 2 Trajectory of the real exchange rate and inflation



become zero: the rate of inflation at every point in time is given by the absolute value of the derivative of z_t as shown in figure 2. Thus one conclusion of the analysis is that, on average, the rate of inflation under pegged rates is lower than under the "flexible" regime, in which case it will always be at π_o: however, there will not be full convergence of inflation rates because the policy of realignments of the nominal exchange rate (devaluations) after each interval of length T sets the real exchange rate again at the initial level [z(o)] which implicitly raises the rate of inflation [$\pi(0) > \pi(T)$].

A second conclusion shown by Giavazzi and Giovannini is that the value of the loss function is smaller under pegged rates. The intuition for this result is very simple. If the real exchange rate is not fixed it introduces an additional source of variation to real output. As the central bank is concerned with fluctuations of real output around the full employment level this is equivalent to increasing the weight of inflation in the loss function. In fact, the choice of the pegged regime can be seen as the equivalent to the appointment of a conservative central banker in the expectations-augmented Phillips curve example.

The model has three main empirical implications. Firstly, inflationary expectations must be lower under pegged rates, secondly with periodic realignments inflation rates do not need to converge internationally and, thirdly, the real exchange rate appreciates between realignments but there will not be any trend real appreciation.

The empirical evidence on the disinflationary process of the 1980s will be discussed in chapter 6 but at this stage some comments on the approach followed by Giavazzi and Giovannini are worthwhile. In our opinion the structure of the model used by the authors does not allow us to address the fundamental question that faces a country chosing a "hard currency" strategy to disinflate. If the pegging of the nominal exchange rate to a low inflation country is to act as an informational device (to warn price and wage setters that the authorities will not accommodate excessive wage claims) there must be a channel through which a real exchange rate appreciation cuts jobs and profits. Within the framework used by Giavazzi and Giovannini a real appreciation does exactly the opposite: it causes output to expand. Presumably, more jobs will be created and profits will rise. Clearly this has precisely the opposite effect of what one would expect from non-accommodating policies and it is a rather unrealistic scenario to start thinking about exchange rates and disinflation. If the exchange rate policy is credible, it is precisely the threat of foreign competition (enhanced by the loss of price competitiveness caused by the pegg) that will ultimately force wage and price moderation. Therefore, there must be a real exchange rate effect on the demand side of the economy (which Giavazzi and Giovannini rule out - see pp. 274-75). It should be noted that if the non-traded goods sector is allowed to expand (rapidly) the threat of job losses will be substantially reduced, in particular if the country has access to the international capital market (it will have to finance a trade imbalance). Therefore, a tight fiscal and monetary policy is necessary not only to sustain the credibility of the peg but also to sustain the excessive expansion of the non-traded goods sector and the resulting deepening of the trade deficit. The pressure on the demand side of the economy (or the potential pressure) will further contribute to wage and price moderation. But now we have gone full circle. What seems to be needed is a model of whether and how the choice of an exchange rate regime affects the wage bargaining process.

Another aspect worth mentioning is that the loss functions in (2) and (15) do not have a clear social welfare interpretation. The point made by Blackburn and Christensen (1989) is as follows. In the first place the model does not specify the preferences and constraints facing private agents and does not suggest how individual optimizing behaviour would generate such an aggregate welfare function. Secondly, even if we accepted the social welfare interpretation, the idea that welfare is improved when private agents are fooled seems odd. Similarly, why should welfare be improved by appointing a conservative, if the function already reflects the aggregation of individual preferences? Thirdly, the results obtained depend crucially on the existence of some labour market distortions (k>1). If these distortions result from taxes and tranfers the fiscal aspects of the model need to be spelled out: one may conjecture that the first-best solution to the inflationary bias is fiscal reform. The alternative view of (2) and (15) mentioned by Blackburn and Christensen (1989) is the political approach in which the loss function is viewed as representing a compromise between two competing groups - advocates of anti-inflation and advocates of economic stimulation. Be that as it may, the important point to make here is that one cannot draw any firm social welfare conclusions based on this framework.

In our opinion there is yet another sense in which the analysis of Giavazzi and Giovannini is not statisfactory. Their "flexible" regime does not contain the main characteristics of the way in which the floating (or quasi-floating) exchange rate regime has been modelled. Despite the controversies about the success or otherwise of the research carried out over the past fifteen years[5] there seems to be a wide consensus that tight money, under flexible exchange rates, capital mobility, fast moving asset prices, slow moving goods prices and rational expectations, cause the nominal and the real exchange rate to overshoot its long-run equilibrium level (given, for example, by long-run PPP à la Dornbusch (1976)). The resulting real exchange rate appreciation will directly and indirectly curb domestic inflationary pressures and so, tight monetary policy under flexible exchange rates and capital mobility can bring down inflation. The costs of doing so are discussed by Buiter and

5 - See, for example, Dornbusch (1989), Krugman (1989), Goodhart (1989), De Grauwe (1989), and Stein (1990).

Miller in a series of papers which are based on the UK's disinflationary process in the 1980's (Buiter and Miller (1981; 1982; and 1983)). What Giavazzi and Giovannini have shown is that (within the context of their model) a disinflationary strategy based on a temporary real exchange rate appreciation dominates another based on a constant real exchange rate. Paradoxically, if we take a long-run view of the experience of the disinflationary process in the participating countries of the ERM, as the evidence to be discussed later suggests, the ERM option looks much closer to a stable or quasi-fixed real exchange rate strategy than to a real appreciation strategy. Have the ERM countries chosen a more costly disinflationary strategy? Was the alternative strategy (floating and capital mobility) a feasible one? In order to answer these questions we have to proceed further in our survey of the theory in particular to examine the work of Buiter and Miller. This has the further advantage of allowing us to place greater weight on the demand-side dimension of real exchange rate appreciation something which is obscured in Giavazzi and Giovannini's analysis. In addition it will provide background for modelling the strategy of ERM-shadowing plus liberalization that has been followed recently by the Portuguese authorities.

5.4 - On the costs of bringing down inflation

As Buiter and Miller (1981; 1982), Dornbusch (1980; 1980a; 1982; 1986; 1987), Dornbusch and Fischer (1986), Dornbusch and Simonsen (1987) and Fischer (1988) point out inflation stabilization involves in general a period of recession or real growth below potential, a rising real interest rate and a balance of payments surplus which tend to appreciate the real exchange rate. To explain these features it is important to understand why the real interest rate tends to rise in the transition from high to low inflation. There are two basic reasons for this "velocity problem". First, during a high inflation nominal interest rates tend to rise reflecting more or less the rate of inflation. Monetary equilibrium will imply a low level of real balances.[6] When stabilization occurs it typically involves fixing wages, prices, the exchange rate and also restrictions on money/domestic credit creation; but even if wages and prices are not frozen by policy measures it is unlikely that they will fall abruptly. This means that the real money stock is roughly frozen at its prestabilization level. Thus, with the nominal interest rate determined by monetary equilibrium approximately at its prestabilization level and with the rate of inflation falling the real rate of interest rises.

Second, if the demand for real balances depends not only on the

[6] - To see why note that monetary equilibrium can be written as M/P = L (i, ...) where M/P are real balances and L (.) is the demand for money which depends, among other factors, on the nominal interest rate (i). The higher (lower) the level of real balances the lower (higher) the equilibrium level of interest rates.

nominal interest rate but also on the expected rate of inflation,[7] the equilibrium nominal interest rate must also rise. The expected fall of inflation raises the demand for real balances at each level of nominal interest rates. With real balances frozen at the prestabilization level monetary equilibrium requires an increase in nominal interest rates. Thus the real interest rate rises yet further. The conclusion (Dornbusch and Simonsen (1988; p.459)) is that

> real interest rates following a high inflation experience will be very high unless either the price level collapses, thus raising real balances, or else [...] the stock of nominal balances is allowed to increase.

In a small open economy inflation stabilization policy involves either the fixing of the nominal exchange rate, the deceleration of the rate of nominal depreciation or monetary tightening whilst still allowing the exchange rate to float. Because of a lack of credibility, long-term contracts, indexing, real wage resistance or slow adjustment of expectations, the inflation process is likely to be stubborn. In a small open economy with any of these features and some openness to the international mobility of (financial) capital, the large inflows of capital resulting from high levels of real interest rates will lead to real exchange rate appreciation. For example, as shown in Dornbusch (1980; 1980a) with imperfect capital mobility and managed (nominal) exchange rates there will be initially a protracted real appreciation with balance of payments equilibrium.[8] As shown in Dornbusch (1980) and Buiter and Miller

[7] - In this case monetary equilibrium becomes $M/P = L(i, \pi^{e}, \ldots)$ where π^{e} is the expected rate of inflation. The higher (lower) the expected rate of inflation the lower (higher) the demand for real balances.

[8] - There will be a current account deficit matched by a capital account surplus.

(1981; 1982) under floating exchange rates and with perfect capital mobility there will be a sharp loss in competitiveness. In the short-run the real exchange rate appreciation reduces domestic inflation directly. However, across steady-states the equilibrium real exchange rate remains unchanged[9] and thus the initial disinflationary gain from real exchange rate appreciation must be repaid when the real exchange rate depreciates.

The problem of real exchange rate appreciation and high real interest rates in the aftermath of a policy of inflation stabilization explains the high unemployment/slow growth costs of disinflation. One important conclusion (Dornbusch (1980; p.403)) is that

> the cumulative change in the real exchange rate is zero and that, accordingly, [...] the cumulative disinflation is entirely due to an output level that is on average below potential.

Within this theoretical framework capital mobility appears to be detrimental. However there is an important link between inflation stabilization and international capital mobility. Recall that one of the main reasons why real interest rates rise after the stabilization is because real balances are frozen at the prestabilization level. If the central bank pegs the exchange rate and does not sterilize the capital inflow that is likely to occur at the moment of pegging, the stock of nominal balances increases and domestic interest rates come down. This suggests that the output costs of disinflation can be eliminated under fixed exchange rates and perfect capital mobility. A second important conclusion (Dornb-

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[9] - The equilibrium level of competitiveness is determined by real factors like relative demand, productivity differentials, investment and thrift, and fiscal stance. The rate of inflation does not affect the real long-run equilibrium.

usch and Simonsen (1987; p.461)) is that

> The more strongly a government works on the fundamentals, in the form of fiscal correction, the more credible the policy of stabilization and the less uncertainty there is for the world capital market. With fiscal correction domestic monetization is not risky, but it is even unnecessary because capital inflows would ensure that interest rates come down as the central bank monetizes the resulting payments surplus.

However, fixing the nominal exchange rate, fiscal correction and monetization might not be sufficient conditions for the success of the stabilization. There must also be a tight synchronization of wage and price setting. The simplest way to understand this is to think of an economy where the growth rate of nominal wages is indexed to past inflation.[10] With actual inflation falling and, say, gradually converging towards the international rate of inflation, real wages will rise as long as lagged inflation exceeds the international inflation rate.[11] The important point to note here is that under these circumstances the real exchange rate will appreciate without any change in the fundamentals that would have warranted this relative price change: the trade balance deteriorates and a serious overvaluation problem will develop. An important conclusion (Dornbusch (1986; p.4) is that

> the income effect of higher real wages [the prosperity period] comes to be dominated by classical substitution away from overpriced domestic labor [the overvaluation period] [...]. Substitution effects on the demand and supply sides lead to bankruptcy and unemployment [and] external debt [...] needs to be serviced. This calls for a trade surplus generated by austerity and sharp real appreciation [and] real interest rates remain high [debt crisis period].

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10 - In discrete time we would have $w_t - w_{t-1} = p_{t-1} - p_{t-2}$ or $\Delta w_t = \Delta p_{t-1}$. where w and p are (logs of) nominal wages and prices.

11 - If $\Delta p_t < \Delta p_{t-1}$ and $\Delta w_t = \Delta p_{t-1}$ then it follows immediately that the real wage rises.

This analysis suggests that incomes policies (together with fiscal adjustment, exchange rate pegging and monetization) can perform an important role in the success of the stabilization.

In this section we study the output costs of disinflation and the role of exchange rate pegging, monetization and incomes policies in reducing or eliminating these costs. We assume that the fundamental factors behind the inflationary process (budget deficits and money printing) have already been corrected.

In section 5.4.1, in order to highlight the problem of high real interest rates and real appreciation involved in the stabilization, we use a version of Buiter and Miller's (1982) model. This is a model with perfect capital mobility under flexible exchange rates and rational expectations. A special feature of this version of the model is that it assumes rational expectations both in asset and labour markets. Rational expectations in labour markets is seen here as the outcome of a deliberate incomes policy that eradicates real wage targeting, lagged indexing, and slow adjustment of expectations from the economy.[12] It turns out that with flexible exchange rates and perfect capital mobility the hypothesis of rational expectations in the labour market is largely inconsequential: disinflation will be costly.

In section 5.4.2, in order to highlight the role of exchange rate pegging and monetization in the stabilization of inflation we extend Buiter and Miller's model in studying the transition from a floating exchange rate regime to a fixed exchange rate regime under perfect capital mobility. This is equivalent to a policy of stop-

12 - The crucial assumption is that there must be some degree of real wage flexibility.

ping inflation. It turns out that inflation stabilizes immediately and without costs because of the large (unsterilized) capital inflow that occurs at the moment of pegging. However in the case of pegged rates rational expectations in the labour market play a fundamental role.

In section 5.4.3 rather than the once-and-for-all policies examined in sections 5.4.1 and 5.4.2, we study the effects of a gradual and permanent policy. The policy experiment consists in switching from a floating regime to an active crawling-peg regime: the rate of exchange rate depreciation is gradually brought down to zero from its initial steady-state value. This policy eliminates the output costs of disinflation. However, as in the case of pegged rates, rational expectations in the labour market play a fundamental role: separate exchange-rate and wage targets are incompatible.

5.4.1 - The costs of bringing down inflation under floating

In this section we present the basic model that we use to discuss the output costs of bringing down inflation. The framework is due to Buiter and Miller (1981; 1982) and is a well-known extension of the seminal overshooting model of exchange-rate determination developed by Dornbusch (1976).[13] The complete formal solution of the model is presented in the Annex. Here we concentrate our attention mainly on the economic intuition behind the results and on the graphical solution of the model. The log-linear equations of the model are as follows.

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[13] - A comprehensive survey of this class of models can be found in Obstfeld and Stockman (1985).

$$m - p = k\,y - \lambda\,r \qquad k,\lambda>0 \qquad \text{(LM curve)} \qquad (22)$$

$$y = -\gamma\,(r-Dp) + \delta\,c \qquad \gamma,\delta>0 \qquad \text{(IS curve)} \qquad (23)$$

$$Dw = \phi y + Dp \qquad \phi>0 \qquad \text{(Phillips curve)} \qquad (24)$$

$$p = \alpha\,w + (1-\alpha)\,(e+w^*) \qquad \text{(Price index)} \qquad (25)$$

$$De = r - r^* - \tau \quad \text{(Uncovered interest parity)} \qquad (26)$$

where: $m-p$ is the level of real balances; m is the nominal money stock; p is the domestic price level; y is domestic income (zero represents full employment); r is the domestic nominal interest rate on non-money assets; w is the nominal wage level; r^* is the foreign nominal interest rate on non-money assets; $c = e-w+w^*$ is the real exchange rate or an index of competitiveness; e is the nominal exchange-rate (domestic currency price of foreign currency); w^* is the foreign wage level; τ is the rate of tax on capital inflows; D is the differential operator ($Dx=dx/dt$) to be taken as the right-hand time derivative of x. In what follows $Dm=\mu$ is the rate of growth of the domestic nominal money supply. Except for interest rates all variables are in logarithms.

The first equation describes the condition for equilibrium in the money market. With an exogenous supply of money, real balances depend on real income and nominal interest rates. Or, to put it differently, the nominal interest rate is a function of real income and real balances. The second equation is the condition for equilibrium in the goods market. Output is demand determined and depends on competitiveness (net exports) and real interest rates (investment). Wage inflation defined in equation (24) is generated by an expectations-augmented Phillips curve. Equation (25) defines the price index used to deflate nominal balances where α is the proportion of the domestic good in consumption and $(1-\alpha)$ is the proportion of the foreign good in consumption, whose price is given by $(e+w^*)$. Equilibrium in the foreign exchange market is given by equation (26). The interest differential in favour of the domestic currency, net of any tax on capital imports, is equal to the perfectly anticipated change (depreciation) of the exchange-rate.

Real liquidity (l) will be defined as nominal balances deflated by the wage level (l=m-w). It is a predetermined variable and, unless otherwise stated, it only jumps in the short run in response to discontinuous changes in μ. This corresponds to the nominal wage stickiness-real wage flexibility variant of the model, which is consistent with rational expectations and wages set by contracts. The real exchange-rate (c) is a forward looking variable and jumps whenever the nominal exchange-rate (e) jumps in response to new information.

The income and interest rate variables can be eliminated to obtain a reduced form system of two equations in liquidity and competitiveness as follows:

$$Dl = (1/\lambda)\, l + a_{12}\, c + b_{11}\, \tau + \mu \qquad (27)$$

$$Dc = a_{22}\, c - (\gamma/\delta)\, a_{22}\, \tau \qquad (28)$$

where:

$a_{12} = -\{(1-\alpha)[1-\alpha(1+\phi\gamma) + k\delta] + \lambda\phi\delta\}/\lambda[1-\alpha(1+\phi\gamma)] < 0$

$a_{22} = -\phi\delta/[1-\alpha(1+\phi\gamma)] < 0$

$b_{11} = \{\lambda[1-\alpha(1+\phi\gamma)] + k\gamma(1-\alpha) + \lambda\phi\gamma\}/\lambda[1-\alpha(1+\phi\gamma)] > 0$

and $[1-\alpha(1+\phi\gamma)] > 0$ is assumed to be positive to ensure that the system (27)-(28) is saddle-path unstable. In economic terms this means that an increase in effective demand increases output at a given nominal interest rate and a given level of competitiveness, which seems a reasonable assumption. To arrive at (27)-(28) we set $w^* = r^* = 0$.

The long-run equilibrium values of liquidity (l^*) and competitiveness (c^*) can be found by setting Dl=Dc=0 in (27) and (28) and solving the system of equations. The steady-state values are as follows:

$$l^* = -\lambda\ (\mu + \tau) + (1-\alpha)\ (\gamma/\delta)\ \tau \tag{29}$$

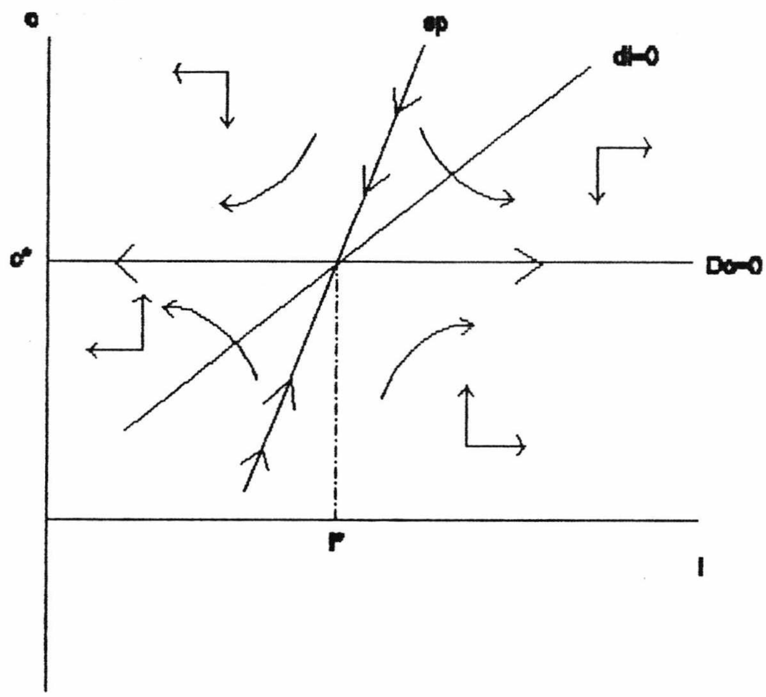
$$c^* = (\gamma/\delta)\ \tau \tag{30}$$

From equations (22) and (29) we can see that a reduction in the rate of monetary expansion will, in the long-run, reduce the domestic nominal interest rate by the same amount ($dr = d\mu$), and increase liquidity by an amount determined by the semi-elasticity of the demand for money ($dl^* = -\lambda\ d\mu$). From equation (30) we can see that the long-run level of competitiveness is not affected by the rate of monetary expansion. In contrast, a reduction in τ represents a "real shock" to the economy and will affect in the long-run both the level of liquidity and competitiveness. The full liberalisation of the capital account or the total removal of capital controls can be interpreted as a decrease in τ. It can be seen from equations (29) and (30) that the liberalisation of the capital account will, in the long-run, reduce competitiveness. Whether it will reduce or increase liquidity depends on the sign of $[-\lambda + (1-\alpha)\ (\gamma/\delta)]$.

The dynamic behaviour described by the system of equations (27) and (28) is illustrated in figure 3.

The locus $Dl=0$ is the locus of l and c that satisfies a stationary level of liquidity and from (27) it can be seen that it is positively sloped. As the horizontal arrows indicate, points to the right (left) of $Dl=0$ imply high (low) liquidity, low (high) nominal interest rates and therefore excess demand (supply). With sticky nominal wages, nominal balances have to increase (decrease) further in order to accommodate the higher (lower) demand for real balances. This is the element of instability that pushes the system away from the schedule. The locus $Dc=0$ is the locus of l and c that satisfy a

Figure 3 Phase diagram of Buiter-Miller's model

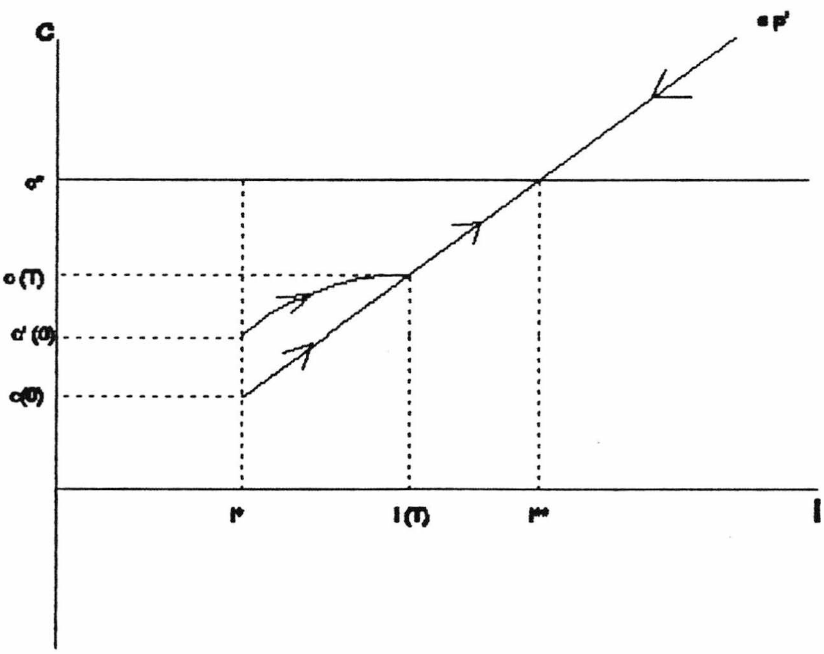


stationary level of competitiveness and from (28) it can be seen that it is horizontal. As the vertical arrows indicate, in points above (below) Dc=0 competitiveness is too high (low) and therefore income is above (below) full employment. The real wage will be increasing (decreasing) and competitiveness deteriorating (improving). This is the element of stability pushing the system back to the schedule.

As suggested by the arrows in figure 3 the equilibrium of the dynamic system is saddlepath, unstable. The determinant of the homogeneous system is negative (Det A = $(1/\lambda).a_{22} < 0$) and the eigenvalues are real, distinct and of opposite signs [$(1/\lambda) > 0$ and $a_{22} < 0$]. These are alternative and equivalent ways of confirming the necessary conditions for the type of equilibrium mentioned.

The assumption that economic agents will not choose an unstable solution means that the economy will always be on the stable manifold following any (unanticipated) disturbance. The stickiness of the wage level and the exogeneity of the money supply means that the level of liquidity is at any time given by past history and it is the real exchange-rate which adjusts, by jumps in the nominal exchange-rate, so as to put the economy on the saddle-path (sp). We can study now the dynamics of the adjustment towards the new steady-state following a reduction in the rate of monetary growth. Two cases must be considered. In the first case the reduction of the rate of monetary growth is not anticipated (or not announced) and in the second case the reduction of the rate of monetary growth is anticipated (or announced and credible). The two cases are illustrated in figure 4.

Figure 4 Effect of a reduction in the rate of monetary growth



In both cases the new equilibrium value will be along the horizontal line through c* because, as we have seen, the monetary shock does not affect the steady-state level of competitiveness. However, the assumption of differential speeds of adjustment in labour and asset markets implies that this equilibrium cannot be achieved instantly. In the short-run the level of liquidity will be unchanged [$l^*=l(0)=m(0)-w(0)$] but the demand for real balances has increased. From the LM equation (22) and the price index equation (25) it can be seen that monetary equilibrium is achieved (instantaneously) through an increase in r and a decrease in e (p). The nominal interest rate increase reduces the demand for real balances, and the price level decrease (through nominal exchange rate appreciation) increases real balances. In the very short-run output (y) and inflation (Dp) do not change. However, from the IS equation (23) we can see that the real exchange rate appreciation and the increase in real interest rates reduce output. Then, from the expectations-augmented Phillips curve equation (24) we can see that as a result of the recession ($y<0$) the growth rate of the real wage becomes negative ($Dw-Dp<0$). This initiates the disinflationary process. The initial higher real (nominal) interest rate must be offset by the expectation of a real (nominal) exchange-rate depreciation and so the real (nominal) exchange-rate jumps and competitiveness deteriorates on impact.

If the monetary policy tightening is not announced (or not anticipated) the system is placed immediately on the new stable manifold (sp′) and the real exchange-rate overshoots its long-run equilibrium value. The jump is given by the vertical distance ($c^*-c(0)$) in figure 4. Once we move from the short-run to the long-run prices will be falling, the nominal (real) interest rate will also be falling and the exchange-rate depreciating. The increased demand for liquidity is satisfied in the new equilibrium because of the lower level of the nominal interest rate in the new steady-state. If the authorities credibly preannounce (at t=0) the future reduction of the rate of growth of the money supply (or if it is anticipated), there can be no jump in the exchange-rate at the time the policy change is implemented (say, at t=T). That would be inconsistent with forward looking behaviour as speculators would anticipate infinite capital gains at t=T. This implies that at the time of the announcement the exchange-rate must jump to eliminate the potential capital gains, though it jumps by less than if the policy change were unanticipated. The dynamics of the system is given, for example, by the divergent path shown in figure 4. This is the unique path to be followed by c and l that places the system on the stable manifold at t=T (c(T),l(T)). When the policy is implemented the exchange-rate does not jump and the system follows the saddle-path trajectory towards the new equilibrium. The general equation of the jump in the real exchange-rate is as follows:

$$(c'(0)-c^{*}) = -\{[a_{22}-(1/\lambda)]/a_{12}\}.\lambda.(\mu_0-\mu_1).\exp[-(1/\lambda)T] \qquad (31)$$

Equation (31) shows that the real exchange-rate overshooting is greater, the larger the reduction in the growth rate of the money supply ($\mu_0-\mu_1$) and, the shorter the timing of the anticipation ($\exp[-(1/\lambda)T]$). In the limit, when the policy is anticipated to be implemented far into the future, the exchange-rate does not jump, as can be confirmed by taking the limit of (31) when $T\to\infty$ (as the exponential term goes to zero). The analysis suggests that if the government can pre-commit itself long before it is due to implement the policy much of the overshooting can be avoided.

Using equations (23) to (26) the output costs of bringing down inflation can be calculated as follows:

$$\int_{t=0}^{\infty} y_t dt = \{(1-\alpha)/[1 - \alpha\ (1+\gamma\phi)]\} \int_{t=0}^{\infty} (-\gamma\pi + \delta c_t)\ dt =$$

$$= [(\alpha-1)/\phi][c^*-c(0)] \qquad (32)$$

Equation (32) shows that the cumulative loss of output is proportional to the exchange-rate overshooting, or to put it differently, depends on the magnitude of the initial loss in competitiveness. This proves that, in general, the reduction of the growth rate of money and the disinflationary process result in a painful adjustment of output in the transition to the new steady-state.

The sacrifice ratio (SR) is the ratio of the percentage of output lost to the reduction of the inflation rate. What factors affect the value of the SR? Note that the inflation rate is reduced from μ_o to μ_1 because in the steady-state the rate of inflation is equal to the growth rate of the money supply. Dividing equation (32) (the output loss) by $(\mu_o-\mu_1)$ (the disinflation gain) we obtain the value of SR as follows:

$$SR = [(\alpha-1)/\phi].\{[a_{22}-(1/\lambda)]/a_{12}\}.\lambda.\exp(-T/\lambda) \qquad (33)$$

Of the three main factors that affect the value of the sacrifice ratio during a disinflationary process initiated by a discrete reduction in the growth rate of the money stock, stated in a more recent paper by Fischer (1988), Buiter and Miller's model capture all but one (to be mentioned below) as follows.

Firstly, the demand for real balances in the new steady state is higher than in the high inflation equilibrium: the economy produces real balances by causing the price level to grow more slowly than the nominal money stock. In an economy where prices are not perfectly flexible in the short-run the increased demand for real balances increases the output costs of disinflation. This effect is captured by the parameter λ in SR. The greater is the interest rate semi-elasticity of the demand for real balances the greater is the sacrifice ratio (see Fischer (1988; p.27 and 35)).

Secondly, in general the monetary policy-induced disinflation causes the real exchange-rate to appreciate. There are four channels through which the exchange-rate appreciation affects the sacrifice ratio. First, "to the extent that imported goods are consumer goods, real appreciation directly affects the CPI, tending to speed up the price response to the reduced growth rate of money. To the extent that the CPI is the price level relevant to the demand for nominal balances, the more rapid response of prices means a smaller reduction in real balances and lesser deflationary pressure". (Fischer (1988; p.30)). This is captured by the term α. The larger the share of imports the smaller $(\alpha-1)$ in absolute terms and also the smaller is the second term in equation (33) which reduces the SR. Second, "if imported goods are factors of production, the appreciation reduces costs, and thus has a favorable effect on domestic supply price, again tending to reduce the sacrifice ratio". (Fischer (1988; p.30)). This is the only factor considered in Giavazzi and Giovannini (1989) and is not captured in Buiter and Miller's analysis because in their model output is demand determined. Third, "if wages adjust to the expected price level, any quick success in reducing the price level will have the effect of reducing wages negotiated during the adjustment period. The more rapidly wages come down, the smaller the output loss". (Fischer

(1988; p.30). This is captured by the parameter ϕ. It is a measure of the degree of real wage flexibility. In the limiting case of instantaneous real wage flexibility ($\phi \to \infty$) the sacrifice ratio is zero. Fourth, "the exchange-rate appreciation reduces the trade surplus, thereby reducing demand for domestic goods and output. This effect increases the sacrifice ratio". (Fischer (1988; p.30). This is captured by the parameter δ, equivalent to the Marshall-Lerner condition for a real devaluation to affect demand positively (net exports). The larger is δ the larger is the second term in equation (33) and that increases the SR.

Fischer notes that "because the effects do not all operate in the same direction, it is not surprising that we do not find an unambiguous answer to the question of how exchange-rate appreciation during a disinflation affects the sacrifice ratio". (Fischer (1988; p.30)). In Buiter and Miller's model the answer is not so ambiguous because the supply factor (imported inputs) was not considered. However, the omission of the supply side has another dimension. If wages are set in long-term contracts and indexed to lagged price levels the real wage tends to increase during a disinflationary process and this may have a recessionary effect increasing the sacrifice ratio. We have not considered this case and assumed instead an expectations-augmented Phillips curve without "money illusion". That is, we have not considered two additional channels that have opposite effects on the sacrifice ratio. It should be noted that any exchange-rate appreciation has eventually to be reversed and implies net foreign borrowing that has to be repaid or serviced. This is also not considered here.

As Buiter and Miller's analysis shows monetary disinflation has its costs in terms of output and employment. However, the analysis has been carried out under a flexible exchange-rate regime which is not the institutional environment of the ERM. We therefore proceed now to extend Buiter and Miller's analysis in order to characterize the behaviour of the economy described by equations (22)-(26) under fixed exchange-rates. We then ask what will be the dynamic adjustment of the system when there is a regime shift from floating to pegging. We can use this analysis to answer the following question: when the authorities are determined to bring down inflation do they have an incentive to peg the currency rather then to let it float? The answer to this question will be important in allowing us to understand why some governments and/or central bankers would like to "tie their hands" during a disinflationary process.

5.4.1 - The costs of bringing down inflation through pegging

To characterize the behaviour of the economy under fixed exchange-rates the system of equations (22)-(26) will be solved assuming that the money supply is an endogenous variable and that the exchange-rate is an exogenous variable ($e=\hat{e}$). The complete solution of the model and the formal proof of the results is presented in the Annex. Here we concentrate our attention mainly on the economic intuition behind the results and on the graphical solution of the model. Capital mobility and full liberalisation of the capital account will also be assumed, that is $\tau=0$.[14] The foreign country

14 - This is neither the institutional environment of the "old-ERM" nor Portugal. The assumption of full capital mobility is made here in order to highlight the role of exchange rate pegging and monetization.

has zero inflation ($w^*=0$; $r^*=0$). This means, from equation (26), that we must have at the time of pegging $r=0$ as, with a credible peg, $De=0$. Under these assumptions the dynamic behaviour of the economy is described by the following differential equation:

$$D(\hat{e} - w) = a_{22}\,(\hat{e} - w) \tag{34}$$

where $(\hat{e}-w)$ is the real exchange-rate or competitiveness and time subscripts are omitted for simplicity. The solution of this equation is given by:

$$\hat{e} - w_t = (\hat{e} - w_0).\exp(a_{22}t) \tag{35}$$

This solution implies the following path for liquidity:

$$l^p = \{(1-\alpha)[1- \alpha\,(1 + \phi\gamma) + k\delta] \;/\; [1- \alpha\,(1 + \phi\gamma)]\}.(\hat{e} - w) \tag{36}$$

where $l^p = m^p - w$, the money supply (m^p) being an endogenous variable.

The steady-state of the pegged regime is given by:

$$D(\hat{e} - w) = 0 \rightarrow \hat{e} = w \text{ or } c^p=0 \tag{37}$$

$$l^p = 0 \tag{38}$$

Three important conclusions can be drawn immediately. Firstly, as equations (28) and (34) show the change in the exchange-rate regime has no effect on the path of the real exchange-rate or competitiveness. Secondly, in the flexible exchange rate regime, the dynamic behaviour of the economy (liquidity and competitiveness) depends essentially on monetary policy and, in particular, on the rate of growth of the money supply. From equations (35) and (36) we can see that the key factor in the dynamic behaviour of the economy under fixed exchange rates is the path of nominal wages. Thirdly, from the steady-state values given by (37) and (38) we can see that pegging to the currency of a zero inflation country is, in the long-run, equivalent to the decision of bringing inflation down to zero with flexible exchange-rates (μ=0). It is important to emphasize that whereas in the floating exchange rate regime there are an infinite number of steady-states, one for each rate of monetary expansion/inflation, in the fixed exchange rate regime there is only one steady-state.

The dynamic behaviour of the pegged regime is illustrated in figure 5. As in the case of the flexible exchange-rate regime the stability of the system depends on whether $[1- \alpha (1 + \phi\gamma)] > 0$, which is a reasonable assumption to make.[15] If the exchange-rate is devalued or is fixed at too high a level such that a level of competitiveness like c(1) results, there will be a trade surplus and high liquidity. Because output is above the equilibrium level this will push the real wage upwards. Eventually the inflationary process will bring the real exchange-rate and liquidity back to their equilibrium levels. Thus devaluations starting from a position of equilibrium are neutral in the long-run. If there is an exogenous increase in the wage level or if the exchange-rate is fixed at too low a level such that a level of competitiveness like c(2) results, there will be a trade deficit and low liquidity. Because output is below the equilibrium level this will push the real wage downwards. Eventually the disinflationary process will bring competitiveness and liquidity back to their equilibrium levels. The system has self-equilibrating mechanisms but the speed of convergence to the steady-state depends, in particular, on the degree of real wage flexibility (ϕ).

15 - As we saw in section 5.4.1 this condition means that an increase in effective demand increases output at a given nominal interest rate and a given level of competitiveness.

Suppose that, starting from a steady-state situation of inflation and flexible exchange-rates, where $De=Dw=Dp=\mu$, the government decides to bring inflation down to zero. We study the output costs of non-announced policies ($T=0$) comparing a policy with flexible exchange-rates where the growth rate of the money supply is reduced immediately to zero and a policy of pegging immediately to the currency of a zero inflation main trade partner.

Pegging implies choosing a level for the exchange-rate ($\hat{e}$) and that is equivalent to the choice of an initial level of competitiveness, because in the short-run the level of the wage is fixed (w_0). In choosing the level of the fixed exchange-rate the government has three options. First, it can choose $\hat{e}$ such that the initial value of competitiveness will be above the long-run equilibrium level. We call this option the undervalued peg. Second it can choose $\hat{e}$ such that the initial value of competitiveness will be below the long-run equilibrium level. We call this option the overvalued peg. Third, the government can fix the exchange rate such that competitiveness will remain at the current level. The first and the second options are illustrated in figures 5 and 6.

If the government chooses the first option, represented in the upper-half of figure 6, which corresponds to a point like $(l(1), c(1))$ in figure 5, there will be a gradual decline in the rate of inflation with output temporarily above its equilibrium level. Before the regime change wage inflation is constant, implying a log-linear path for the nominal wage. After the regime change the rate of wage inflation comes down gradually and the (log of) nominal wage approaches the long-run level. To understand why recall that through pegging one source of inflation is immediately suppressed as

Figure 5 Diagram of the pegged exchange rate regime

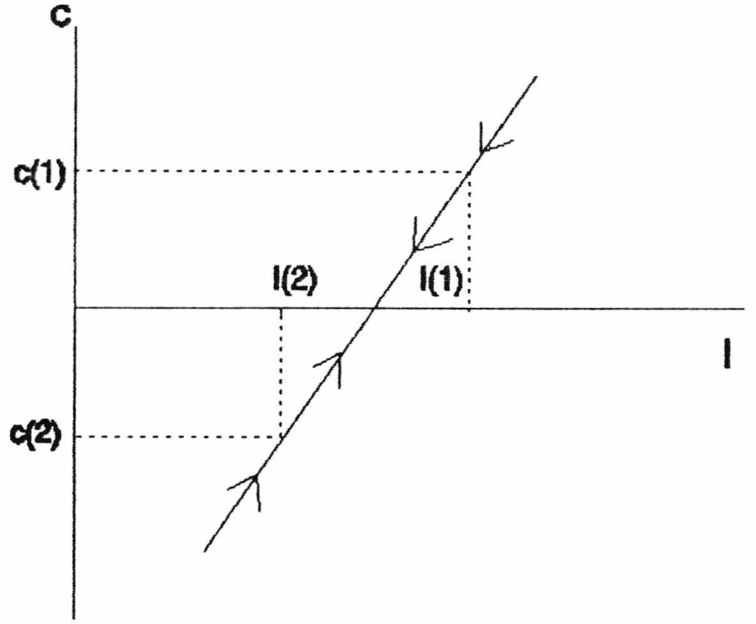
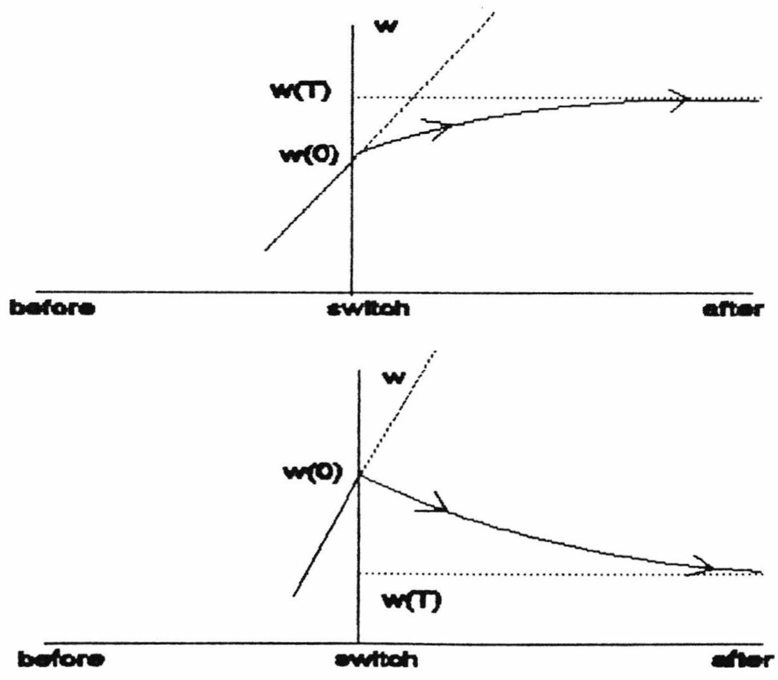


Figure 6 The two options for pegging

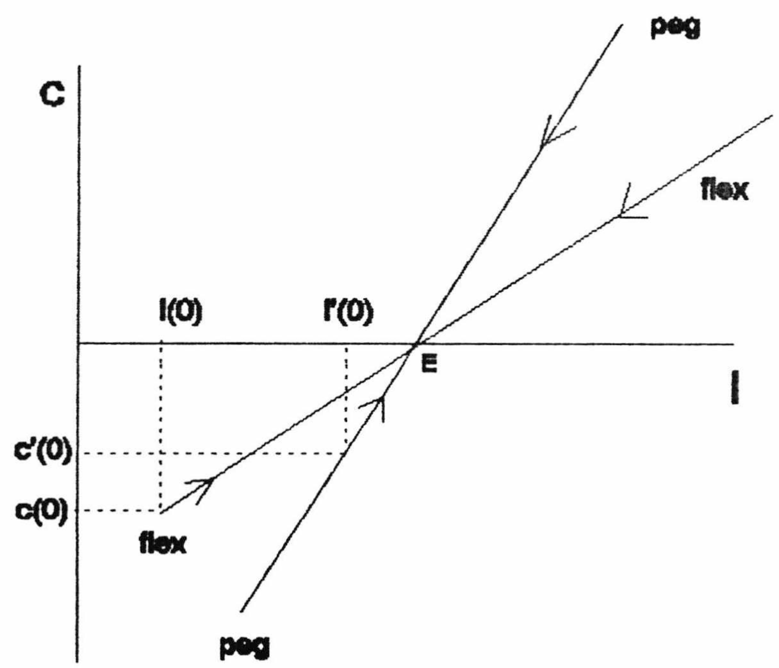


can be confirmed from the price index equation (25). This will dampen inflation and nominal wage growth. If the government chooses the second option, represented in the lower-half of figure 6, which corresponds to a point like (l(2),c(2)) in figure 5, there will be a period of deflation with output below the equilibrium level. This seems to suggests that governments will be tempted to choose to peg from an initial situation of undervaluation. However, this choice is likely to be anticipated by the private sector, in which case the economy will be set in an explosive (hyperinflationary) path.[16] For this reason we consider that this option will not be chosen. If the pegged regime is fully credible the government can choose to fix the exchange-rate at the current level: the economy jumps to the new steady-state and inflation stops immediately. We see this option as a limiting case. Therefore, in the remainder of this section we compare the tight-money-under-floating policy with the overvalued-peg option.

The two non-announced policies are compared in figure 7. The locus of the pegged regime, identified as "peg", shows the feasible combinations of c and l with fixed exchange-rates. Under reasonable assumptions about the structural parameters of the economy, the slope of "peg" will be steeper than the slope of "flex" in the (l,c) space. The economic intuition for this is as follows: given a

16 - Suppose the government announces (the private sector anticipates) that a regime change from floating to pegging will occur at time T and the private sector anticipates a discrete devaluation of the exchange-rate; that is, the government chooses (is believed to choose) an undervalued peg. This creates the expectation of infinite capital losses inconsistent with forward looking behaviour. The result will be an immediate sharp depreciation of the currency at the time of the announcement (anticipation) that eliminates all future potential capital losses. This sets the economy off the saddle-path in an explosive hyperinflationary motion.

Figure 7 Non-announced policies to bring down inflation



certain level of liquidity, an initial larger competitiveness "gap" under pegged rates than under flexible rates is necessary to move the economy to the same steady-state. This is because under the floating regime competitiveness and real interest rates both contribute to the initial recession, whereas under fixed rates it is the level of competitiveness alone that has to initiate the recession, because of the decline in real interest rates (nominal interest rates fall immediately due to the increase in liquidity).

It is immediately apparent from figure 7 that, if the government decides to switch from a floating steady-state like (l(0),0) to a pegged exchange-rate regime, there will always be an initial level of competitiveness to be chosen, say c′(0), that is lower than the initial level of competitiveness implied by monetary tightening under floating c(0). As the output costs of disinflation and the sacrifice ratio depend on the initial loss of competitiveness, there is a clear incentive to disinflate under pegged rates rather than to disinflate under floating rates. Under floating the initial loss in competitiveness is given by the vertical distance c(0)-l(0) whereas the initial real exchange rate appreciation under pegged rates is given by the vertical distance c'(0)-l'(0).

To understand this recall that at the time of pegging wage inflation is positive: it will be brought down through a transitional period of deflation with output below full employment. How is the recession initiated? At the time of pegging there is an increase in the demand for real balances and a decrease in the real interest rate. The central bank intervenes in the foreign exchange market in order to fix the exchange-rate and the nominal interest rate falls to zero. The loss in competiveness causes an immediate loss of output and sets the economy in the trajectory to the steady state. Whilst the loss of output shrinks the demand for real balances the central bank has to buy foreign currency to accommodate the higher demand for real balances and preserve monetary equilibrium. As a result liquidity jumps at the moment of pegging.

Equation (32) shows that the output cost of a monetary disinflation is proportional to the initial loss of competitiveness and this is so, regardless of the exchange-rate regime chosen. The alternative policy - flexible rates and immediate reduction of the growth rate of the money supply - implies an initial jump in competitiveness given by equation (31) which in this case is equal to:

$$c_o = -\{[a_{22}-(1/\lambda)]/a_{12}\}.\lambda\mu \tag{39}$$

This means that the output costs of bringing down inflation will be lower under the immediate-peg strategy than under the alternative policy if the government chooses an initial level of competitiveness lower than (39). That choice is made possible because of the jump in liquidity at the moment of pegging.

Another way of understanding this result is to see how the real exchange-rate can be stabilized under the floating strategy. As Buiter and Miller suggest, suppose that the level of the nominal money stock is immediately increased by $-\lambda\mu$ at the same time that the rate of monetary growth planned for the future is reduced to zero. The economy would jump to the new steady-state without any costs! However, as the authors note, this policy is likely to raise credibility problems as it is very difficult to distinguish, at the outset of the disinflationary programme, whether the big M-jump is a once and for all stock adjustment or a U-turn in policy. Note that in the case of pegging the monetization of the economy does not raise credibility problems because the big M-jump does not result from a deliberate policy of monetary expansion.

We can answer now the question asked at the beginning of this chapter. When a government has decided to bring down inflation there is an incentive to peg rather than float. The incentive is given by the magnitude of the sacrifice ratio, which is lower when the peg strategy is chosen.

These results can be used to understand the incentives for joining the ERM. This is the case if joining the ERM is interpreted as equivalent to the announcement that the government has decided to bring down inflation in the very short-run and if by joining the ERM the government persuades the public to believe the announcement, therefore enjoying the reputation of the Bundesbank. However, contrary to Giavazzi and Giovaninni's (1989) conclusion, the ERM choice appears to be preferable to floating not because it leads to greater real exchange-rate variability but for quite the opposite reason: it stabilizes the real exchange-rate therefore reducing the output costs of disinflation. The existence of margins of fluctuation and the policy of periodic realignments can be seen either as temporary features of the system allowing it to work like a constrained crawling peg, which, as will be discussed in the next section, can be seen as having the pegged regime as the limiting case; or as maintaining some "flexibility" to allow for equilibrium movements in the real exchange-rate. These movements are warranted by changes in the fundamental determinants of the real exchange-rate (real factors) which have been assumed to remain constant during the disinflationary process or transition to fixed exchange-rates.

5.4.3 - The role of exchange-rate rules and incomes policies

As the analysis of the preceding sections shows monetary disinflation is likely to be painful, both under fixed and flexible exchange-rates and, as we have seen, one of the reasons for that is the slow adjustment of the wage, both the level and the rate of growth. If the pegged regime is fully credible the government can choose to fix the exchange-rate at the current level: the economy jumps to the new steady-state and inflation stops immediately. Recall that this option is equivalent to freezing the exchange rate and the nominal wage at their current levels at moment of the regime switch.[17] Under pegged exchange rates the assumption of rational expectations in the labour market is essential: it is through appro-

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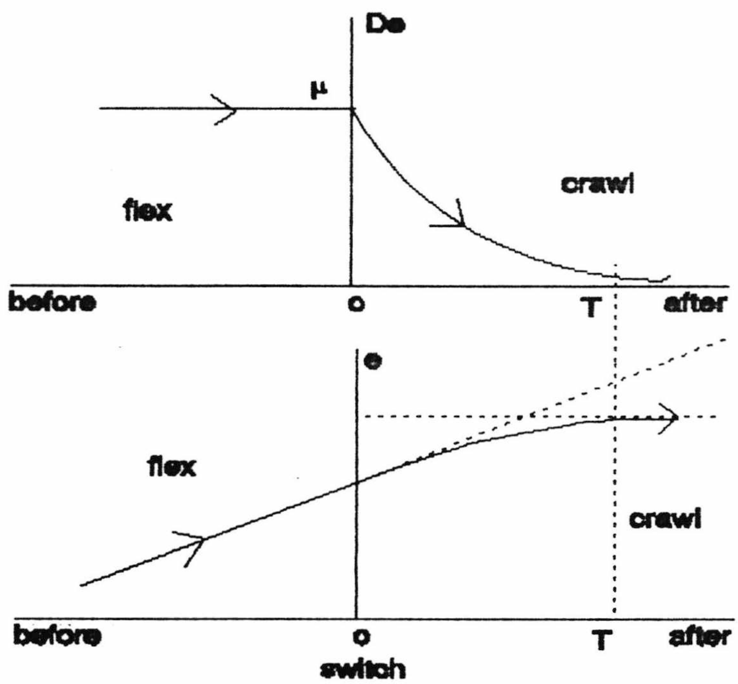
17 - Recall from equation (35) that the dynamics of the pegged regime is given by $\hat{e}-wt = (\hat{e}-w0).\exp(a22t)$. If $\hat{e}=w0$ then $\hat{e}-wt=0$ and it follows immediately from equation (36) that $1P=0$.

priate nominal wage changes that the economy is brought to the steady-state. This observation suggests that if the programme of monetary restraint is accompanied by an active incomes policies the output costs of disinflation can be reduced or even eliminated. In this section we illustrate this idea from a different perspective. Rather than the once-and-for-all policies examined above (the discrete reduction in the growth rate of the money supply under the flexible regime or the immediate peg strategy) we study the steady-state and dynamic effects of a gradual and permanent policy. The policy experiment consists in switching from a floating regime to an active crawling-peg regime: the rate of exchange-rate depreciation is gradually brought down to zero from its initial steady-state value of μ. We show that this policy eliminates the output costs of disinflation.

To characterize the behaviour of the economy under the active crawling-peg regime the system of equations (22)-(26) will be solved assuming that the money supply is an endogenous variable and that the rate of change of the exchange-rate is an exogenous gradually changing variable ($De_t = D\hat{e}_t$). The complete solution of the model and the formal proof of the results is presented in the Annex. As before, capital mobility and full liberalisation of the capital account will also be assumed, that is $\tau=0$. The foreign country has zero inflation ($w*=0$; $r*=0$). This means, from equation (26), that we must have, $De=r$. The path of the nominal exchange-rate is illustrated in figure 8.

Before the regime change ($t<0$) the rate of depreciation is constant ($De=\mu$), implying a log-linear path for the nominal exchange-rate ($e=e_0+\mu t$ if $t<0$). After the regime change an active

Figure 8 Active crawling-peg



crawling-peg policy brings down the rate of depreciation ($De = \mu.\exp(-\rho t)$ if $t>0$). Gradually, the (log) nominal exchange-rate approaches the long-run level. Note that by an appropriate choice of ρ we can make the rate of depreciation after T to be arbitrarily small, forcing the economy to behave like the fixed exchange-rate regime from that moment onwards.

Under these assumptions the dynamic behaviour of the economy is described by the following differential equation:

$$Dw = D\hat{e} - a_{22}\,(\hat{e} - w) \qquad (40)$$

where time subscripts are omitted for simplicity. This equation implies that, starting from the steady-state of the flexible regime, we must have during the transition to the new steady-state the following condition:

$$w_t = \hat{e}_t \quad \text{or} \quad c_t = 0 \qquad (41)$$

This solution implies the following path for liquidity:

$$l^c = -\lambda D\hat{e} \tag{42}$$

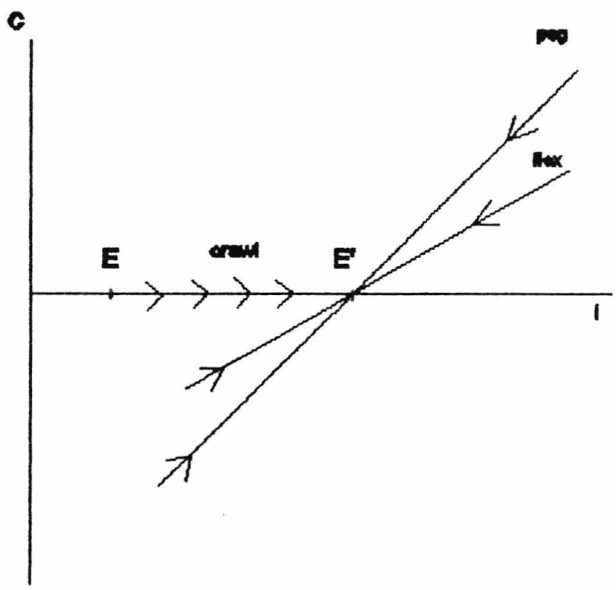
where $l^c=m^c-w$, the money supply (m^c) being an endogenous variable. The steady-state of the crawling-peg regime is given by equations (43) and (44) as follows:

$$c^c = 0 \tag{43}$$

$$l^c = 0 \tag{44}$$

Again we can see from equations (28), (34) and (40) that the change in the exchange-rate regime has no effect on the path of the real exchange-rate. Furthermore, the gradual permanent policy described above brings the economy, in the long-run, to a zero inflation equilibrium.

Figure 9 Diagram of the crawling peg regime



The dynamic behaviour of the crawling peg regime is described in figure 9. Starting from a steady-state situation of inflation and flexible exchange-rates (E) the government decides to bring down inflation to zero through a permanent and gradual reduction in the rate of depreciation. In the new steady-state (E′) real balances will have increased. At the moment of the regime switch there is no jump in the nominal exchange-rate and competitiveness will remain unchanged throughout the transition to the new equilibrium. At the moment of the regime switch liquidity does not jump and the economy follows the path (E-E′) indicated by the arrows. As the output costs depend on the initial jump in competitiveness, zero in this case, disinflation is costless!

This example proves that a gradual permanent policy of monetary restraint has no real effects. Three comments on this result are worthwhile. Firstly, we can say that costless disinflations are also a possibility under the flexible regime should it be announced that the reduction in the rate of growth of the money supply is to be implemented far into the future. In fact, in some circumstances, the crawling-peg solution is similar to the commitment of bringing down inflation only in the long-run. However, as we have mentioned, by an appropriate choice of ρ we can make the rate of depreciation to be arbitrarily small after T, thus bringing inflation down to (near) zero at T. Furthermore, by definition, the crawling-peg result does not rely in promising a far distant shift in policy that, in fact, will never occur during the lifetime of the economic agent! The crawl implies a permanent shift in policy that can be easily monitored by living economic agents. Secondly, from an incomes policy perspective (rational expectations in the labour market) we can see that the active crawl works like a simultaneous and coordinated gradual reduction in the growth rate of nominal wage and exchange rates (see equation (41)). It is as if the growth of wages were indexed to the future path of the exchange-rate (and inflation). An important conclusion is that "ex-ante indexation [that sets wages on the basis of some agreed upon ... forecast] provides the lowest sacrifice ratio". (Fischer (1988; p. 45)). This illustrates the important idea that separate exchange rate and wage targets are incompatible. Thirdly, the crawl regime has the disturbing feature that positive exogenous shocks to the wage must be fully accommodated by the government and will cause immediate losses of foreign exchange reserves. This gives rise to the concern that exchange-rate rules oriented towards keeping competitiveness constant (PPP rules) may contribute to price level instability. This is a well-known result (see for example Dornbusch (1980)).

This active crawling-peg regime presented here can be used as a model of the ERM, with some qualifications. Firstly, as we saw in chapter 1, from 1979 until 1987 the path of the Italian lira against the DM looked more like a crawl than a peg. However, during that period, Italy's capital account was not liberalised, a feature that was essential in permitting the gradual adjustment of the exchange-rate. With this qualification we can understand the incentive for operating the ERM like a crawl: it eliminates the output costs of disinflation. This option might be important in particular if the private sector does not believe the actual level of the exchange-rate to be consistent with a long-run equilibrium determined by the fundamentals. A second qualification has to do with the potential instability of the price level under the crawl: it does not seem to have been a feature of the ERM. This means, for example, that exogenous positive shocks to the wage level are not automatically and completely accommodated, as implied by the model presented here. Therefore, at best, the ERM has to be seen as a constrained crawling-peg and it might have been preferable to incorporate those constraints, explicitly, in the model. Nevertheless, the model presented in this section captures some features of the recent disinflationary process in Portugal (1985-88) and helps explaining why it was virtually costless (see chapter 7). A final qualification has to do with the absence of capital controls. It is clear that with perfect capital mobility any anticipated (announced) realignment, either under pegged rates or crawling-peg rules, would immediately lead to a speculative attack that would exhaust central bank's reserves. If the fundamentals change, can the level of the nominal exchange-rate remain credibly constant or slow moving?

Conclusions

In this chapter we have reviewed from a theoretical perspective what kind of macroeconomic incentives EC countries might have to join the ERM. The argument most often referred to is related to the credibility problem facing a government at the outset of a disinflationary programme. By joining the ERM the government or the central bank of the entrant will benefit from Bundesbank reputation of being tough on inflation. This corresponds, as we have seen, to achieving and sustaining the zero inflation precommitment equilibrium of the one-shot game as a non-cooperative equilibrium in a repeated game. The work reviewed (Giavazzi and Giovannini (1989)) suggests that much of the incentive to join the ERM is due to the increase in the variability of the real exchange rate which results from accepting the rules of the arrangement. We suggest an alternative view of the incentives to join the ERM which can be derived from Dornbusch-Buiter-Miller's analysis. The incentive to join the ERM is understood if governments have decided to bring down inflation in the short-run: this is because the output costs of disinflation are likely to be lower under an immediate-peg strategy than under a floating regime. Within our framework we can also understand the importance of precommitment because, in general, the output costs of disinflation are decreasing in the horizon of the announcement (or anticipation) of the policy shift and because in some cases full credibility allows immediate jumps from one steady-state to another. Nevertheless, the case for operating the ERM with some flexibility under perfect capital mobility seems persuasive. A policy of permanent and gradual reduction in the rate of exchange-rate depreciation achieves a first-best result. This variant of the model highlights also the importance of a coordinated and gradual reduction in the growth rate of wages and the exchange-rate and the dangers for price stability of an automatic accommodation of exogenous shocks to the wage. An important qualification of our analysis is that it does not allow any changes in the fundamental determinants of the real exchange-rate to occur and in particular we have assumed the absence of any fiscal imbalances. This is justified because in this chapter we have been focusing on the macroeconomic incentives that governments and central bankers might have in "tying their hands" during a "monetary" disinflationary process.

ANNEX

In this Annex we present the solution of the models and the proof of the results discussed in the chapter. We keep the numbering of the equations as in the main text to facilitate cross-references. Whenever necessary, other equations are introduced and numbered beginning in (A1), (A2), etç.

The log-linear equations of the model are as follows.

$$m - p = k\,y - \lambda\, r \quad k,\lambda>0 \quad \text{(LM curve)} \tag{22}$$
$$y = -\gamma\,(r - Dp) + \delta\, c \quad \gamma,\delta>0 \quad \text{(IS curve)} \tag{23}$$
$$Dw = \phi y + Dp \quad \phi>0 \quad \text{(Phillips curve)} \tag{24}$$
$$p = \alpha\, w + (1-\alpha)\,(e+w^*) \quad \text{(Price index)} \tag{25}$$
$$De = r - r^* - \tau \quad \text{(Uncovered interest parity)} \tag{26}$$

where: m-p is the level of real balances; m is the nominal money stock; p is the domestic price level; y is domestic income (zero represents full employment); r is the domestic nominal interest rate on non-money assets; w is the nominal wage level; r^* is the foreign nominal interest rate on non-money assets; $c = e-w+w^*$ is the real exchange rate or an index of competitiveness; e is the nominal exchange rate (domestic currency price of foreign currency); w^* is the foreign wage level; τ is the rate of tax on capital inflows; D is the differential operator (Dx=dx/dt) to be taken as the right-hand time derivative of x. Except for interest rates all variables are in logarithms.

Solution under flexible exchange-rates

In what follows $Dm=\mu$ is the rate of growth of the domestic nominal money supply, the policy variable under flexible exchange-rates. Real liquidity (l) is defined as nominal balances deflated by the wage level (l=m-w). It is a predetermined variable and, unless otherwise stated, it only jumps in the short run in response to discontinuous changes in μ.

The income and interest rate variables can be eliminated to obtain a reduced form system of two equations in liquidity and competitiveness as follows:

$$Dl = (1/\lambda)\, l + a_{12}\, c + b_{11}\, \tau + \mu \tag{27}$$
$$Dc = a_{22}\, c - (\gamma/\delta)\, a_{22}\, \tau \tag{28}$$

where:
$a_{12} = -\{(1-\alpha)[1-\alpha(1+\phi\gamma)+k\delta] + \lambda\phi\delta\}/\lambda[1-\alpha(1+\phi\gamma)] < 0$
$a_{22} = -\phi\delta/[1-\alpha(1+\phi\gamma)] < 0$
$b_{11} = \{\lambda[1-\alpha(1+\phi\gamma)] + k\gamma(1-\alpha) + \lambda\phi\gamma\}/\lambda[1-\alpha(1+\phi\gamma)] > 0$
and $[1-\alpha(1+\phi\gamma)] > 0$ is assumed to be positive to ensure that the system (27)-(28) is saddle-path unstable. To arrive at (27)-(28) we set $w^*=r^*=0$.

Imposing the saddle-path solution means that an increase in effective demand increases output at a given nominal interest rate and a given level of competitiveness. To show this, add an exogenous demand-shock variable (g) to the IS equation (23) and by appropriate substitutions, using equations (24)-(26), derive the following expression for real output:

$$y_t = \{(1-\alpha)/[1-\alpha(1+\phi\gamma)]\}[-\gamma r_t + \delta c_t + g_t] \tag{A1}$$

From (A1) we see that $\partial y/\partial g > 0$ iff $[1-\alpha(1+\phi\gamma)] > 0$.

Steady-state

The long-run equilibrium values of liquidity (l^*) and competitiveness (c^*) are found by setting $Dl=Dc=0$ in (27) and (28) and solving the system of equations. The steady-state values are as follows:

$$l^* = -\lambda(\mu+\tau) + (1-\alpha)(\gamma/\delta)\tau \tag{29}$$
$$c^* = (\gamma/\delta)\tau \tag{30}$$

General solution

Note that the system (27)-(28) is recursive. We begin by solving for the path of competitiveness. With $\tau=0$ in (28) we have the following differential equation:

$$Dc = a_{22}c_t \tag{A2}$$

Applying Laplace transforms to (A2) we get:

$$s\,\mathfrak{L}\{c_t\} - c_o = a_{22}\,\mathfrak{L}\{c_t\} \tag{A3}$$

where s is the dummy variable associated with the Laplace transforms; c_o is the initial value of competitiveness; and $\mathfrak{L}\{.\}$ denotes the Laplace transform of the variable. Solving the linear equation

(A3) in c, we get:

$$c_t = c_o\ \mathcal{L}^{1}\{1/(s-a_{22})\} \tag{A4}$$

where $\mathcal{L}^{-1}\{.\}$ denotes the inverse of the Laplace transform. Therefore, the general solution of the path of competitiveness is given by:

$$c_t = c0\ \exp(a_{22}t) \tag{A5}$$

In deriving equations (A3) and (A5) we used some of the basic proprieties of the Laplace transform, which are:

$$\mathcal{L}\{f'(t)\} = s.\mathcal{L}\{f(t)\} - f(0)$$
$$\mathcal{L}\ \{c_1.f_1(t) + c_2.f_2(t)\} = c_1.\mathcal{L}\ \{f_1(t)\} + c_2.\mathcal{L}\ \{f_2(t)\}$$
$$\mathcal{L}\ \{1\} = 1/s$$
$$\mathcal{L}\{t\} = 1/s^2$$
$$\mathcal{L}\{\exp(a.t)\} = 1/(s-a)$$

where c_1 and c_2 are constants and $f(t)$, $f_1(t)$ and $f_2(t)$ are functions whose Laplace transforms exist and $f'(t)$ denotes time derivative of $f(t)$.

The next step is to solve for the path of liquidity. With $\tau=0$ in (27) we have the following differential equation:

$$Dl = (1/\lambda)\ l_t + a_{12}\ c_t + \mu_t \tag{A6}$$

Applying Laplace transforms to (A6) we get:

$$s\ \mathcal{L}\{l_t\} - l_o = (1/\lambda)\ \mathcal{L}\{l_t\} + a_{12}\ \mathcal{L}\{c_t\} + \mathcal{L}\{\mu_t\} \tag{A7}$$

where l_o denotes the initial level of liquidity.

Solving the linear equation (A7) in l, using (A3), we get:

$$\begin{aligned} l_t = {} & l_o\ \mathcal{L}^{-1}\{1/[s-(1/\lambda)]\} + \\ & + c_o\ \mathcal{L}^{1}\{[a_{12}/(s-a_{22})]/[s-(1/\lambda]\} + \\ & + \mu\ \mathcal{L}^{1}\{(1/s)/[s-(1/\lambda]\} \end{aligned} \tag{A8}$$

From (A8) we can derive the general solution for the path of liquidity, which is given by:

$$\begin{aligned} l_t = {} & \{l_o - c_o\ a_{12}/[a_{22} -(1/\lambda] + \lambda\mu\ \}\ \exp(t/\lambda) + \\ & + \{c_o\ a_{12}/[a_{22} -(1/\lambda]\}\ \exp(a_{22}t) - \lambda\mu \end{aligned} \tag{A9}$$

In deriving equation (A8) we used the basic proprieties of the Laplace transform and partial fractioning, as follows:

$$\mathcal{L}^{-1}\{1/[s-(1/\lambda)]\} = \exp[(1/\lambda).t]$$

$$\mathcal{L}^{-1}\{ 1/[(s-a_{22}).(s-1/\lambda)]\} = \mathcal{L}^{-1}\{[-1/(a_{22}-1/\lambda)].[1/(s-1/\lambda)]\} +$$

$$+ \mathcal{L}^{1}\{[1/(a_{22}-1/\lambda)].[1/(s-a_{22})]\} =$$

$$= [1/(a_{22}-1/\lambda)].[\exp(a_{22}t)-\exp(t/\lambda)]$$

$$\mathcal{L}^{1}\{(1/s)/[s-(1/\lambda)]\} = \mathcal{L}^{1}\{\lambda/(s-1/\lambda)\} - \mathcal{L}^{1}\{\lambda/s\} =$$

$$= \lambda[\exp(t/\lambda)-1]$$

Saddle-path solution

In order to eliminate the potential explosive behaviour of the economy (bubbles), due to the presence of the positive exponential term in (A9), we must set $\{l_o - c_o \; a_{12}/[a_{22} -(1/\lambda)] + \lambda\mu\} = 0$. This condition places the system in the stable manifold, the saddle-path, which corresponds to the negative exponential term in the general solution. The equation of the saddle-path is obtained through the elimination of the explosive part of (A9) and using (A5). It is given by:

$$(l_t - l*) = \{a_{12}/[a_{22} -(1/\lambda)]\} (c_t - c*) \qquad (A10)$$

where l* and c* are the steady-state values of the system.

Anticipated disturbances: how to determine the value of the initial jump in competitiveness

When the government announces (t=0) that a shift in monetary policy will occur at t=T (or when economic agents anticipate that shift) the economy cannot remain in the saddle-path. From the date of the announcement until the moment the policy shift is implemented the economy must follow an explosive path given by (A5)-(A9). From time t=T onwards the economy will follow, again, the saddle-path trajectory given by (A5)-(A10). To calculate the jump in the level of competitiveness that occurs at the moment of the announcement we use the fact that no discontinuity can occur at t=T. This implies that c_o must be such that:

$$l_T^- = \{l_o - c_o\, a_{12}/[a_{22} - (1/\lambda)] + \lambda\mu_o\}\exp(T/\lambda) +$$

$$+ \{c_o\, a_{12}/[a_{22} - (1/\lambda)]\}\exp(a_{22}T) - \lambda\mu_o =$$

$$= l_T^+ = -\lambda\mu_1 + \{a_{12}/[a_{22} - (1/\lambda)]\}\, c_o \exp(a_{22}T) \qquad \text{(A11)}$$

where μ_o and μ_1 are, respectively, the growth rates of the money supply before and after the policy shift.

From (A11) we derive the general equation of the jump in the real exchange rate as follows:

$$(c_o - c*) = -\{[a_{22} - (1/\lambda)]/a_{12}\}.\lambda(\mu_o - \mu_1).\exp[-(1/\lambda)T] \qquad (31)$$

Solution under pegged exchange-rates

To characterize the behaviour of the economy under fixed ex-change-rates we solve the system of equations (22)-(26) assuming that the money supply is an endogenous variable that the exchange-rate is an exogenous variable. The policy variable under fixed exchange-rates is the level of the exchange-rate ($e_t = \hat{e}$). Under these assumptions the system of equations (22)-(26) simplifies to the following differential equation:

$$D(\hat{e} - w) = a_{22}\,(\hat{e} - w)_t \qquad (34)$$

where $(\hat{e} - w)_t$ is the real exchange-rate.

<u>General solution</u>

Applying Laplace transforms to (34) we get:

$$s\,\mathfrak{L}\{(\hat{e} - w)_t\} - (\hat{e} - w)_o = a_{22}\,\mathfrak{L}\{(\hat{e} - w)_t\} \qquad \text{(A12)}$$

Solving the linear equation (A12) in $(\hat{e} - w)$, we get:

$$(\hat{e} - w)_t = (\hat{e} - w)_o\,\mathfrak{L}^{-1}\{1/(s - a_{22})\} \qquad \text{(A13)}$$

The general solution for the path of competitiveness is given by:

$$(\hat{e} - w)_t = (\hat{e} - w_o).\exp(a_{22}t) \qquad (35)$$

In deriving equation (35) we used the basic proprieties of the

Laplace transform.

Note that under pegged rates (with zero foreign inflation) we must have r=0, from the interest parity equation (26) (De=0 => r=0), and we must have $Dp = \alpha.Dw$ from the price index equation (25). Thus, by substitution in the LM equation (22) we derive the endogenous path of the money supply as follows:

$$m^{p} = \alpha.w + (1-\alpha).\hat{e} + k.[\ \gamma\alpha\ Dw + \delta\ (\hat{e}-w)\ ] \qquad (A14)$$

which rearranging and using (34) yields:

$$(m^{p}-w) = (1-\alpha).(\hat{e}-w) + k.[\ \gamma\ \alpha\ -a_{22}\ (\hat{e}-w) + \delta\ (\hat{e}-w)\ ] \qquad (A15)$$

Using (35) this implies the following path for liquidity:

$$l^{p}{}_{t} = a.(\hat{e} - w)_{t}$$

$$l^{p}{}_{t} = a.(\hat{e} - w_{0}).\exp(a_{22}t) \qquad (36)$$

where: $a = \{(1-\alpha)[1-\alpha\ (1 + \phi\gamma) + k\delta] / [1-\alpha\ (1 + \phi\gamma)]\} > 0$; $a_{22} = -\phi\delta/[1-\alpha\ (1 + \phi\gamma)] < 0$, and, $l^{p} = m^{p} - w$, the money supply (m^{p}) being an endogenous variable.

Equation (36) is the locus of the pegged exchange-rate regime in the (l,c) space. Note that in the pegged regime there are no elements of instability as the exponential term in (35)-(36) is negative. This means that there is no need to specify a "saddle-path" trajectory.

Steady-state

The steady-state of the pegged regime is given by:

$$D(\hat{e} - w) = 0 \Rightarrow \hat{e} = w \text{ or } c^{p}=0 \qquad (37)$$

$$l^{p} = 0 \qquad (38)$$

From equations (29)-(30) and (37)-(38) we can see that the steady-state of the pegged regime is equal to the steady-state of the flexible regime when the growth rate of the money supply is zero (zero inflation).

Slopes of the saddle-path and of the locus

For the analysis that follows it is useful to compare the slopes of the saddle-path of the floating regime (flex) and of the locus of the pegged regime (peg). The locus (peg) will be steeper than the saddle-path (flex), in the (l,c) space, if:

$$a > a_{12}/[a_{22} - (1/\lambda)] \qquad (A16)$$

or, by substitution, if:

$$k.\delta/[1- \alpha\ (1 + \phi\gamma)] > \alpha/(1-\alpha) \qquad (A17)$$

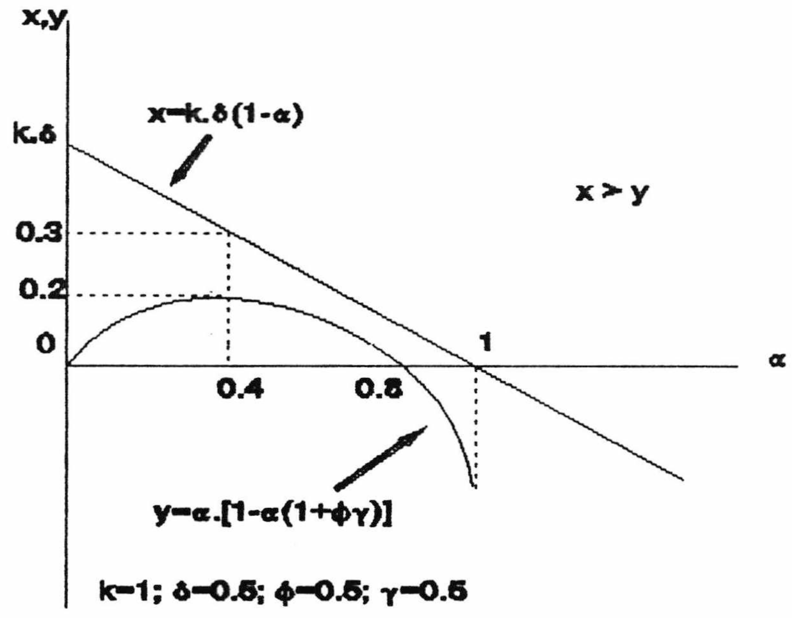
As the denominator in the right-hand side of (A16) is always larger than the denominator in the left-hand side and, as both sides are positive, the inequality is likely to hold, at least under reasonable values of the parameters k and δ, for any feasible value of α. This is illustrated in figure A1.

The line (x) represents the left-hand side of the inequality and the parabola (y) represents the right-hand side, expressing both sides as functions of α. For the values considered, x>y for any value of α. For lower values of the structural parameters the inequality might be reversed in particular for values of α in the vicinity of 0.5. In the main text we have assumed that the locus (peg) is steeper than the saddle-path (flex) because it leads to a more plausible and interesting dynamics.

Switching from flexible to fixed exchange-rates

We start from a steady-sate of the flexible regime with a positive rate of inflation, when the private sector anticipates the regime change to occur at t=T. The exchange rate jumps immediately in order to eliminate all future capital gains (losses). At the moment of pegging liquidity jumps but there is no discontinuity in

Figure A1



the path of the real exchange rate.

From (A5) and (35) the initial jump in competitiveness is given by e^J_0 such that:

$$\hat{e} - w_T = (e^J_0 - w_0).\exp(a_{22}T) \qquad \text{(A18)}$$

ensuring that at time t=T the exchange rate reaches the level at which it will be pegged ($e_T = \hat{e}$).

From (A9) and (A18) we determine the path of liquidity between the moment of the anticipation and the moment of the policy change (0<t<T) as follows:

$$l^F_t - (-\lambda\mu) = (\hat{e}-w_T).\{a_{12}/[a_{22} - (1/\lambda)]\}.$$

$$.\exp(-a_{22}T).[\exp(a_{22}t)-\exp(t/\lambda)] \qquad \text{(A19)}$$

From (A19) we can see that the behaviour of the economy after the anticipation will differ from its unperturbed path $[l^F_t-(-\lambda\mu)]$ depending on the level of the peg and on the moment of the anticipation. In particular:

-if $\hat{e} > w_T \rightarrow [l^F_t-(-\lambda\mu)] < 0$ which corresponds to the undervalued peg;

-if $\hat{e} < w_T \rightarrow [l^F_t-(-\lambda\mu)] > 0$ which corresponds to the overvalued peg;

From (A19) and (36) the jump in liquidity at the moment of pegging is given by:

$$l^P_T - l^F_T = (\hat{e}-w_T).$$

$$.\{a - a_{12}/[a_{22} -(1/\lambda)]. [1 - \exp(1/\lambda - a_{22})T] +$$

$$+ \lambda\mu \qquad (A20)$$

Crawling-peg solution

To characterize the behaviour of the economy under the crawling-peg regime we solve the system of equations (22)-(26) assuming that the money supply is an endogenous variable and that the exchange-rate is an exogenous variable. The policy variable under the crawling-peg is the rate of change the exchange-rate ($De = D\hat{e}$). Under these assumptions the system of equations (22)-(26) simplifies to the following differential equation:

$$Dw = De - a_{22}.(e - w)_t \qquad (A21)$$

or

$$Dw - a_{22}.w_t = De - a_{22}.e_t$$

where $a_{22} = -\phi\delta/[1- \alpha\ (1 + \phi\gamma)] < 0$.

The crawling-peg rule is given by:

$$De = \exp\ (-\rho.t) \qquad (A22)$$

which implies that the path of the nominal exchange rate after the regime switch is given by:

$$e_t = (e_o + 1/\rho) - (1/\rho).\exp(-\rho.t) \qquad (A23)$$

By substitution of (A22) and (A23) in (A21) we get

$$Dw-a_{22}.w_t = \exp(-\rho.t)-a_{22}.[(e_o + 1/\rho)-(1/\rho).\exp(-\rho.t)] \qquad (A24)$$

Solving the differential equation (A24) we find the path of nominal wages under the crawling-peg. Applying Laplace transforms to (A24) and using the basic proprieties of the Laplace transform we obtain:

$$\mathfrak{L}\{w_t\} = [1/(s-a_{22})].w_o + [1+a_{22}/\rho].[1/(s-a_{22})].[1/(s+\rho)] - \\ - a_{22}.(e_o + 1/\rho).(1/s).[1/(s-a_{22})] \qquad (A25)$$

The solution is given by:

$$w_t = (e_o + 1/\rho) - (1/\rho).\exp(-\rho.t) + (w_o-e_o).\exp(a_{22}.t) \qquad (A26)$$

In deriving (A26) we used the partial fractioning

$$[1/(s-a_{22})].[1/(s+\rho)] = [1/(\rho+a_{22})].\{[1/(s-a_{22})]-[1/(s+\rho)]\}$$

$$(1/s).[1/(s-a_{22})]=(1/a_{22}).\{-(1/s)+[1/(s-a_{22})]\}$$

Using (A23) and (A26) it follows immediately that the path of competitiveness under the active crawling-peg is given by:

$$e_t - w_t = (e_o - w_o).\exp(a_{22}.t) \qquad (A27)$$

and it then follows that if $e_o=w_o$ competitiveness will remain unchanged throughout the transition to the new equilibrium. Starting from the steady-state of the flexible regime where $w^*=e^*$ ($c^*=0$) we must have:

$$e_t = w_t \quad \text{or} \quad c_t = 0 \qquad (41)$$

Note that under the crawling-peg (with zero foreign inflation) we must have $r=De$, from the interest parity equation (26), and we must have $Dp = \alpha.Dw+(1-\alpha)De$ from the price index equation (25). Thus, by substitution in the LM equation (22) we derive the endogenous path of the money supply as follows:

$$m^c=\alpha.w+(1-\alpha).e+k.\{\gamma[De-\alpha Dw-(1-\alpha).De]+\delta(e-w)]-\lambda De \qquad (A28)$$

which rearranging and using (41) yields:

$$l^c = (m^c-w)_t = -\lambda De \qquad (42)$$

CHAPTER 6

The costs of disinflation and the ERM: empirical evidence

Introduction

The disinflation in the countries participating in the exchange rate mechanism of the EMS (ERM) since the early 1980's has been substantial. As we have seen in chapter 5, the low inflation rates achieved within the ERM can be interpreted, in the light of the traditional ideas, as being the result of the disciplining feature of the arrangement. However, this decline in the inflation rate within the ERM is not exceptional when we compare it with the disinflation that has occurred in the rest of the industrialized countries during the same period, despite the floating exchange rate regime chosen by some of them. For example, Coe et al. (1988), studying the disinflation of the 1980s in the OECD-countries, conclude that the principal factors accounting for the disinflation were the restrictive monetary policies adopted and that the prices of commodities (oil and non-oil) and exchange-rate developments had only a minor role. This point is illustrated most clearly in figure 1 where we show inflation rates in Germany, France and U.S.A. from 1961 until 1990 based on GDP deflators (all the data used in this chapter is taken from European Economy). Three important years are indicated in the figure: 1973, 1979 and 1986. These years correspond respectively to the first oil shock and the final breakdown of the Bretton Woods system; the second oil shock and the beginning of the EMS; the third (negative) oil shock and the return, at a global international level, to a greater management of and concern about exchange rates. As the figure shows, during the 1980s, both France and the U.S.A. reduced their inflation rates towards the German standard, the different disinflationary strategies chosen notwithstanding (the dollar floated whilst the french franc participated in the ERM). This evidence casts some doubts on the traditional ideas about the inflationary bias of the floating regime.

To see what the different disinflationary strategies implied in practice, let us look at the path of competitiveness and real interest rates. We shall not be concerned here with the long-run swings in the real exchange rate and in the real interest rate. Instead we shall direct our attention to the evidence on the path of competitiveness and real interest rates during the disinflationary process of the 1980's and ask whether it is consistent with the predictions of the theoretical analysis of chapter 5. As we have seen, disinflation under the monetary-tightening-floating strategy (U.S.A./dollar) implies an initial large loss of competitiveness and a higher level of real interest rates, whereas the immediate-peg strategy (France/franc) is likely to imply a greater stability of competitiveness and a lower level of real interest rates.

In figure 2 we show the path of competitiveness for the dollar, the french franc and the deutschmark, measured by relative unit labour costs, from 1961 to 1990 (here, an increase in the index means loss of competitiveness). The figure shows the relative stability of the real exchange rate of the french franc, closely tied to the path of the real exchange rate of the deutschmark, particularly during the 1979-1986 disinflationary period; the volatility of the real exchange rate of the dollar, and, in particular, the sharp real appreciation of the early 1980's followed by the steep decline of the 1985-1988 period.

In figure 3 we show the path of real interest rates, measured as long-term nominal interest rates deflated by actual inflation rates (GDP deflators). As the figure shows, the disinflationary period of 1980-1986 is marked by an increase in the general level of real interest rates. We note also during that period the gradual convergence of French real interest rates towards the German level; the steep increase and the higher level of real interest rates in the U.S.A..

This evidence is broadly consistent with the theoretical analysis presented in chapter 5. However, in the light of the modern thinking about exchange rates and inflation the question that has to be answered is whether and to what extent the ERM has made the reduction of inflation possible at a lower cost than other exchange rate regimes. According to the sacrifice ratio (SR) of disinflation, calculated as the ratio of the cumulative unemployment above the 1981 level divided by the disinflation between 1981 and 1988, presented in Dornbusch (1989), the costs were higher in Germany (SR = 4.17) and France (SR=1.41) than in the U.S.A. (SR=-0.09) and, according to the misery index (MI), calculated as the sum of the inflation and unemployment rates from 1980 to 1988, presented in De Grauwe (1990), the costs were higher in France (MI=16.8) than in the U.S.A. (MI=12.8) and were less costly in Germany (MI=9.9). This casts some doubts on the relevance of the reputational effects of the ERM and contradicts the prediction that the peg strategy should be less costly than the float strategy.

This chapter is divided in three main parts. In the first section we compare the disinflationary experiences in the United

Kingdom and France during the 1980s. The comparison is interesting because in 1979 France joined the exchange rate mechanism of the EMS, whilst the United Kingdom remained an "outsider" and sterling continued to float. The evidence presented in the first section confirms what we have already seen in the introduction, namely that the disinflationary process occurred independently of the exchange rate regime chosen; and that the reputational effects of ERM membership might be more difficult to realise than the theoretical literature suggests. However, the evidence suggests, that the disinflationary process in France (peg) was in fact less costly than in the U.K. (flex). In section two we review the empirical literature on the credibility effects of the ERM. This confirms how difficult it is to find any convincing evidence on the significance of the reputational effects of the ERM. A final section presents the main conclusions of the chapter.

6.1 - The disinflationary experience in the United Kingdom and France during the 1980s

In this section we compare the disinflationary experience in the U.K. and France during the 1980s. Our interest in this case study lies in the fact that these are two european countries of similar dimension and level of development that can be seen as having chosen opposite disinflationary strategies during the 1980s. France, by joining the exchange rate mechanism of the EMS in 1979, can be seen as having chosen the immediate peg strategy. Meanwhile, the U.K. remained an "outsider" and sterling continued to float, whilst a programme of monetary restraint and fiscal correction was announced and began to be implemented in 1979.

Inflation rates

During the 1980s both countries experienced a substantial decline in the inflation rate, as illustrated in figure 4. In fact, we can say that by 1986-87 the rate of inflation in the U.K. and France had virtually converged towards the German standard. However, the experience of the last two years of the decade seems to suggest that the nominal convergence achieved between France and Germany is more firmly established than between the U.K. and Germany. This evidence confirms that the disinflationary experience of the 1980s occurred independently of the exchange rate regime chosen.

Competitiveness

As predicted by the theoretical analysis presented in chapter 5 the disinflationary strategy chosen by the U.K. caused an initial sharp loss of competitiveness that was eventually (gradually) reversed. In contrast, the disinflationary strategy chosen by France dampened the initial loss of competitiveness and, eventually, linked the path of the real exchange rate of the franc to that of the mark. This is illustrated in figure 5. Note that by 1986-87, as inflation rates converged, the initial loss of competitiveness of the sterling had been reversed and the real exchange rates of the franc and the mark became closely tied.

Real interest rates

The path of real interest rates is less conclusive. In theory we would have predicted the long-run convergence of real interest rates. As illustrated in figures 6 and 7 there is in fact some convergence of both short-term and long-term real interest rates towards the German average (marked by the horizontal doted lines).

In the case of real interest rates in France there is not only a convergence towards the German level but there is also a close correlation between the changes in real interest rates in both countries. However, this configuration is clearer for long-term rates than it is for short-term rates and in the late 1980s there is a tendency for real interest rates in France to be above German rates. This could be due to the pattern of current account imbalances (or, the savings-investment gap) to be discussed further below.

In the case of the U.K. there is also an apparent convergence in the level of real interest rates. However, the correlation between the path of real interest rates in the U.K. and Germany is much looser than it is between those of France and Germany. This is a clear illustration of the basic difference between the exchange rate regimes chosen: floating gave some monetary autonomy to the U.K. whereas by pegging France gave up much of its monetary autonomy. In this regard it is interesting to note that the path of real interest rates, inflation and competitiveness in the U.K., after 1986, differs quite markedly from those of France and Germany. Whereas in the U.K. there is a downward trend in real interest rates in France and Germany we note exactly the opposite trend, most noticeable in the case of French real interest rates. Although, we could say that the difference is only significant in the direction of the movement and not in the level of interest rates, the fact is that this coincides with a period marked by further nominal convergence between France and Germany and by the interruption of the nominal convergence between these countries and the U.K.. Meanwhile, competitiveness in Germany and France continued to move very closely whereas the sterling appreciated very sharply in real terms.

It is important to note here that there is a feature of the time series behaviour of real interest rates apparently at odds with the theoretical predictions of the model discussed in chapter 5. Looking at figures 6 and 7 we can see that during the 1979-1981 period the real appreciation of the sterling was not led by higher (than German) real interest rates: it is quite the opposite pattern that emerges (see, Buiter and Miller (1983)). However, it is also true that during the same period when real interest rates in the U.K. were below the German level, sterling was appreciating. After sterling reached its peak in 1981, a period marked by real depreciation began. This is the 1982-1986 period when real interest rates in the U.K. were above the German average. Finally, in 1988-89, long-term real interest rates in the U.K. were again below the German rates and sterling was appreciating. This pattern is consistent with the Fisher open rational expectations hypothesis incorporated in the model presented in chapter 5, which states that the domestic-foreign (real) interest rate differential must be equal to the expected/actual (real) exchange rate change. What does not seem to be explained by Buiter and Miller's model is the fact that the "overshooting" appeared stretched over time. An explanation that helps to explain this divergence can be offered based on the real (long-run) determinants of real interest rates and competitiveness, which we shall discuss below.

Current Account

As figure 8 shows the period 1979-1981 is marked by current account deficits in France and Germany and by surpluses in the U.K., a pattern that can be attributed, among other reasons, to the "oil factor" and fiscal policies. It is possible to argue that during the late 1970s and early 1980s there were real factors pushing real interest rates up in Germany and France (shortage of savings over investment) and pushing it down in the U.K. (excess of savings over investment); the same factors would also warrant an initial real depreciation of the sterling in contrast with a long-run or trend real appreciation. In fact we can say that the change in thrift that occurred in that period decreased long-term real interest rates in the U.K. relative to the world level and caused a non-speculative outflow of long-term capital from the U.K.. This had an impact effect and a cumulative effect. The existence (or emergence) of an integrated international market for long-term capital requires the convergence of long-term real interest rates. The impact effect of the change in thrift is an initial decline in domestic real interest rates followed by a gradual convergence towards the world level (increasing in the U.K.) and a real depreciation (of sterling), both caused by the outflow of long-term capital. The cumulative impact is different and is as follows. The outflow of capital due to the change in thrift raises claims on foreigners, without affecting the capital stock of the country (U.K.), therefore increasing wealth and consumption. This effect will tend to reduce savings over time. In the new steady-state the stock of foreign assets held by residents will be higher and the flow of capital will stop. This means that the real exchange rate must appreciate relative to its initial level in order to balance the current account. It is the real appreciation that ensures the decrease in the trade balance necessary to offset the higher level of income receipts due to the increased claims on foreigners. These are the conclusions of the FEREX model (Fundamental Real Exchange Rate Model) due to Stein (1990), which is a neo-classical model that concentrates exclusively in the long-term determinants of real interest rates and competitiveness and ignores short-term factors.[1] Similar conclusions about the relation between equilibrium real exchange rate movements and the current account can also be drawn using the approach suggested by Dornbusch and Fischer (1980). A complete discussion of this topic is beyond our purposes; what is important to note here is that it is possible that, in the early 1980s, a combination of the effects of long-term non-speculative outflows of capital (caused by changes in thrift) and short-term speculative inflows of capital (caused by monetary tightening) generated the observed persistence in the real appreciation of sterling.

The same reasoning points out a critical disequilibrium trend, should the U.K. repeat the same disinflationary strategy of the 1980s in the 1990s. As figure 9 shows, the large current account deficits of the late 1980s suggest that a situation of relative shortage of savings over investment could be developing in the U.K., precisely the opposite of the situation that occurred in the early 1980s. Therefore the real appreciation of sterling in the late 1980s would have had to have been reversed as the net foreign asset position of the U.K. was eroded and a further sharp loss in competitiveness implied by monetary-tightening-under-floating appeared an infeasible or disequilibrium option when sterling finally joined the ERM (September, 1990). This suggests that, in the late 1980s, the choice of the disinflationary strategy in the U.K. was constrained by the state of the current account and reveals a flaw in the theo-

1 - Stein's model is presented in annex 1 to chapter 2.

retical analysis of chapter 5 in the sense that it ignores stock-flow interactions.

Unemployment

There is now sufficient evidence accumulated to show that the disinflationary process was not costless. We illustrate this in figure 10 where we plot the inflation-unemployment "scissors" of Germany, France and the U.K.. The "scissors" are just a different way of looking at the short-run Phillips curves. In the left-hand axis we measure the unemployment rate and in the right-hand axis we measure the inflation rate: opening up the scissor means bringing down inflation at the cost of increasing unemployment, and closing the scissor means bringing down unemployment at the cost of increasing the inflation rate. Plotting in the same figure the paths of inflation and unemployment over the 1979-1989 period a similar scissor configuration appears in all three countries. This illustrates the fact that disinflation had its costs in terms of unemployment: even Germany had to pay in terms of increased unemployment to keep the inflation rate low.

It is interesting to note that the nominal divergence between the U.K. and the other two EC partners in the late 1980s is associated with the pronounced closing of the scissors in the U.K., in contrast with what happened in France and Germany where the scissors remained open. This reveals a difference in policy stance that was already apparent from our discussion of the path of real interest rates.

The costs of disinflation

The evidence presented suggests that the reputational effects of Bundesbank's credibility, both in Germany and in France, might be less important, or at least more difficult to realise, than the theoretical literature suggests. Nevertheless, it is interesting to try to quantify the output costs of disinflation in the countries concerned. Table 1 presents the sacrifice ratios and misery indices for France, Germany, and the U.K.. We have added the values for the U.S.A.. The countries are ordered by decreasing output costs of disinflation.

The first point to note in our calculations is that they imply exactly the same ordering of the countries as found by Dornbusch and De Grauwe and presented in the papers already mentioned, despite the differences in sample and source of data. Looking at the misery index the ordering appears to be consistent with the credibility theory because of the three european countries considered Germany shows the lower cost and the U.K. the higher. However, as predicted by Buiter and Miller's analysis of the two main internationally traded currencies the costs were higher for the more volatile currency (dollar) and lower for the less volatile (mark). Looking at the sacrifice ratio the ordering contradicts the credibility theory because, among the european countries, the sacrifice ratio was higher in Germany. The sacrifice ratio contradicts also Buiter and Miller's analysis because, of the two most internationally traded currencies the costs were higher for the more stable (mark). By contrast, the relative ordering of France and the U.K. is consistent with Buiter and Miller's analysis. It should be noted that the non-linear nature of the relation between inflation and unemployment tends to penalize the country with the lowest rate of inflation when the sacrifice ratio is used. This should be taken into account when interpreting the reversal of the relative position of Germany.

Table 1 – Output costs of disinflation (1980-1989)

Sacrifice Ratio		**Misery Index**	
Germany	= 21.7	U.K.	= 17.2
U.K.	= 6.7	France	= 16.2
France	= 4.7	U.S.A.	= 12
U.S.A.	= 3.1	Germany	= 8.7

Sacrifice ratio: is the ratio of the cumulative unemployment above the 1979 level divided by the disinflation between 1980 and 1989;
Misery index: is the sum of the inflation and unemployment rates in each year from 1980 to 1989.

Summarizing, we have not found any conclusive evidence on the reputational effects of ERM membership. Pegging to a low inflation country will certainly reduce inflation, at least in the long-run, but the same result can be achieved through a policy of monetary tightening under floating. As we have seen, some of the evidence suggests that a peg strategy is less costly than a flex strategy (U.K. vs. France, for example). However, this might not be the result of reputational effects. As the analysis of chapter 5 suggests the difference can also be explained by the different paths of competitiveness and real interest rates implied by the choices, rational expectations, and full credibility notwithstanding. But the fact that disinflation was costly, both under pegging and floating, reinforces the view that at the root of the adjustment problem may lie in, either a slow learning process by economic agents or a sluggish adjustment of expectations (lack or prolonged convergence to the rational expectations equilibrium) or with rational expectations, price and wage stickiness resulting from contracting, real wage resistance or more generally from product and labour market distortions. Another reason for the emergence of adjustment costs under pegging could be the lack of or incomplete monetization (inflow of capital) at the moment of the regime switch. This could be related to the non-credibility of the level of the exchange rate chosen at the moment of pegging, a situation likely to arise if the country starts from a situation of current account deficits, thus requiring an equilibrating real devaluation. These are topics which deserve further theoretical and empirical scrutiny. These conclusions must also be compared with the findings of other researchers. We do this in the section that follows.

6.2 - The disinflationary experience in Europe during the 1980s: a critical review of the empirical research on reputational effects

As noted by Blackburn and Christensen (1989) there has been very little empirical research on the credibility and reputational effects. This "state of the art" reflects in part fundamental methodological problems.

Giavazzi and Giovannini (1989) suggest a method for the identification of the role of the EMS in the European disinflation based on the implications of the "Lucas critique". As Lucas (1976) pointed out, statistical relationships between economic variables are likely to be affected by policy regimes. If we can identify changes in policy regimes we can use empirical shifts in the statistical relations among economic variables to give evidence on the effects of the new regimes. Giavazzi and Giovannini apply these ideas to assess the role of the EMS in two steps. Firstly, a reduced-form system of equations for wages, prices and output is specified and estimated over the period preceding the EMS. Secondly, the model is used to forecast inflation and growth during the EMS period. If the equations show parameter instability and overpredict inflation this is interpreted as evidence supporting the view that the EMS has had a credibility effect, decreasing the costs of disinflation. It should be mentioned that if the reputational effects are likely to be reflected in time-varying parameters there must be a way of distinguishing it from the more usual parameter instability that arises from model misspecification. This is a difficult question not addressed by Giavazzi and Giovannini.

The results reported by the authors are far from conclusive. For example, the model estimated underpredicts German wage and price inflation, and overpredicts the growth of output in Germany from the beginning of the EMS. This seems to suggest that the arrangement has caused a loss of Bundesbank's credibility in Germany an idea that cannot be taken too seriously. On the other hand, the model overpredicts French wage and price inflation not from 1979 but from 1982 onwards, suggesting that credibility needs time to be established. However, as output growth in France is also overpredicted from 1980, suggesting a rise in the unemployment rate that did in fact occur, it is impossible to discriminate between a number of views. The shift in expectations that occurred in 1982 could be a delayed credibility effect or, more simply, a consequence of wage and price rigidity or the consequence of the slow adjustment in expectations, as in the analysis developed by Friedman-Phelps (adaptive expectations). The results for the U.K. are very similar to those found for France: overprediction of inflation from 1982 and overprediction of growth from 1980. As mentioned before, France and the U.K. chose different disinflationary strategies. Although some authors have argued that the output costs of disinflation in the U.K. were severe because the Thatcher regime lacked credibility, due to the high level of government indebtedness at the outset of the disinflationary programme (see, for example, Sargent (1986)), what is important here is to stress the similarity of the results found for the U.K. and France. In particular, the shift in expectations (i.e., the predictive failure of the inflation models) arises after a period where growth rates are also overpredicted, which coincides with a period of rising unemployment rates in both countries. Therefore, in our opinion, the methodology used and the results found are unable to discriminate the "time to establish reputation" hypothesis from the "slow adjustment of expectations" or "sticky prices" hypothesis implicit in the more traditional models.[2]

Rejecting the model-building approach, considered as impractical to analyze the costs of disinflation, De Grauwe (1990) compares the experience of the EMS countries with the other OECD countries by looking at selected macroeconomic indicators. The author presents an impressive array of evidence that seems to contradict the credibility hypothesis. Firstly, in the non-EMS OECD-countries unemployment starts declining substantially from 1983 but continues to increase in the EMS where the unemployment rate stabilizes around 10% from 1984. Secondly, in the non-EMS countries a strong inward movement of the inflation-unemployment trade-off occurs since 1983

2 - Further problems with the results presented by Giavazzi and Giovannini are related to the poor diagnostic testing of the models (only autocorrelation tests are reported); the autocorrelated residuals reported in the French inflation equation; the lack of statistical significance of the parameter shifts; and the absence of the computation of the standard errors of the forecasts which precludes any formal tests on the statistical significance of the difference between the model's predictions and actual experience.

whereas in the EMS-countries the trade-off remains stuck at a very unfavorable level from 1984. Thirdly, considering only the European OECD countries the EMS-countries went further in eradicating inflation but were much less successful in reducing unemployment. Fourthly, during the 1980s the growth rates of real output and employment in the EMS-countries have not only declined but have also been on average lower than in the other OECD-countries. Nevertheless, the author does not interpret this as evidence against the credibility hypothesis for two reasons. In the first place the unfavorable performance of the EMS-countries might be related to the inefficiency of the wage bargaining process in some member countries. This hypothesis was tested by the author who found econometric evidence supporting the idea that the different unemployment trends are related to the degree of wage centralization. This confirms the hypothesis developed by Calmfors and Driffill (1988) which states that countries with highly centralized and highly decentralized wage bargaining have the best macroeconomic performance in terms of the inflation-unemployment trade-off. Therefore, it seems to be the coincidence between EMS-countries and countries with intermediate degrees of centralization of the wage bargaining that partially explains the poorer performance of these countries. However, a specific EMS-effect remained to be explained. In order to explain this specific effect De Grauwe interprets the EMS experience as equivalent to the choice between a gradualist disinflationary strategy and the shock therapy followed by the non-EMS countries. We agree with this interpretation of the strategies but not with what follows in the case made by the author. According to De Grauwe the shock therapy, unlike the gradualist, allows a very rapid establishment of credibility, therefore reducing the costs of disinflation. To support this view the experiences of France and the U.K. (and Italy) are compared. In our opinion the choice of these countries is most unfortunate for the case being made by the author because, as we have shown, the costs of disinflation were unambiguously higher in the U.K. than in France. The example chosen is surprising because the misery indices presented by the author lead exactly to the same conclusion that we have drawn: in this particular case, the shock therapy was more costly than the gradualist therapy. Furthermore, as long as the discount rate is positive (i.e. the rate of time preference) the evidence against the shock therapy is reinforced as it brings forward (raises) the unemployment costs of disinflation in the U.K.! But beyond the inefficiencies in the wage bargaining process discussed above, the second reason why the author does not see the evidence presented as contradicting the credibility hypothesis is, because, according to his interpretation, Barro and Gordon's analysis "tells us how incentives of the authorities affect the equilibrium inflation rate" and "is silent about the costs of disinflation". If the credibility hypothesis is silent about the costs of disinflation how can we understand and justify the relevance of the discussion about the "shock vs. gradualist" therapies? We do not agree with this interpretation of the game-theoretic approach and therefore we tend to see De Grauwe's evidence as, at best, inconclusive but certainly not favourable to the hypothesis.

Dornbusch (1989) looking at the disinflationary experience in Ireland presents further evidence that casts some doubts on the significance of the credibility hypothesis. Despite being a member of the ERM from the beginning (within the narrow band) Ireland suffered all the symptoms of the adjustment described in chapter 5 (Buiter and Miller's analysis): real exchange rate appreciation, high real interest rates, massive unemployment and emigration, low growth and a collapse of investment. In fact, at the end of the 1980s, nominal convergence between Ireland and Germany had been achieved but at what seems to have been a very high cost. Furthermore, the combination of low growth and high real interest rates, and the loss of monetary seigniorage, contributed to the emergence of a difficult fiscal situation: Ireland has "the highest debt/GDP ratio among industrialized countries" despite the fiscal correction it underwent throughout the 1980s. As Dornbusch argues, this could be a factor undermining confidence in the Irish currency thus requiring an exchange rate risk premium over German interest rates, delaying the convergence of nominal and real interest rates. This can only reinforce the idea that there is no evidence of a credibility bonus in Ireland.

In a more recent paper Kremers (1990) expresses a different opinion about the Irish experience, presenting econometric evidence supporting the idea that inflation expectations in Ireland were moderated by entry into the ERM. The author's methodology and results are worth describing in some detail. The basic hypothesis is common: consumer price inflation in Ireland depends on cost factors (wages and imported inputs) and international price competition but, because Ireland is a small open economy, the latter factors are likely to be relatively more important. With these considerations in mind the author specified an empirical model where inflation expectations in Ireland are explained by expected inflation in the U.K., expected inflation in the ERM-countries, domestic wage costs and oil prices and the real effective exchange rate. The first factor is included because the Irish pound had been fixed at parity with sterling for over half a century without any capital controls between Ireland and the U.K.. Under these circumstances, the former (smaller) country is expected to be very dependent on monetary policy and price behaviour in the latter (larger). The second factor reflects the expected impact of the termination of the parity with sterling and of the introduction of capital controls, which resulted from Ireland's participation and the U.K.'s non-participation in the ERM. As a consequence of the regime shift, monetary and price developments in Ireland were expected to become more dependent on ERM-countries' developments after 1979. The third factor reflects the influence of domestic (wage) and international (oil) costs. The fourth factor is justified because a real exchange rate appreciation has direct (impact on expectations) and indirect (impact on employment) effects in the inflationary process.

The model of expected inflation was estimated first over the pre-EMS period and then re-estimated over the whole sample [1965(1)-1986(4)]. Actual inflation rates in Ireland, U.K. and ERM-countries (average) were used, justified by the rational expectations assumption. To take account of the simultaneous determination of the three expectational variables, an instrumental variables estimation procedure was used. The basic results found by the author can be summarized as follows. First, a parsimonious model of inflation expectations estimated in the pre-ERM period suggests that the influence of expected inflation in the U.K. was the dominant factor, the influence of wage costs and oil prices being relatively small. The level and the changes in competitiveness did not affect expectations in the pre-ERM period: only sharp movements (accelerations) were found to have a significant, though lagged, effect. Second, the model breaks down when extended beyond 1979. In order to find the source of the model breakdown the expectations model was estimated using the entire sample allowing shifts in the coefficients on U.K. and ERM inflation and competitiveness (multiplicative dummies). It was possible to find a parsimonious model for Irish inflation expectations that passes several stringent diagnostic tests and does not show parameter instability. This model reveals that there is a sharp shift in importance from expected U.K. inflation to expected ERM inflation after 1979(1) and that during the ERM period the lagged level of competitiveness became an important determinant of expected inflation and the lagged effects of accelerations in the loss of competitiveness were shortened.

Finally, the post-1979 coefficients were estimated by recursive instrumental variables. This exercise confirmed that there is no evidence of significant parameter instability during the 1979-86 period and led to the conclusion that by 1981 the estimated coefficient on expected ERM inflation was already significantly larger than that for the pre-ERM period and that by 1981-82 the estimated coefficient on the level of competitiveness became significantly negative.

Taking these results together the author concludes that Ireland's disinflation policy has derived credibility from its participation in the ERM: firstly, because before 1979 Irish inflation expectations followed expected inflation in the U.K. and after entry into the ERM those expectations began to reflect the expected price behaviour of ERM partners; and secondly, because competitiveness became a more important determinant of expected inflation in Ireland after 1979. However, according to the author, credibility needed time to be established, a process that seems to have taken place during 1979-82 rather than several years after the start of the ERM.

We offer an alternative interpretation of Kremer's results that shows the ambiguity of the claim that Ireland benefited from a credibility bonus. In the first place, we must emphasize that it seems uncontroversial that, by pegging, the small country links its inflation rate to that of the foreign (large) country, at least in the long-run. In our opinion the econometric results presented in the paper support this idea but of course this is not sufficient evidence in favour of the existence of a credibility bonus. Of particular interest however is the fact that the influence of expected U.K. inflation breaks down in 1979, suggesting that the turning point in expectations coincided with ERM-entry. The timing of the structural break might reflect a fall in the U.K. share in Ireland's external trade due to the sharp real appreciation of sterling that occurred during the 1979-81 period; but more importantly, the pre-ERM model underpredicts Ireland's inflation during the 1979-1982 period, a result that suggests that had Ireland not joined the ERM, expected inflation would have been lower during that period because of the very rapid fall in the inflation rate in the U.K. during the 1980-83 period. Therefore, it seems odd to conclude that the credibility of the disinflationary process in Ireland was established during the 1979-82 period, precisely when the ERM option was "shielding" the Irish pound from the real appreciation of the sterling and "insulating" Ireland from the disinflationary process in the U.K.! Secondly, the fact that the level of competitiveness affects inflation (i.e. is statistically significant) only after 1981-82 is not necessarily a sign of a credibility bonus and could indeed reflect the opposite. If the level of the real exchange rate affects competitiveness and employment and, therefore, directly and indirectly affects the inflationary process, we must have a sufficiently long period of sustained real appreciation in order to estimate those effects. As Kremers notes, after a long period of real exchange rate stability, the Irish pound appreciated over 15% in real effective terms during the 1981-86 period and so the unemployment effects of the loss of competitiveness are concentrated in the final years of the sub-sample. In our opinion it is possible that the impact of the level and the second changes in competitiveness estimated during the ERM period are capturing, indirectly, the disinflationary impact of the acceleration and increase in the level of unemployment. But, if inflation subsided only under the impact of the rapid rise in the unemployment rate observed during that period (with the unemployment rate stabilizing in Ireland at an exceptional level in historical terms after 1985) how can we claim that Ireland benefited from a credibility bonus? And, if credibility was established early, during the 1979-82 period, why did the unemployment rate continued to rise after that period? To support our interpretation we show in figure 11 unemployment and inflation rates in Ireland during the 1979-1989 period. Again, a "scissors" pattern is found but, more importantly, we can see that the disinflationary period (1981-86) is marked by a rapid increase in the rate of unemployment as well as by the stabilization of the unemployment rate at a very high level. This is evidence against the idea that credibility was gained early during the 1979-82 period. To summarize we think that the econometric evidence presented by Kremers is, at best, ambiguous and we endorse Dornbusch's interpretation of the Irish experience.

Finally, in reviewing the Italian disinflationary experience of the 1980s, Giavazzi and Spaventa (1989) conclude that participation in the ERM did not automatically produce an improvement of the unemployment-inflation trade-off. According to their analysis the decisive event that produced a turn-around in inflation expectations was the defeat of the trade-unions in the national referendum on wage indexation clauses in 1984. In fact, econometric evidence supports the idea that the shift in expectations occurred in the first quarter of 1985. Nevertheless, the authors suggest that "EMS membership might have helped by providing a justification for unpopular policies".

Conclusions

In this chapter we have looked at the experience of disinflation in the 1980s in some selected countries. The main objective of the chapter was to confront the reputational and credibility hypothesis with the empirical evidence. Because the concepts involved in reputation and credibility are not tangible and also because it is impossible to know what the world would have been under different circumstances, any conclusions must be seen as tentative.

The first conclusion to draw is that the disinflation of the 1980s was a global phenomenon that occurred in spite of the flexible exchange rate regime that prevailed among the main internationally traded currencies. In particular, in Europe, both participants and non-participants in the ERM reduced their inflation rates. This casts some doubts on the validity of the traditional ideas about the inflationary bias of the floating regime.

The second conclusion to draw is that, in general, the disinflation of the 1980s was costly in terms of output and employment, even in the countries participating in the ERM. In fact, the empirical evidence suggests that the reputational effects of ERM-membership might be less important or at least more difficult to realise that the theoretical literature suggests.

The third conclusion to draw is that the paths of competitiveness and real interest rates seem to have influenced the output costs of disinflation, which tended to be lower under pegged rates. This could possibly be a justification for ERM participation, independently of any further credibility effects that might arise. But the fact that disinflation was costly, both under pegging and floating, reinforces the view that at the root of the adjustment problem may lie, either a lack or prolonged convergence to the rational expectations equilibrium or, even with rational expectations, price and wage stickiness resulting from product and labour market distortions.

Put together the evidence seems to suggest that if the output costs of disinflation are to be minimized ERM-participation in itself cannot be a substitute for other measures directed at alleviating market distortions.

Figure 1 Inflation rates in Germany, France and U.S.A.

(1961–1990)

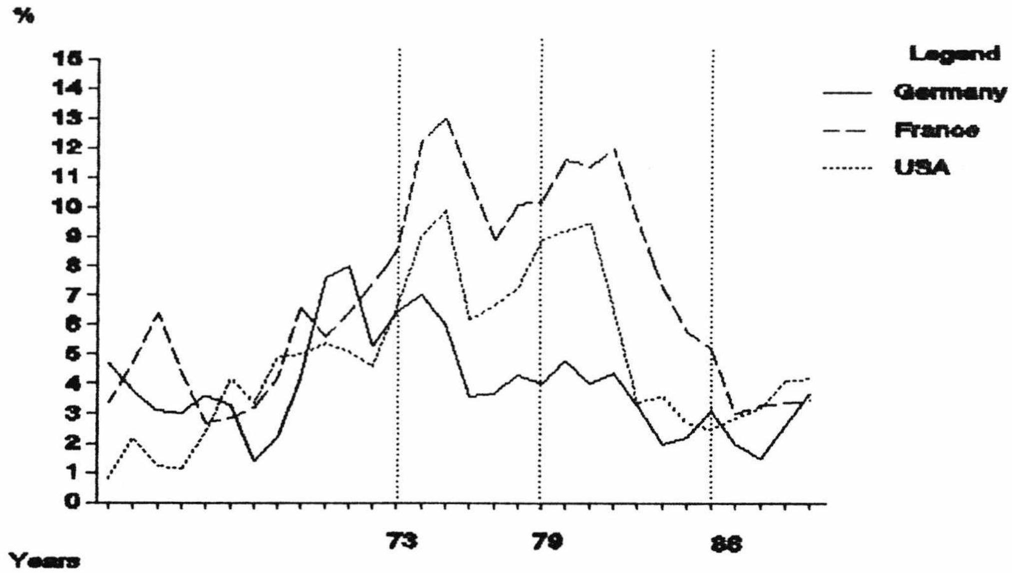


Figure 2 Real exchange rates: mark, franc and dollar (1961-1990)

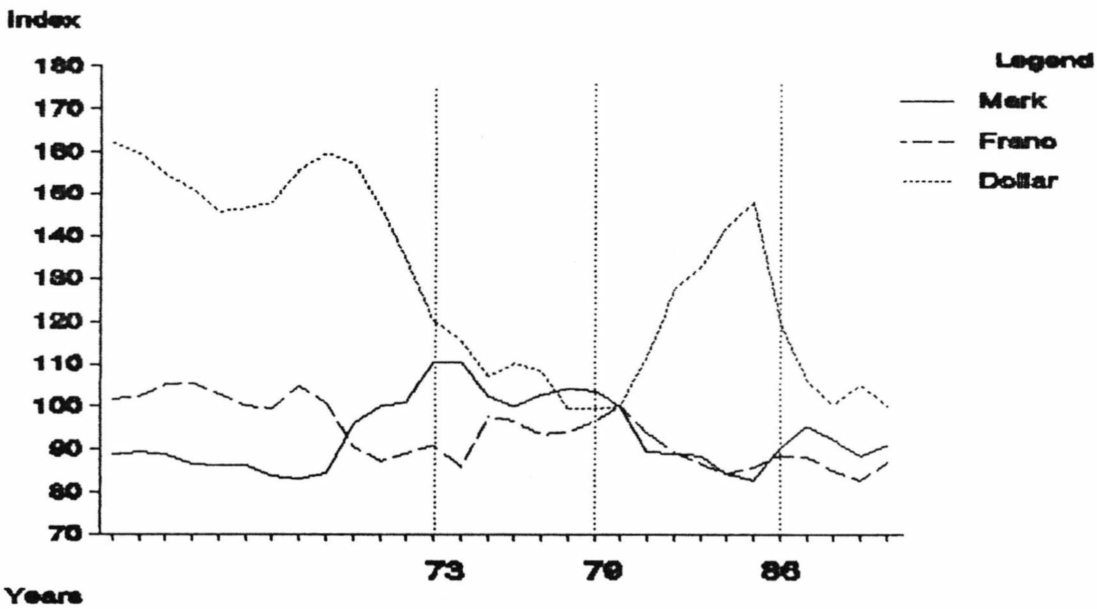


Figure 3 Real interest rates: Germany, France and U.S.A.

(1961-1990)

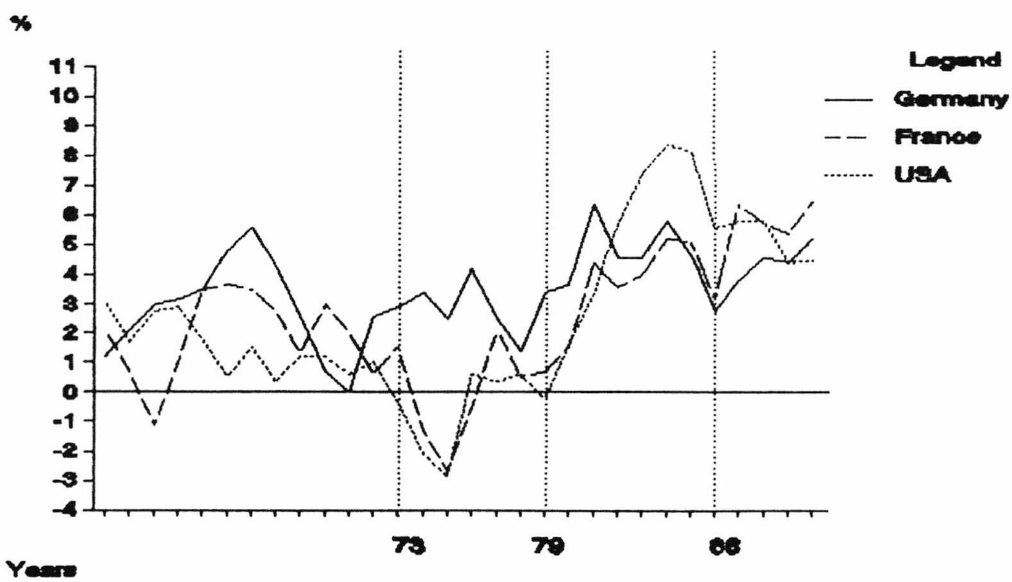


Figure 4 Inflation rates in Germany, France and U.K.

(1979-1989)

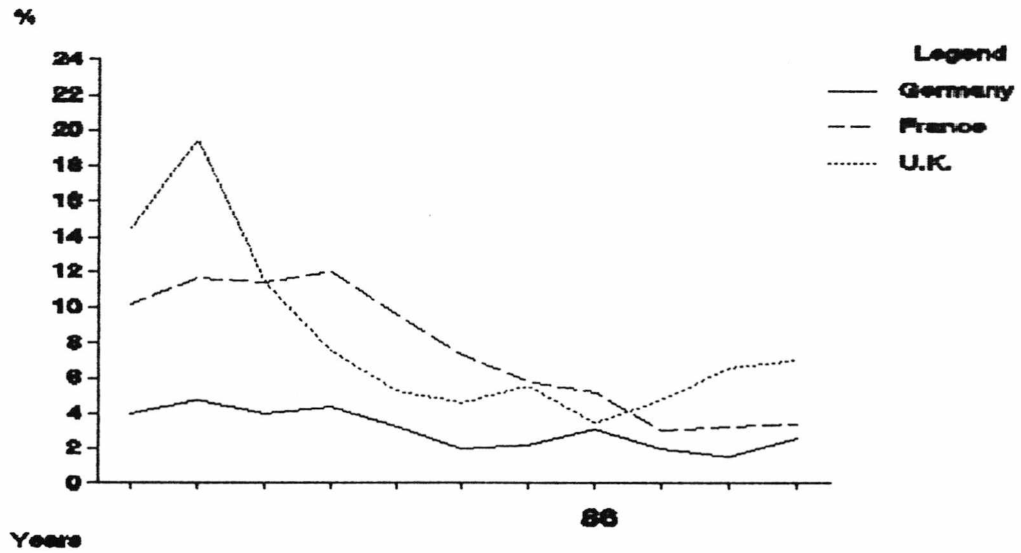


Figure 5 Real exchange rates: mark, franc and sterling

(1979-1989)

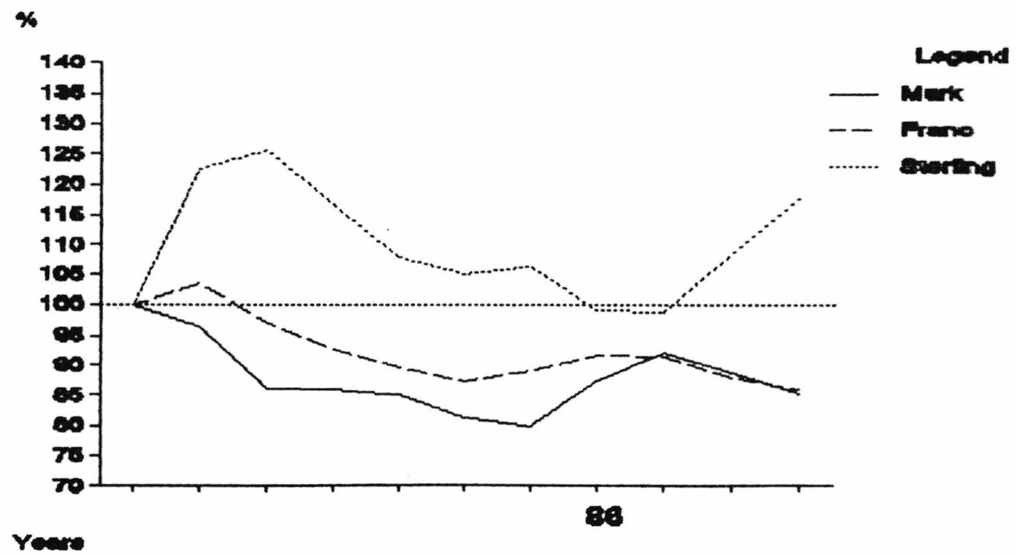


Figure 6 Long-term real interest rates: Germany, France and U.K.

(1979-1989)

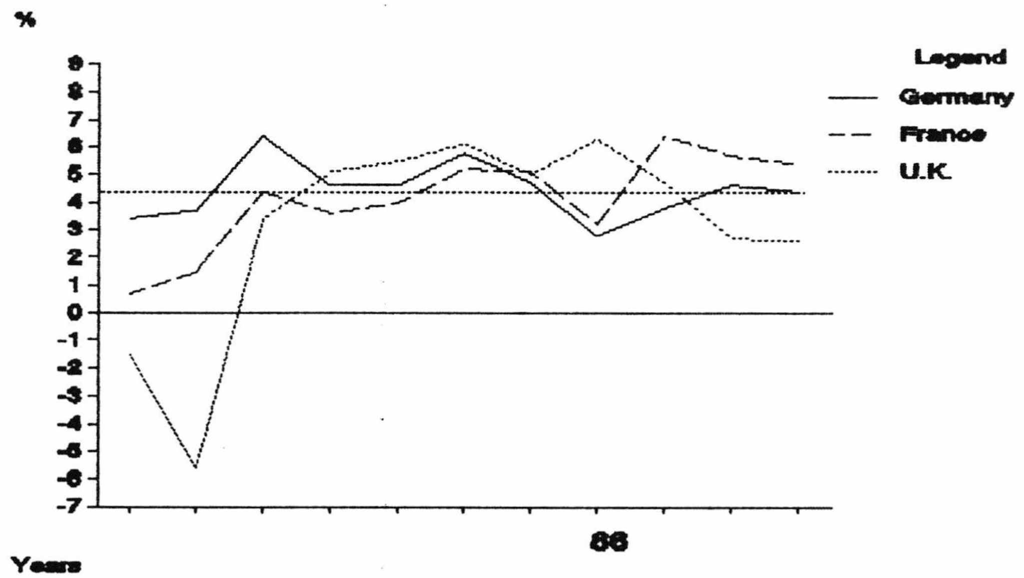


Figure 7 Short-term real interest rates: Germany, France and U.K.

(1979-1989)

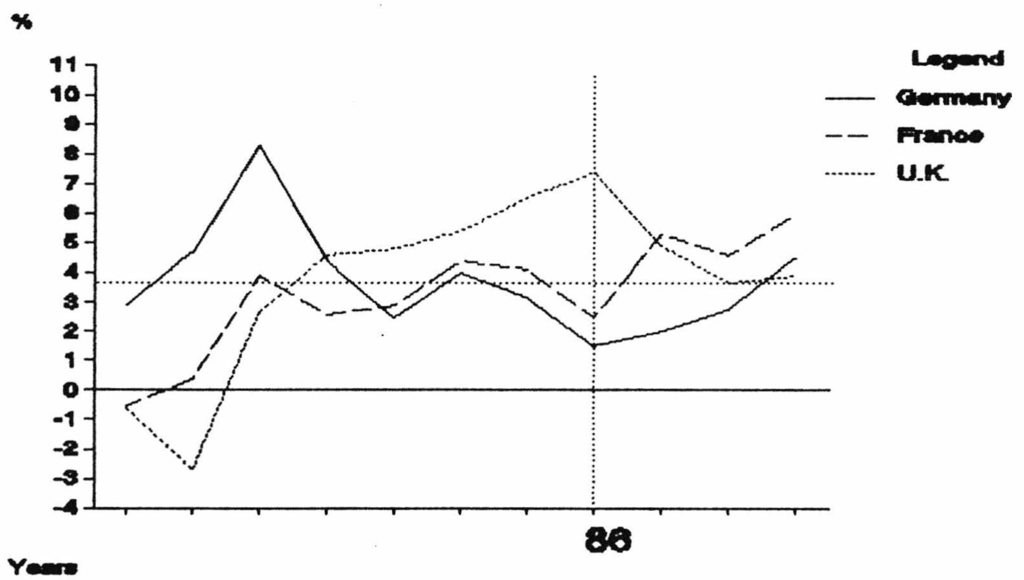


Figure 8 Current Account as % of GDP: Germany, France and U.K.

(1979–1989)

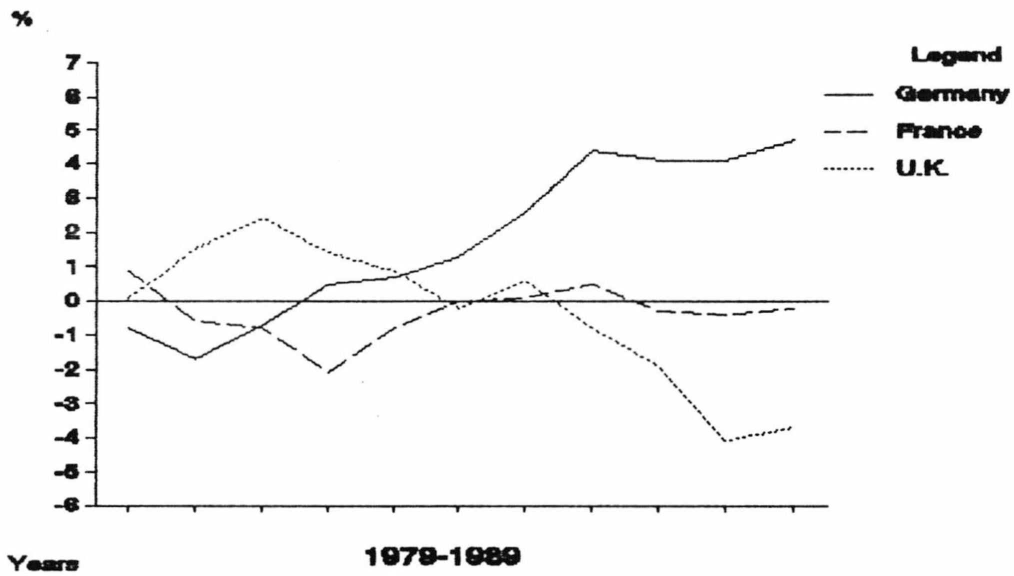


Figure 9 Current Account and Competitiveness: U.K.

(1961–1990)

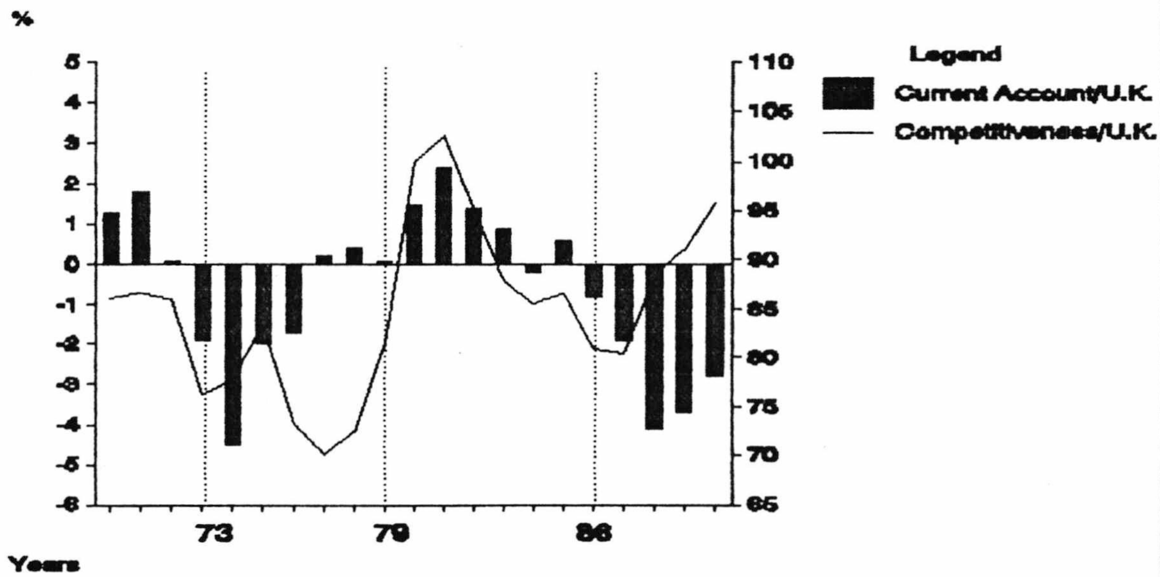


Figure 10 Inflation and unemployment in Germany, France and U.K.

(1979-1989)

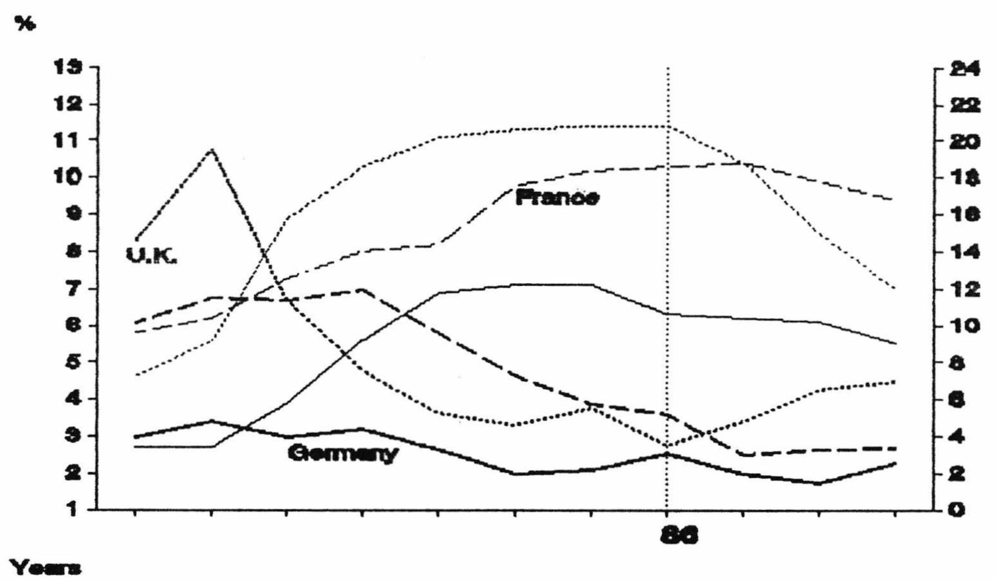
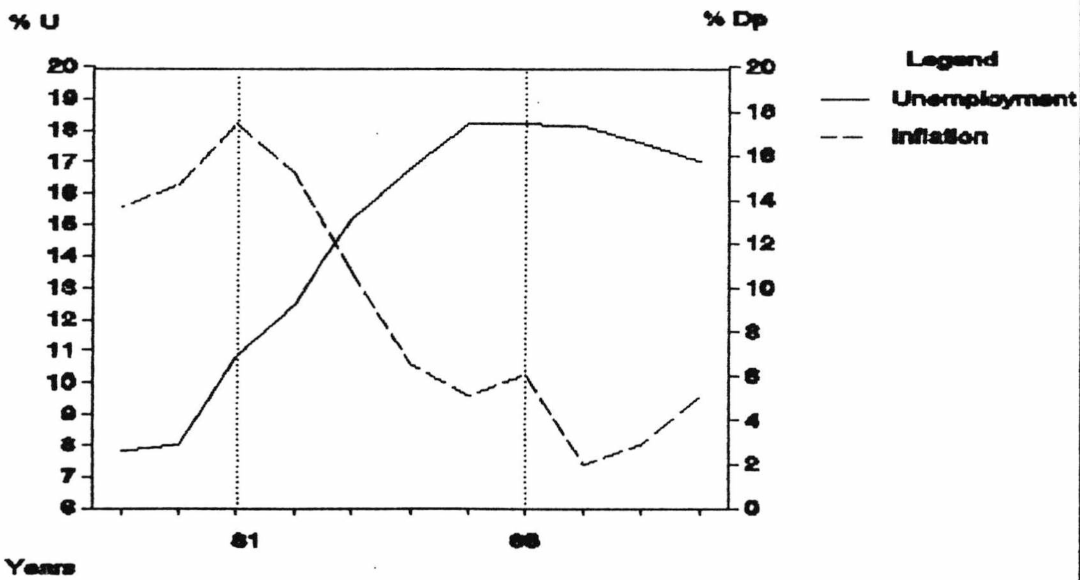


Figure 11 Unemployment and Inflation in Ireland

(1979-1989)



CHAPTER 7

Disinflation without costs:

some aspects of the recent Portuguese experience

Introduction

In the previous chapter we concluded that the disinflation of the 1980s was a global OECD-wide phenomenon. We have seen evidence suggesting that it occurred mainly because of the restrictive monetary policies adopted in the aftermath of the second oil shock and that both the prices of commodities and exchange rate developments had only a minor role in the disinflation. In particular, we have seen that the disinflationary process in Europe had its costs in terms of unemployment, regardless of whether the countries participated or not in the exchange rate mechanism of the EMS.

The sequence of events in Portugal, during the 1980s, does not match this description: the fall in the inflation rate happened only in the late 1980s, was abrupt, and occurred without any employment costs. However, the disinflationary process was interrupted in 1988, and the failure to narrow the inflation differential between Portugal and the EC average helps to explain the hesitation of the Portuguese government over full participation in the EMS. This experience of "disinflation without tears" raises several interesting questions that we try to answer in this chapter. In the light of the credibility theories reviewed in chapter 5, episodes of successful disinflation are likely to occur when there is a decisive turn-around in expectations. Thus, firstly, can we find any evidence to support the idea that a decisive shift in inflation expectations occurred in Portugal in 1987? Secondly, can we identify any particular event or regime shift that could explain such a change in expectations? Thirdly, is the interruption of the disinflationary process due to a loss of policy credibility? Fourthly, can we suggest another way of interpreting the Portuguese experience that puts less emphasis on the role of credibility? In order to answer these questions we organize the chapter in four main sections. In section one we present empirical evidence on inflation, unemployment and real growth of the Portuguese economy over the last three decades. In section two we review the empirical findings of other researchers on the Portuguese economy. The econometric work reviewed in this section suggests plausibly that a wage-price spiral would develop in the Portuguese economy following an exchange rate devaluation and also that any disinflationary process in Portugal would have high output costs. In section three we test the hypothesis that a shift in expectations occurred in 1987. The results presented in section three tend to support the idea that a turnaround in inflation expectations occurred precisely in 1987. This coincides with the beginning of the implementation of an incomes policy agreed between the government, trade unions and representatives of the private sector and explicitly directed at reducing the rate of inflation. In section four we present an alternative interpretation of the facts based on the Dornbusch-Buiter-Miller framework of chapter 5. Whilst not denying the importance of the role played by the recent incomes policy in changing the inflationary climate of the previous years, there are other factors that might have been relevant as well. In particular, the role of terms of trade shocks, exchange rate and monetary policy, and external liberalisation are reviewed in section 4. The conclusions are presented at the end of the chapter and are very orthodox. It seems extremely difficult to halve the rate of inflation if we start from a relatively moderate level (12%), the economy is growing at potential and the unemployment rate is below the "natural rate" and declining. And, under these virtuous cycle circumstances, one might wonder why the country should be forced into recession.

7.1 - Empirical evidence on the Portuguese economy: inflation, unemployment and real growth

In this section we look at the Portuguese experience of inflation, unemployment and real growth over the last three decades (1961-1988). The basic facts are presented in figures 1, 2, and 3 with data taken from European Economy.

In figure 1 we show the rate of inflation during the 1961-1988 period, measured by the price deflator of GDP. As the figure shows inflation accelerated in the 1970s, apparently stabilizing at a relatively high level by the mid-1980s. From 1985 onwards a disinflationary process is also evident, and in particular there is a sharp decline in the rate of inflation from 21% in 1986 to 11% in 1987.

Figure 2 shows the inflation-unemployment "trade-off" from 1961 to 1988. The pattern found suggests that a wage-price spiral was developing in the 1970s, a situation similar to that of most OECD countries during the same period. The figure shows also that for a decade (1977-86) the rate of inflation and the rate of unemployment stabilized on a clock-wise loop around 22% and 8% respectively, suggesting a break in the wage-price spiral. After 1986, we observe a strong inward movement of the trade-off, suggesting that a decisive downward shift in inflationary expectations occurred in 1987.

In figure 3 we plot actual relative to potential growth of real GDP. The potential real growth rate is the 1961-1988 average and is equal to 4.7%. As the figure illustrates, if we exclude the years of the Revolution (1974-75), the Portuguese economy grew below the potential rate during most of the 1980s. Nevertheless, the fall in the rate of inflation in 1987 coincides with an apparent return to potential real growth.

7.2 - Econometric studies on Portuguese inflationary process

The "classical" study on the Phillips curve tradition for Portugal is Mateus (1980). The author estimated two equations, a price equation and a wage equation reproduced in table 1.

The price equation combines cost-push, demand-pull and expectational factors given respectively by: a mark-up specification represented by the last three terms (unit costs of imports, labour and capital); an excess demand specification proxied by growth of money supply in excess of income; and expected inflation proxied by the lagged dependent variable (i.e. assuming static expectations). The wage equation is an expectations-augmented Phillips curve. Both equations were estimated with a "Revolution" dummy variable which takes the value 1 in 1974-75 and 0 in other years. In the price equation, the standard errors of the estimated coefficients of excess growth of money supply, unit labour costs and unit capital costs are relatively large and so the coefficients are not statistically significant at the 5% level. This leaves as the main determinants of the inflationary process in Portugal, imported inflation (devaluation) and expected inflation (the lagged inflation term). The "Revolution" dummy is statistically significant but has a negative sign: this means that the policy of price controls, introduced in those years to sustain inflationary pressures, was effective, at least in the short-run. The wage equation preferred by the author can be re-written as:

$$\Delta w_t - 0.63(\Delta p_t+\Delta q_t) = 0.15(1/U)_t - 3.11 + \hat{e}_t \qquad (1)$$

Table 1. Phillips curve for Portugal estimated by Mateus

Estimation by OLS
The sample is 1953 to 1977

<u>Price equation</u>:

$$\Delta p_t = \underset{(1.00)}{-1.13 + 0.20}\,(\Delta m-\Delta y)_t + \underset{(3.20)}{0.49}\,\Delta p_{t-1} + \underset{(2.81)}{0.33}\,\Delta pm_t + \underset{(1.52)}{.19}\,\Delta ulc_t + \underset{(1.67)}{0.03}\,\Delta ucc_t + \hat{e}_{1t}$$

R^2=0.95 SER=0.022 DW=1.74 k=6 n=25

<u>Wage equation</u>:

$$\Delta w_t = \underset{(4.040)}{0.63}\,\Delta p_t + \underset{(1.793)}{0.15}(1/U)_t + \underset{(2.136)}{0.63}\,\Delta q_t - 3.11 + \hat{e}_t \qquad \text{(t statistics)}$$

R^2=0.87 SER=0.036 DW=1.99 k=4 n=25

p is the consumer price index; m is nominal money; y is real income pm is an index of import prices; ulc are unit labour costs; ucc are unit costs of capital; q is labour productivity. All variables are in logs.

In the wage equation the coefficients are statistically significant at the 5% level and the residuals are not autocorrelated. The estimated model suggests that the growth of real wages (adjusted for productivity growth) is a non-linear function of the rate of unemployment, with an implicit "natural rate of unemployment" ≈ to 5%

(0.15/3.11). Three points are worth noting. First, the inflation term enters the wage equation without a lag and has a relatively large coefficient. Second, the non-linear relation implies a large real wage-unemployment elasticity for low rates of unemployment (-7.5 if U=2%) and a small real wage-unemployment elasticity for high rates of unemployment (-0.75 if U=20%). Put differently, the Phillips curve is nearly vertical for low rates of unemployment and nearly flat for high rates of unemployment. Third, the "Revolution" dummy in the wage equation is statistically significant and positive, suggesting that the wage increases that occurred in that period were exceptional.

These results led the author to very pessimistic conclusions about the long-run effectiveness of devaluations in Portugal: on the one hand, the results suggest that wages adjust very rapidly to expected and actual inflation, the moderating impact of unemployment notwithstanding; on the other hand, imported inflation (devaluations) appears to be the major determinant of the inflation rate. These are of course the necessary conditions for a wage-price-devaluation spiral to develop. Finally, these results suggest that any disinflationary process in Portugal is likely to be very painful unless a shift in expectations occurs.

A second econometric study of the inflationary process in Portugal, covering the 1953-80 period is Morrison (1987). The author estimated a price equation as follows:

$$\Delta p_t = c_0 + c_1 (\Delta p_t)^e + c_2 \Delta y_t + \Sigma c_{3i} \Delta m_{t-i} + + c_4 \Delta\Delta w_t + c_5 \Delta s_t + e_t \quad (2)$$

where p is the consumer price index; $(\Delta p)^e$ is the expected rate of inflation; s is the nominal exchange-rate (escudo-dollar); w are nominal wages; y is real income and m is nominal money; $\Delta\Delta$ denotes second differences.

The model was estimated with a dummy variable which takes the value 0 before 1974 and 1 in 1974 and after. The first three terms in the equation represent monetary factors and are derived from a Cagan type money demand function. The wage term (acceleration of wage growth) seeks to capture structural factors, the exchange rate imported inflation and the dummy a possible structural break in 1974. The expected inflation term is a variable constructed according to the adaptive expectations hypothesis. The estimation of the equation gave results very similar to those obtained by Mateus (1980) namely that the major determinants of the inflationary process in Portugal are expectations of inflation and devaluations.

That both authors reach the same conclusions is not surprising as the price equations estimated by them are very similar. Nevertheless, Morrison (1987) finds that the coefficient of the income variable is not statistically different from −1 and that changes in the money supply are statistically significant with lags extending back to 2 years, the sum of the coefficients of the monetary variables not being statistically different from 1. These results led the author to be very pessimistic about the long-run effectiveness of the crawling-peg and to warn about the possible unemployment effects of disinflationary policies based on monetary restraint, despite some evidence that "market forces" functioned in Portuguese economy.

To assess the potential costs of inflation stabilization in Portugal one of the most important questions is whether there is real wage flexibility in the Portuguese economy. In this regard the estimation of price equations such as those presented above which basically regress actual price changes on lagged price changes and exchange rate changes (import prices in domestic currency) are not very useful. The problem is that regardless of the exchange rate regime it seems inevitable that large inflation differentials will have to be reflected sooner or latter in nominal exchange rate changes. How can we say that it is the devaluation that causes inflation? Why is not the inflation (differential) causing the devaluation? Consider, for example, the real depreciation of the escudo from 1976 to 1986. Why did a wage-price spiral not develop in Portugal in the 1980s as the econometric work reviewed above suggests? Presumably, it was the combination of relatively high rates of unemployment with some real wage flexibility that broke the wage-price spiral in Portugal.

7.3 - Testing the shift in inflation expectations

7.3.1 - Income velocity of money and inflation

In this section we test the hypothesis that a shift in inflation expectations occurred in 1987. This year coincides with the beginning of the implementation of an incomes policy agreed between the government, trade unions and representatives of the private sector and explicitly directed at reducing the rate of inflation. To test the hypothesis that a shift in expectations occurred in 1987 we estimate a simple model of inflation over the 1962-1986 period and then reestimate it over the 1962-1988 period. If a structural break occurs in 1987 and the model overpredicts inflation in 1987 and 1988 this is interpreted as evidence that a shift in expectations has occurred. The model of inflation is as follows:

$$\Delta p_t = \lambda_o + \sum_{i=0}^{n} \mu_i \, (\Delta m - \Delta y)_{t-i} + \sum_{i=1}^{m} \pi_i \, \Delta p_{t-i} + e_t \qquad (3)$$

where p is a price index; m is money; and y is real income. All variables are in logs.

Equation (3) can be interpreted in two different ways. One is that high inflation is essentially inertial. In its simplest form inertial inflation means that current inflation (Δp_t) depends on (or is approximately equal to) last years inflation (Δp_{t-1}); the economy's cyclical position, proxied by the growth rate of money (or domestic credit) in excess of the real growth rate ($\Delta m - \Delta y)_t$; and exogenous shocks (e_t). The reason for this persistence is primarily wage indexation interacting with staggered wage setting (Dornbusch and Simonsen (1987)).

Another interpretation is based on a synthetic monetarist model of inflation due to Vanderkamp (1975) (see, also, Frisch (1983)). The model incorporates a demand for money relation and a mechanism specifying the process of formation of inflation expectations. Equation (3) can be obtained from logarithmic differentiation of a Cagan-type money demand function where it is assumed that the income elasticity of the demand for money is unity, that the income velocity of money is positively related to inflation expectations, and that the money supply is exogenous ($\Delta m_t - \Delta p_t - \Delta y_t = \epsilon . \Delta[(\Delta p_t)^e]_t$). The process of formation of inflation expectations (adaptive expectations) states that if the inflation rate is higher (lower) than expected, inflation expectations will be revised upwards (downwards). Put differently: at each point in time economic agents expect a certain rate of inflation which depends on the past history of inflation with exponentially decaying weights $[(\Delta p_t)^* = \Sigma\pi_i \ \Delta p_{t-i}]$.

As mentioned the sample period runs from 1962 to 1988 but firstly the model is estimated omitting the last two observations (1987-88). We follow a general-to-simple strategy and only the parsimonious model is presented in table 2. The parameters are statistically significant at the 5% level and the residuals are neither autocorrelated nor heteroscedastic, according to the Lagrange Multiplier tests reported in table 2. As suggested by the analysis of one-step forecasts and the Chow test reported in table 2, the model shows parameter instability and in particular a structural break in 1987.

From a monetarist perspective two interesting conclusions can be drawn from this model. First, the long-run static solution ($\Delta p_t = \Delta p_{t-1}$) implies that, in equilibrium, the rate of inflation is equal to the excess of the growth rate money over the growth rate of real income, that is, we have long-run monetary neutrality. Second, in the short to medium-run money is not neutral. It takes two years for excess money growth to affect the rate of inflation (two lags in $(\Delta m - \Delta y)_{t-i}$), and, it takes nearly four years for this effect to be completed. It takes therefore nearly six years for inflation to completely neutralize the excessive growth of money.

Table 2. Estimation of the model of inflation

Estimation by OLS
The sample is 1963 to 1988 less 2 forecasts

$$\Delta p_t = \underset{(-1.819)}{0.022} + \underset{(2.294)}{0.265}\,(\Delta m - \Delta y)_{t-2} + \underset{(7.364)}{0.739}\,\Delta p_{t-1} + \hat{e}_t \quad \text{(t statistics)}$$

$R^2=0.86$ SER=0.034 RSS=0.024 $F(2,21)=65.13$ DW=2.2 k=3 n=24

Model validation tests

Serial Correlation	$F(1,20)=0.67$	$F(2,19)=1.27$
ARCH	$F(1,19)=0.0$	$F(2,19)=1.27$
Normality	$Chi^2(2)=1.339$	
Chow test	$F(2,21)=4.49$ *	

Analysis of one-step Forecasts

Date	Actual	Forecast	s.e.	t-value
1987	0.121	0.225	-0.105	-2.807 *
1988	0.117	0.187	-0.069	-1.640

Static long-run solution

$$\Delta p = \underset{\substack{(1.461)\\ [0.057]}}{0.083} + \underset{\substack{(2.363)\\ [0.467]}}{1.015}\,(\Delta m - \Delta y) \quad \text{(t statistics) [standard errors]}$$

Wald test $Chi^2(2) = 21.938$

m is M1; p is the cpi; y is real gdp. All variables are in logs.

Data Source: Banco de Portugal-Annual Report, European Economy and IMF-International Financial Statistics

From the perspective of inertial inflation the results confirm the idea that current inflation (Δp_t) is approximately equal to last years inflation (Δp_{t-1}) as the estimated coefficient of lagged inflation is relatively high (0.74) and statistically significant.[1] The rate of inflation is also influenced by the economy's cyclical position, proxied by the growth rate of money (or domestic credit) in excess of the real growth rate $(\Delta m - \Delta y)_{t-2}$. This finding is consistent with the idea that demand pressure caused by budget

1 - This means that the rate of inflation is strongly autorregressive.

deficits (financed by money printing) contribute also to the inflationary process.

The structural break in 1987 and the overprediction of inflation in 1987 and 1988 are consistent with the idea that a decisive shift in inflation expectations occurred in 1987. According to our point estimates the rate of inflation came down by 10.4% in 1987 as a result of that shift in expectations (forecast error of inflation).

It should be mentioned that the model shows another structural break in 1972 (according to a Chow-test not reported). This can be interpreted in at least two ways. Firstly, we can say that in the early 1970s as monetary growth and inflation accelerated, the catching-up process started but actual and expected inflation rates diverged. Therefore, the structural break in 1972 might reflect a shift in inflation expectations, from a low to a high inflation environment. Secondly, we may say that the parameter instability is simply a reflection of misspecification of the model, a topic to be discussed further below.

So far we have chosen to interpret the recent instability of the income velocity of money as a signal that a turn-around in expectations occurred. However another plausible interpretation is that the (implicit) demand for money function is not correctly specified. In this case the Chow-tests and the poor out-of-sample performance of the estimated equation may be a signal of a more fundamental problem with the design of the model.

This point can be made more explicit if we recall that the money demand function included in the overshooting model discussed in chapter 5 postulates a static equilibrium between money (m), real income (y), the price level (p) and the interest rate (r) as follows:

$$m - p = k\, y - \lambda\, r \qquad (4)$$

$$\text{with } k, \lambda > 0$$

A complete discussion of the specification and estimation of the demand for M1 in Portugal is beyond the scope of this thesis. What we want to stress here is that the inference that price inflation is determined by excess money supply, something which is backed by regressions like those reported in table 2 (or like those reported by Mateus and Morrisson), is not completely reliable. For example, in the Portuguese case, it is possible to show that m, p, y and r are cointegrated [C(1,1)]. The test for cointegration is presented in table 3: as we cannot reject cointegration the main conclusion is that equation (3) lacks an error correction term and so the parameter instability should be interpreted with some caution. Of course, it is still possible that the demand for money breaks down in 1987, even with an error correction specification. This issue as well as the money-income causality controversy (which does not affect cointegration) deserve further research that cannot be pursued in this thesis.[2]

2 - Hansen (1989) and Muscatelli (1989) are references for further research on these topics. See also Surrey (1989).

Table 3. Cointegration and demand for money

The sample is 1960-1988

Cointegrating regression

$$m_t = 0.85\ p_t + 0.84\ y_t - 2.12\ r_t - 3.28 + \hat{e}_{1t}$$

Statistics

$R^2 = 0.99$ CRDW = 1.406   DF = -3.703   ADF(2) = -3.527

Cointegrating regression

$$p_t = 1.15\ m_t - 0.93\ y_t + 2.63\ r_t + 3.57 + \hat{e}_{2t}$$

Statistics

$R^2 = 0.99$ CRDW = 1.378   DF = -3.656   ADF(2) = -3.420

m is M1; p is the cpi; y is real gdp; r is the nominal inter est rate on 6 month deposits

Source: Banco de Portugal Annual Report, European Economy and IMF International Financial Statistics

7.3.2 - Estimation of a Phillips curve for Portugal

The existing econometric work reviewed in section 7.2 suggests that any disinflationary process in Portugal is likely to be very painful. In fact, the slow adjustment of inflationary expectations and the non-linear shape of the Phillips curve imply that it needs a large increase in the rate of unemployment to break the inertia of inflationary expectations and the inertia of the inflationary process itself. Within this framework any policy directed at lowering inflationary expectations may be a useful tool to lessen or even eliminate the costs of reducing inflation. In this section we estimate a Phillips curve for Portugal over the 1962-1986 period and then reestimate it over the 1962-1988 period. If a structural break does not occur in 1987 and the model predicts correctly wage disinflation in 1987 and 1988 this is interpreted as further evidence that a shift in expectations has occurred. The equation to be estimated is:

$$\Delta w_t = \delta_0 + \sum_{i=0}^{n} \rho_i \, (1/U)_{t-i} + \sum_{i=0}^{m} \gamma_i \, \Delta p_{t-i} + e_t \qquad (5)$$

where w are nominal wages; p is a price index; and U is the rate of unemployment. All variables are in logs except U.

In table 4 we present the estimated (short-run) Phillips curve for Portugal. As mentioned the sample covers the 1962-1988 period but first the model is estimated leaving out the last two observations (1987-88). In our econometric work we follow a general-to-simple strategy. The parsimonious model presented in the table is an "F-acceptable" simplification of the more general representation. A further restricted model was estimated and is presented at the end of table 4.[3] The parameters are statistically significant at the 5% level and have the sign and magnitudes suggested by the theory. The residuals are neither autocorrelated nor heteroscedastic, according to the Lagrange Multiplier tests reported. The model includes a dummy variable that takes the value 1 in 1970 and 0 in other years which corresponds to an "outlier" and ensures the normality of the residuals. As suggested by the analysis of one-step forecasts and the Chow test reported in table 5, the model does not show parameter instability.

To emphasize the good out-of-sample forecast performance of the model we re-estimated the Phillips curve using data covering the 1962-1984 period and then used the model to forecast the path of wage growth during the recent disinflationary period (1985-88). As

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3 - This last model confirms the estimates of the Phillips curve.

figures 4 and 5 show the estimated values of nominal wage growth are not statistically different from the actual values and the model tracks very accurately the deceleration of nominal wage growth.

A series of more stringent tests on the structural stability of the model were also performed, through recursive least squares estimation of the Phillips curve. The model was estimated using data covering the 1962-1981 period and then was re-estimated adding one observation each time. In figures 6 and 7 we plot the estimates of the parameters and in figure 8 we plot the sequence of Chow-tests against the final period. The figures confirm that the Phillips curve does not breakdown in the 1980s.

The most important conclusions to be drawn from these exercises are as follows. First, the full adjustment of expectations to actual inflation experience is not rejected by the data, as the estimated coefficient of the inflation rate is not statistically different from one. Second, the relation between the rate of growth of real wages (the growth rate of nominal wages given the steady-state expected rate of inflation) and the unemployment rate is inverse and non-linear. Furthermore, the rate of unemployment dampens the growth of the real wage with a lag of one year. Third, the estimated relation remains stable throughout the period, in particular during the recent disinflationary episode. Fourth, the estimate of the "natural rate of unemployment" implied by the model is 5.8% (0.35/0.06).

Table 5. Estimation of the Phillips curve

Estimation by OLS
The sample is 1962 to 1988 less 2 forecasts

$$\Delta w_t = \underset{(-3.034)}{-0.068} + \underset{(5.904)}{0.365}\,(1/U)_{t-1} + \underset{(13.359)}{1.02}\,\Delta p_t + \underset{(4.582)}{0.142}\,D + \hat{e}_t \quad \text{(t statistics)}$$

$R^2=0.91$ SER=0.029 RSS=0.017 $F(4,20)=52.84$ DW=1.835 k=5 n=25

Model validation tests

Serial Correlation	F(1,19)=0.14	F(2,18)=0.41
ARCH	F(1,18)=.02	F(2,16)=0.25
Normality	$Chi^2(2)=0.939$	
Chow test	F(2,20)=0.51	

Analysis of one-step Forecasts

Date	Actual	Forecast	s.e.	t-value
1987	0.108	0.075	0.035	0.973
1988	0.088	0.087	0.035	0.027

Re-estimation of the model over the whole sample

$$\Delta w_t = \underset{(-3.216)}{-0.062} + \underset{(6.467)}{0.354}\,(1/U)_{t-1} + \underset{(14.458)}{1.01}\,\Delta p_t + \underset{(4.757)}{0.140}\,D + \hat{e}_t \quad \text{(t statistics)}$$

$R^2=0.91$ SER=0.028 RSS=0.017 $F(3,23)=77.07$ DW=1.776 k=4 n=27

Model validation tests

Serial Correlation	F(1,22)=0.27	F(2,21)=0.42
ARCH	F(1,21)=.01	F(2,19)=0.16
Normality	$Chi^2(2)=1.05$	

Direct estimation of the constrained model over the whole sample

$$(\Delta w_t - \Delta p_t) = \underset{(-5.056)}{-0.06} + \underset{(8.734)}{0.350}\,(1/U)_{t-1} + \underset{(4.895)}{0.140}\,D + \hat{e}_t \quad \text{(t statistics)}$$

$R^2=0.83$ SER=0.028 RSS=0.018 $F(2,24)=57.67$ DW=1.74 k=3 n=27

Model validation tests

Serial Correlation	F(1,23)=0.31	F(2,22)=0.41
ARCH	F(1,22)=0.03	F(2,20)=0.13
Normality	$Chi^2(2)=1.017$	

Source: Banco de Portugal *Annual Report*, European Economy and IMF *International Financial Statistics*

7.3.3 - Conclusions on evidence about the shift in expectations

The results presented suggest that a shift in inflationary expectations occurred in 1987. To make our point clear it is convenient to review what the results obtained so far indicate. Firstly, the Phillips curve is consistent with the data. The estimated model, which passed various diagnostic tests, does not show parameter instability and is consistent with the theory. Secondly, the income velocity-inflation model is also consistent with the data. The estimated model confirms that in equilibrium the rate of price inflation is equal to the growth rate of excess money supply implying long-run monetary neutrality. In the short and medium-runs however money is not neutral. In this model, the basic source of non-neutrality comes from the (gradual) learning of the inflationary process as economic agents adapt their expectations to higher or lower rates of inflation. When such process is under way the income velocity of money changes.

Put together, these results suggest that the inward movement of the inflation-unemployment "trade-off" noted for the Portuguese economy after 1986 is due to the decisive shift in inflationary expectations occurred in 1987, which explains why it was costless. According to our (point) estimates the rate of inflation came down by 10.4% (=forecast error, statistically significant) as a result of the incomes policy of the government which was explicitly directed at breaking inertial inflation.

Our results confirm the early idea that a long-run trade-off between inflation and unemployment does not exist in Portugal. However, if the unemployment rate is above the "natural rate" the real wage will decline. For example, using our estimates of the

Phillips curve for Portugal and starting from a steady-state with an inflation rate of 20% ($\Delta w=\Delta p=20\%$) and unemployment at its "natural rate" (U=5.8%) we estimate that the initial rate of unemployment needed to halve the growth of nominal wages is 11.8% ($\Delta w=10\%$).

7.4 - Other factors in the Portuguese disinflation

In this section we develop our interpretation of the recent Portuguese disinflationary experience. This is done in two steps. Firstly, it is important to bear in mind that import prices may have played an important role in the recent disinflation. Secondly, we compare some features of the two episodes of costless disinflations that occurred in Portugal in the recent past. From 1977 to 1981, inflation fell from its peak of 27% to 18%, the rate of unemployment declined from 8% to 7% and the Portuguese economy grew at the potential rate. From 1985 to 1988, inflation fell from 25% to 12%, unemployment declined from 9% to 6% and real growth returned to potential. In both cases the crawling-peg was moderated or interrupted, the escudo appreciated in real effective terms and long-term real interest rates increased very rapidly towards international levels. However, whilst the disinflation of the early 1980s was marked by large and increasing current account deficits that eventually led to the balance of payments crisis of 1983 (see chapter 4), the recent disinflation is marked by current account equilibrium and large inflows of long-term (non-speculative) capital. This suggests that the apparent interruption of the disinflationary process in 1988 was not due to a loss of credibility. We argue that to some extent the recent disinflationary experience of the Portuguese economy goes beyond the shift in inflationary expectations and could be an illustration of the gradualist-monetization story told in chapter 5. We argue that the disinflationary policy of the early 1980s relied "too much" on exchange rate policy and was not supported by other policies. In the late 1980s the disinflationary policy relied "too much" on incomes policy. A common feature of these episodes appears to be a rapid return to "full employment" which might be related to the lack or incompleteness of fiscal correction. This could explain the slippage in further reducing inflation.

7.4.1 - On the role of imported inflation and productivity

In the results presented in section 7.3 there is no direct role for imported inflation. This seems to be an important shortcoming in the analysis of (dis)inflation because any small open economy like Portugal must be very dependent on the behaviour of foreign prices, namely through the cost of imported inputs and foreign price competition. In figure 9 we compare the rate of inflation in Portugal with EC inflation average. The figure suggests that the trend of inflation rate in Portugal is related to the trend of EC inflation; the two "positive" oil shocks (1973 and 1979) and the devaluations of 1977 and 1983, which caused large terms of trade shocks, seem to have been important factors determining the deviation of Portuguese inflation from the EC average; and the "negative" oil shock (1986) and the devaluation of the dollar (1985-86) seem to have been important factors determining the recent fall in the inflation rate. To study the role of imported inflation (and devaluations) mark-up models have been estimated by, among others, Lipsey and Parkin (1970), and Goldstein (1974; 1977) and, more recently, by

Rowlatt (1988), Drèze and Bean (1990) and Karlsson and Löefgren (1990). Using a Phillips curve and a mark-up equation we can make several points.[4]

$$\Delta w_t = \delta_0 + \rho_1 \ (1/U)_t + \Delta p_t \tag{6}$$

$$\Delta p_t = \alpha.(\Delta w_t - \Delta(y/L)_t) + (1-\alpha).\Delta pm_t \tag{7}$$

where w are nominal wages; U is the rate of unemployment; p is a price index; pm is an index of import prices; and (y/L) is output per head or labour productivity. What these equations tell us is a very conventional story. The schematic diagram below describes the connections between the various factors.

```
                                                     Nominal
Foreign prices  →  Domestic Prices  →      Wages    →  Domestic Prices
↑                                      ↑              ↑                ↓
↑                                 Unemployment   Productivity          ↓
↑                                                                      ↓
 ←   ←   ←   ←   ←   ←   ←   ←   ←   ←   ←   ←   ←   ←   ←   ←
```

Firstly, foreign prices, which include import prices in foreign currency and the nominal exchange rate, have a direct (food and other consumption goods) and indirect (costs of imported materials and investment goods) influence on domestic prices. Secondly, wage earners try to keep real wages unchanged and will pass actual inflation into nominal wage growth. However, their ability to do so depends on the state of the labour market and/or aggregate demand, a factor captured by the (inverse of) unemployment rate. Thirdly, whether nominal wage growth is passed into prices depends on the path of productivity. Producers feed the wage-price spiral only when wages increase at a higher rate than productivity.

These considerations are important to keep the recent disinfla-

4 - In this thesis we do not report a mark-up equation for Portugal because the estimates derived proved rather unsatisfactory.

tion in Portugal in perspective. It might be the case that a virtuous combination of factors supported the disinflation effort and enhanced the credibility of incomes policy. Among these factors we should mention nominal wage growth deceleration fostered by the previous peak in the rate of unemployment (9% in 1985), favourable terms of trade shock (oil prices decline in 1986) and productivity gains (after 1985) some of which may be due to cyclical factors such as the end of the 1983-84 recession. If this interpretation is correct, the disinflationary process stopped because some of the factors that were behind it are now exhausted.

7.4.2 - On the role of gradualism and monetization

From 1977 to 1981, the rate of inflation fell from 27% to 18% and the inflation differential between Portugal and EC average narrowed, whilst the rate of unemployment declined from 8% to 5%. This experience of costless disinflation was interrupted because with large and increasing current account imbalances developing (see figure 10) the portuguese government accelerated the rate of the crawling-peg and devalued the escudo, thus feeding the inflationary process again. Some features of this period are worth mentioning. First, the disinflation of the late 1970s early 1980s was marked by the reduction in the rate of the crawling-peg, particularly during the 1979-81 period, (see figures 11 and 13) but we do not observe any parallel reduction in the rate of growth of domestic credit (see figure 13). Secondly, although real interest rates had risen towards international levels by 1980 (see figure 14) the current account imbalances and the relaxation of credit policy suggest that the disinflationary strategy of the early 1980s relied "too much" on exchange rate policy, and was not supported by other policies. Furthermore, the policy of real appreciation was not supported by any significant inflow of long-term (non-speculative) capital (see figure 12).

The disinflation of the late 1980s is marked also by the reduction in the rate of the crawling-peg (see figures 11 and 13) but this time we observe as well a parallel and gradual reduction in the rate of growth of domestic credit and a gradual decline of nominal interest rates (see figure 13) perhaps with some slippage in 1988. There is a rapid increase in long-term real interest rates towards international levels (see figure 14) and we observe some real exchange rate appreciation (see figure 11); but in major contrast with the situation in the early 1980s the real appreciation is supported by current account equilibrium and massive inflows of long-term capital (see figures 10 and 12). These large inflows of capital are related to the external liberalisation process under way (mentioned in chapter 4) and we think that they are one of the major factors that contributed to the elimination of the costs of the recent disinflation, because they facilitated the monetization of the economy in the way suggested by the theoretical analysis in chapter 5 (see figure 15). In short, it can be argued that the gradualist approach to disinflation that was followed and the virtuous monetization that occurred may also have contributed to the elimination of the costs of disinflation.

Can we say that the disinflationary process in Portugal was interrupted in 1988 because of a loss of policy credibility, perhaps motivated by the "hesitation" of the government over the timing of ERM entry? If that was the case, how can we then explain the unprecedented increase in foreign exchange reserves of the Bank of Portugal in 1989, which reveals the extent of the foreign exchange intervention carried out to sustain the real appreciation of the escudo (see figure 16)? In fact we do not believe that a loss or lack of credibility is behind the interruption of the disinflationary process in Portugal.

Conclusions

We can now answer the questions raised at the begining of the chapter. Firstly, we found evidence that supports the idea that a decisive turn-around in expectations occurred in Portugal, in 1987, and this could be the reason why disinflation was costless. Secondly, such a change in expectations coincided with the beginning of the implementation of an incomes policy explicitly directed at breaking inertial inflation, and can be seen as a measure of the success of that policy. These conclusions have been drawn within the framework of the expectations-augmented Phillips curve. Within this framework some important stylized facts about the Portuguese economy have emerged - although there is no long-run trade-off between inflation and unemployment the real wage is flexible. But within this framework the interruption of the disinflationary process in 1988 cannot be understood, unless some exogenous loss of credibility happened.

This is a plausible interpretation because the Portuguese escudo did not join the ERM, at least not explicitly. However it is possible to look at the Portuguese experience from a different angle. Perhaps real wage flexibility, productivity gains, terms of trade shocks, exchange-rate and monetary policy and external financial liberalisation played an important role in this "disinflation without tears". This is not in contradition with the idea that a shift in the inflationary climate occurred in 1987. But the advantage of having these qualifications in mind is that they suggest a solution to the puzzle of the interruption of the disinflationary process: it seems extremely difficult to halve the rate of inflation if a country has moderate inflation, the economy is growing at potential and the unemployment rate is below the "natural rate" and declining. And this approach is also consistent with persistence of the massive flows of long-term capital into Portugal a fact that seems at odds with the idea of a loss of credibility. If reputational factors are not at the root of the present problems of the Portuguese economy, an immediate entry into the ERM and the greater fixity of nominal exchange rates that it would imply would only force the country to discontinue the gradualist approach to disinflation. One might wonder why the country should be forced into recession.

Figure 1 Inflation rate in Portugal

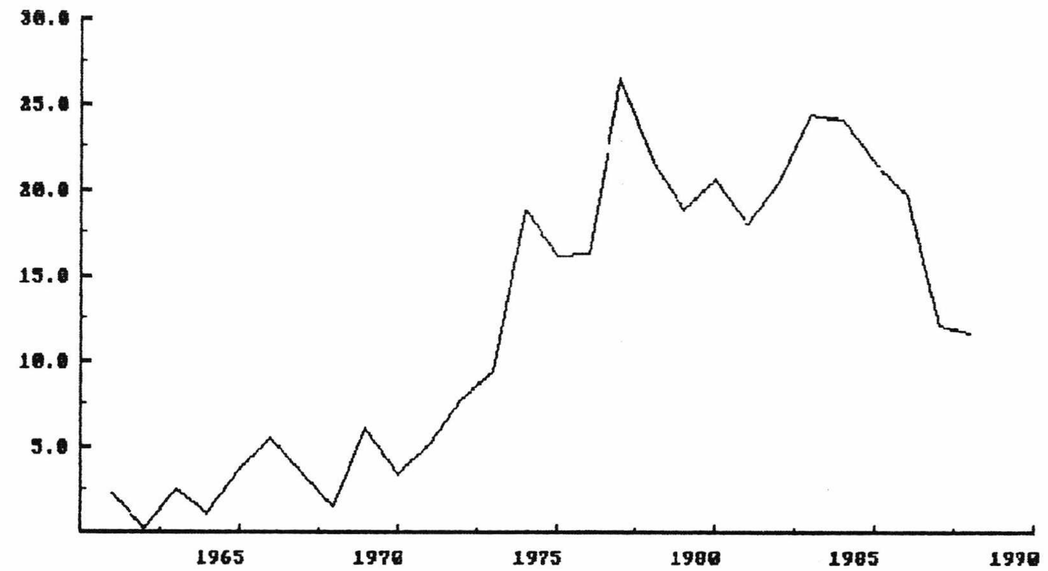


Figure 2 Inflation-unemployment trade-off in Portugal

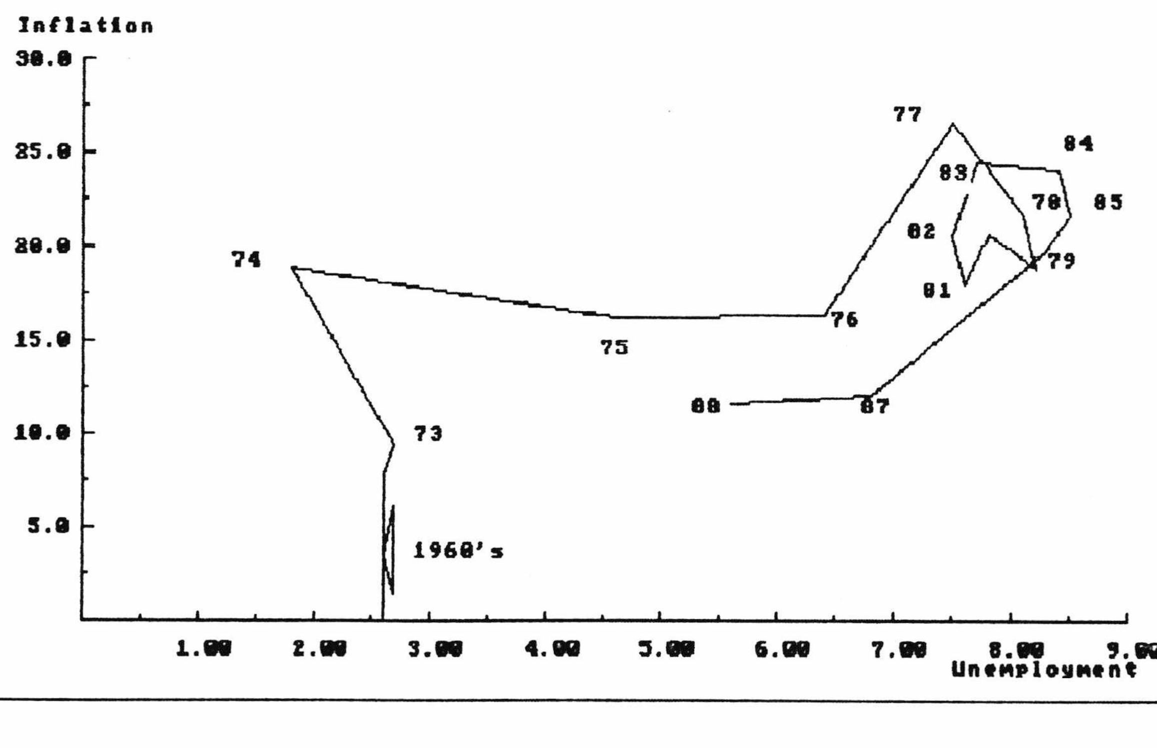


Figure 3

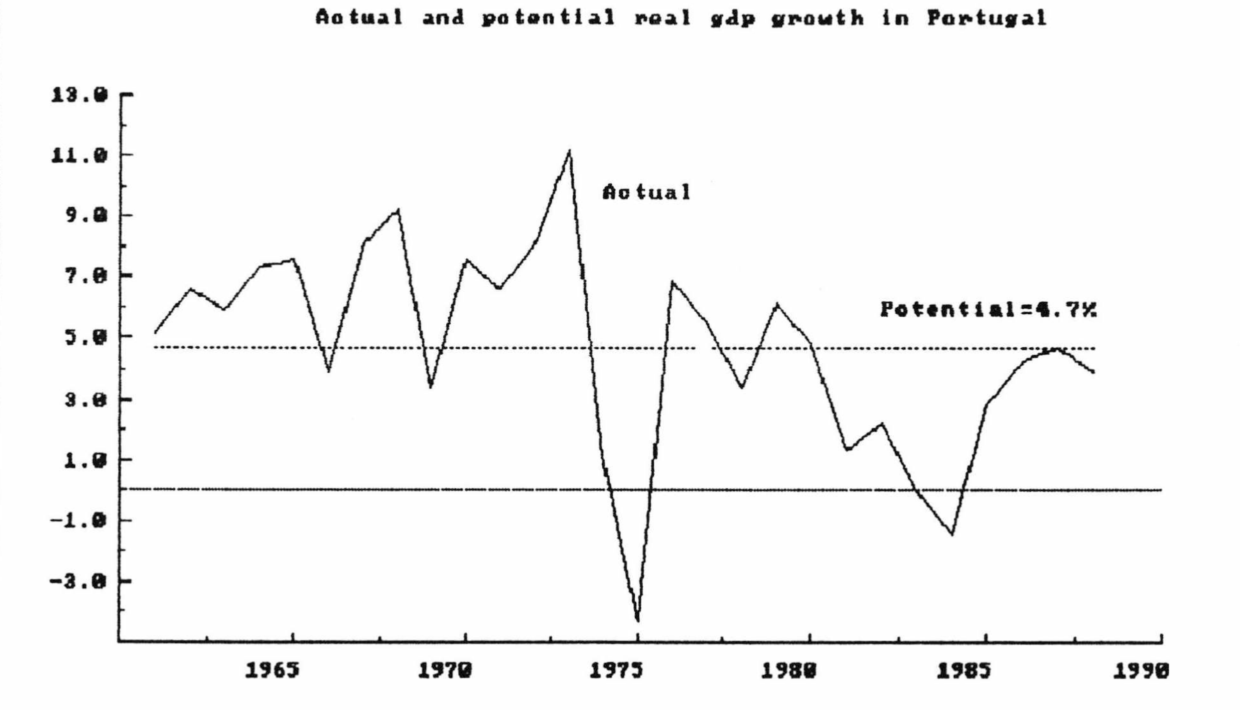

Actual and potential real gdp growth in Portugal
13.0
11.0
9.0
7.0
5.0
3.0
1.0
-1.0
-3.0
Actual
Potential=4.7%
1965
1970
1975
1980
1985
1990

Figure 4

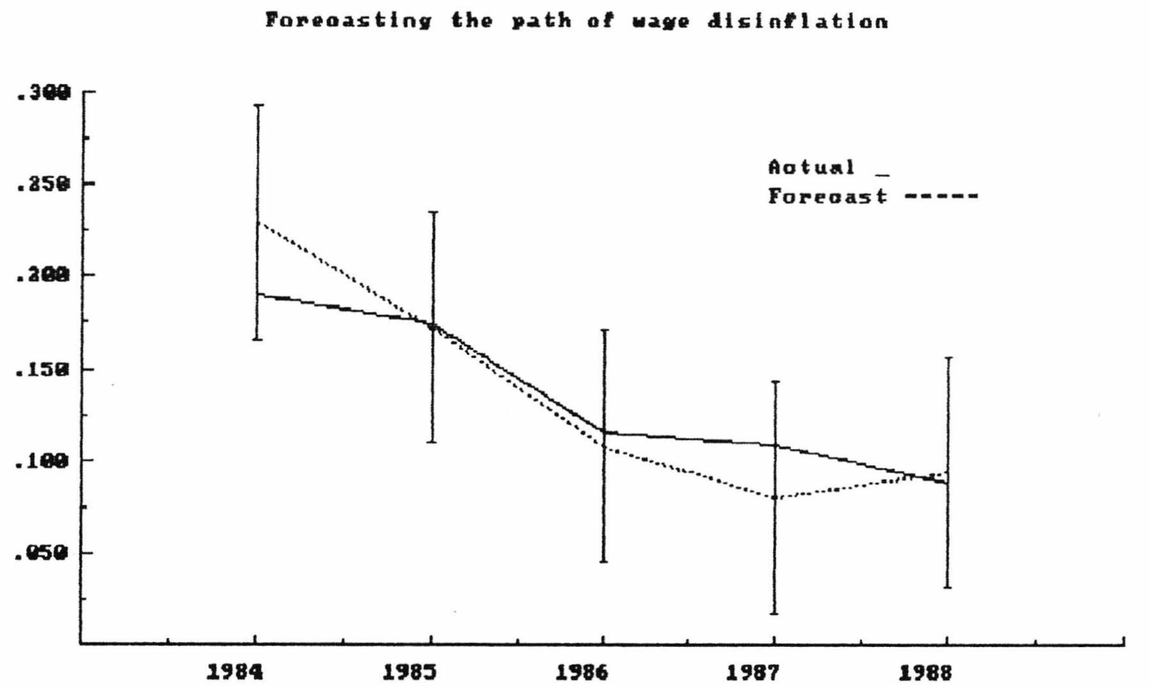


Figure 5

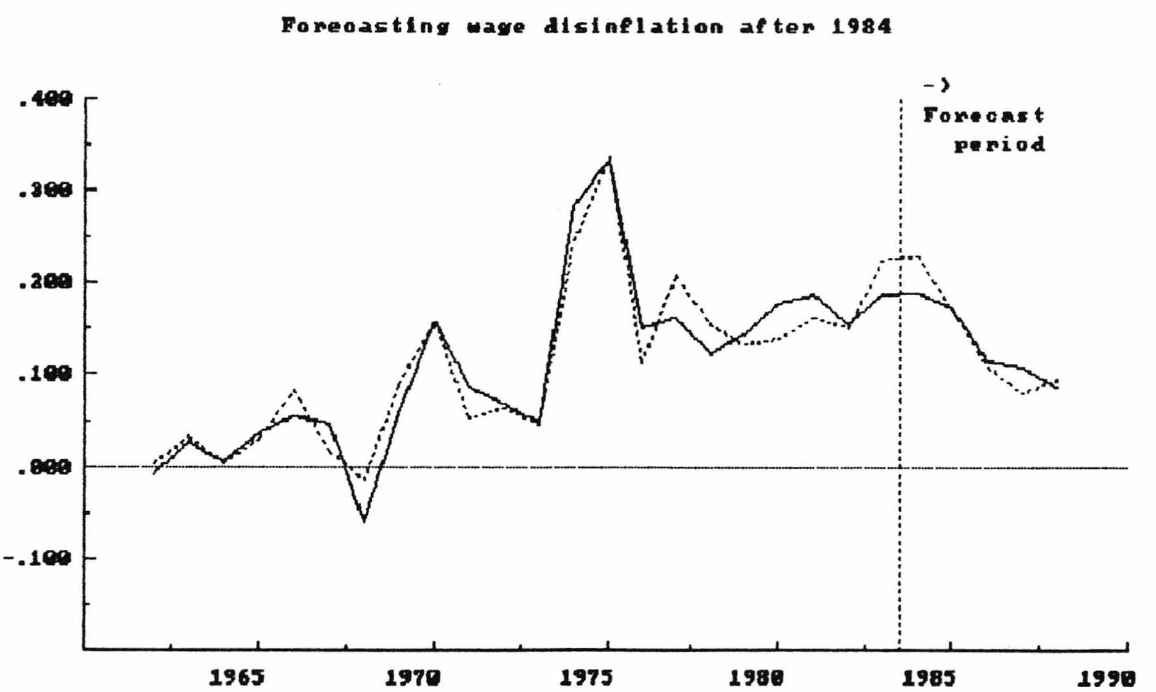


Figure 6

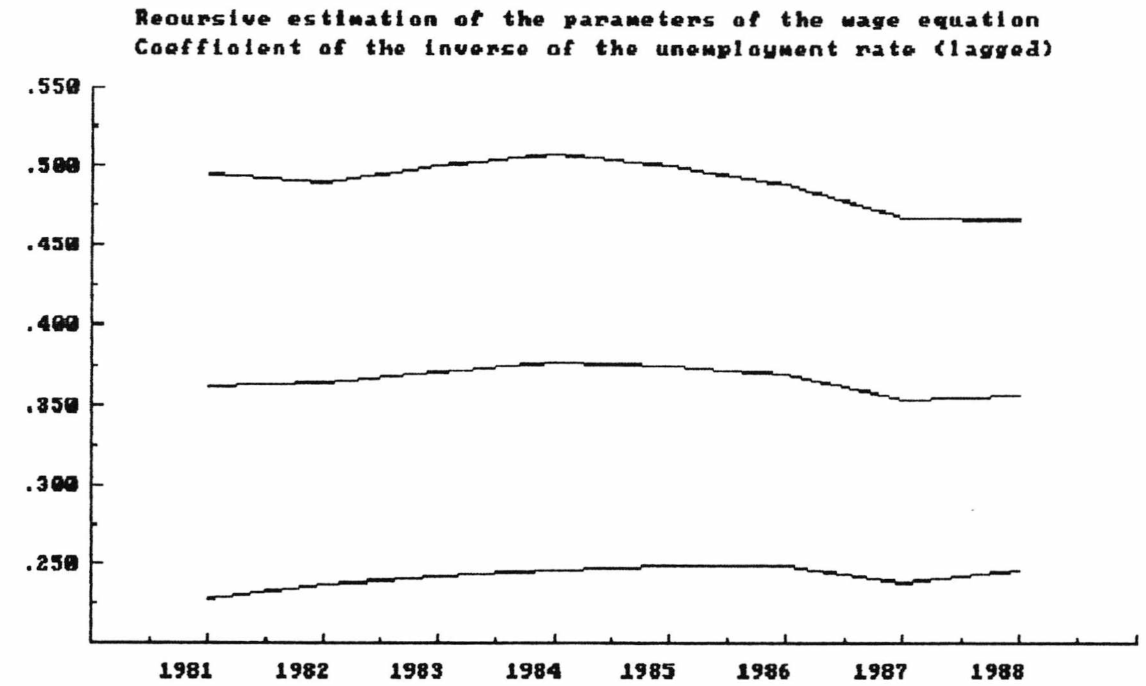


Figure 7

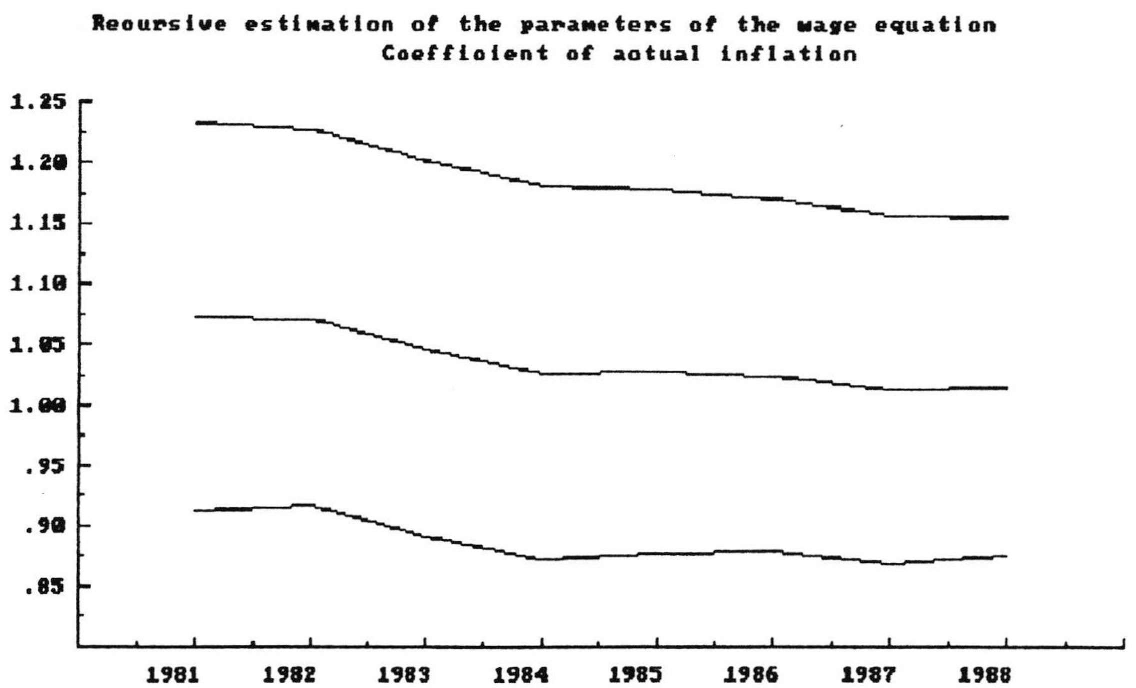


Figure 8

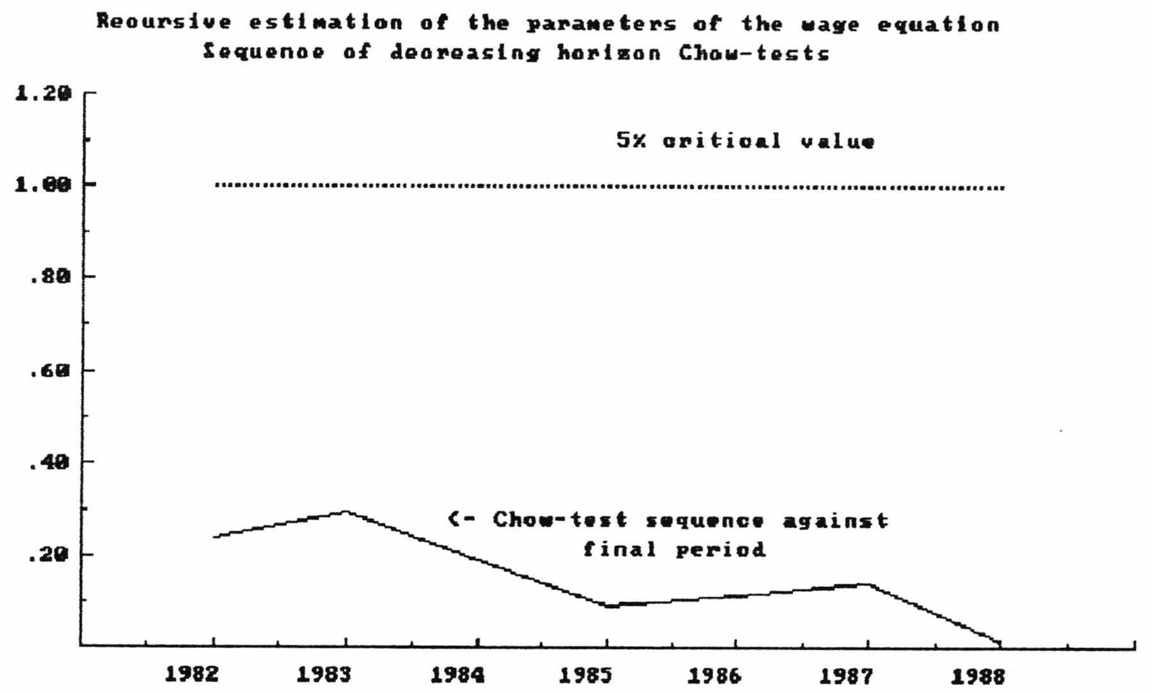

Recursive estimation of the parameters of the wage equation
Sequence of decreasing horizon Chow-tests
1.20
1.00
.80
.60
.40
.20
5% critical value
<- Chow-test sequence against
final period
1982
1983
1984
1985
1986
1987
1988

Figure 9 Inflation in Portugal and EC (1961-1989)

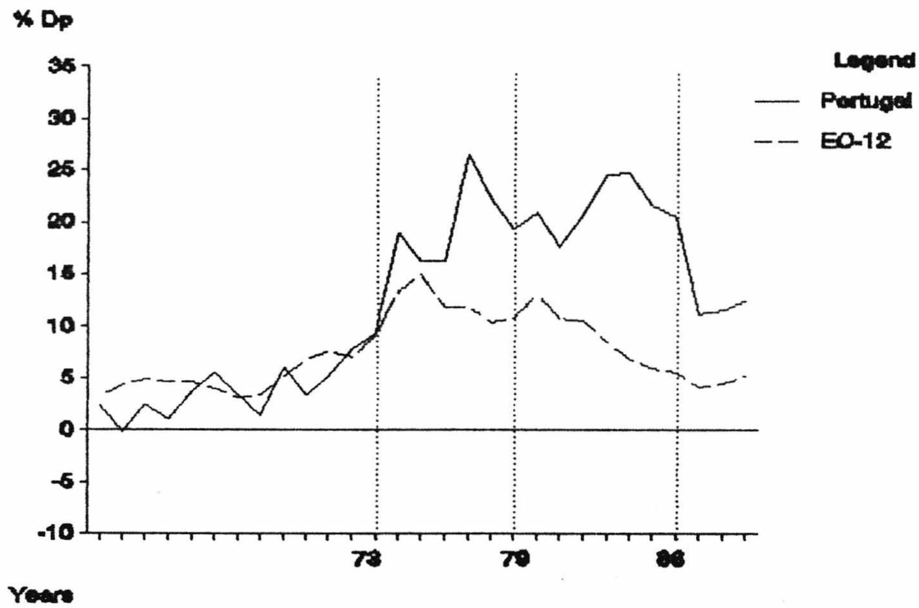


Figure 10 Current Account and Competitiveness in Portugal

(1961-1989)

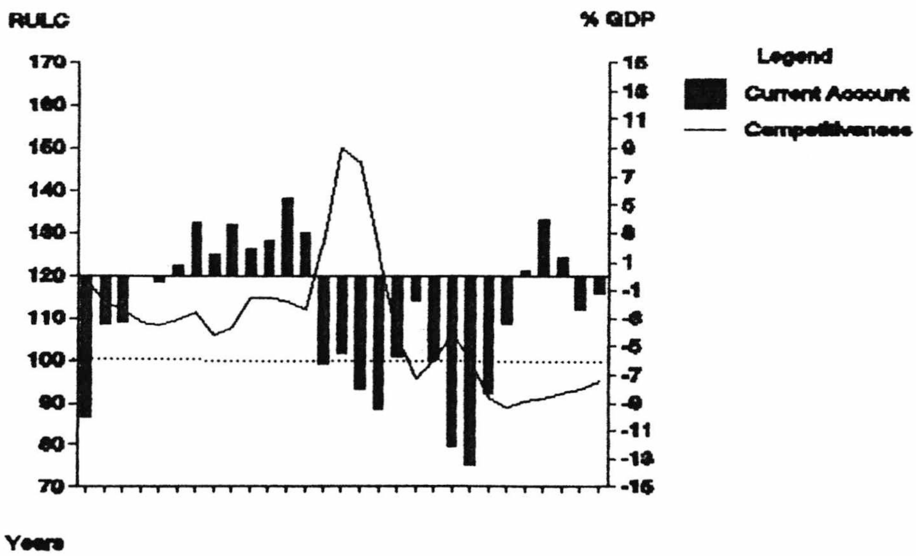


Figure 11 Nominal and Real Effective Exchange Rates

Portuguese Escudo (1976-1989)

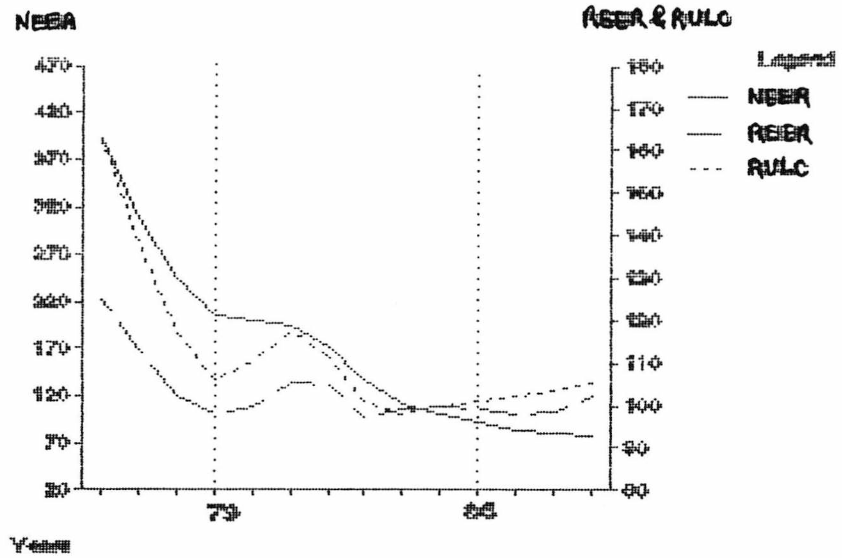


Figure 12 Capital Account (Long-term Capital)

Portugal (1976-1989)

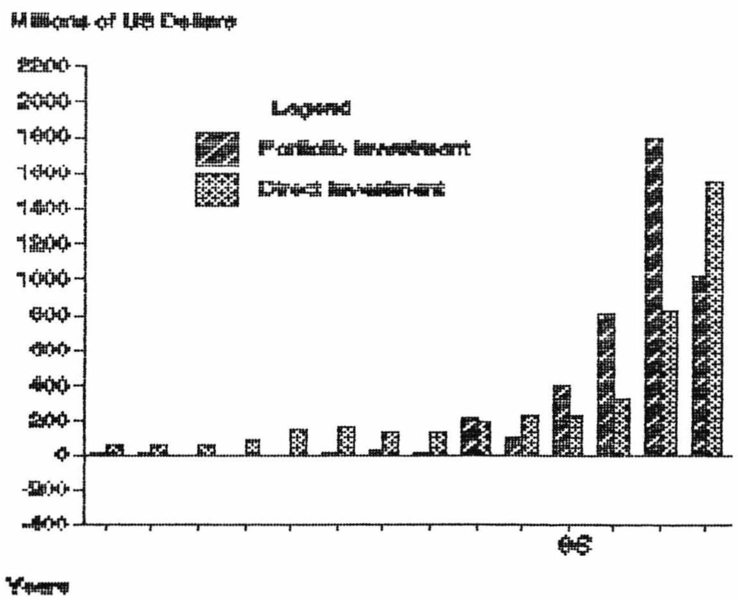


Figure 13 Growth of credit, Rate of Crawl and Interest rate

(1976-1988)

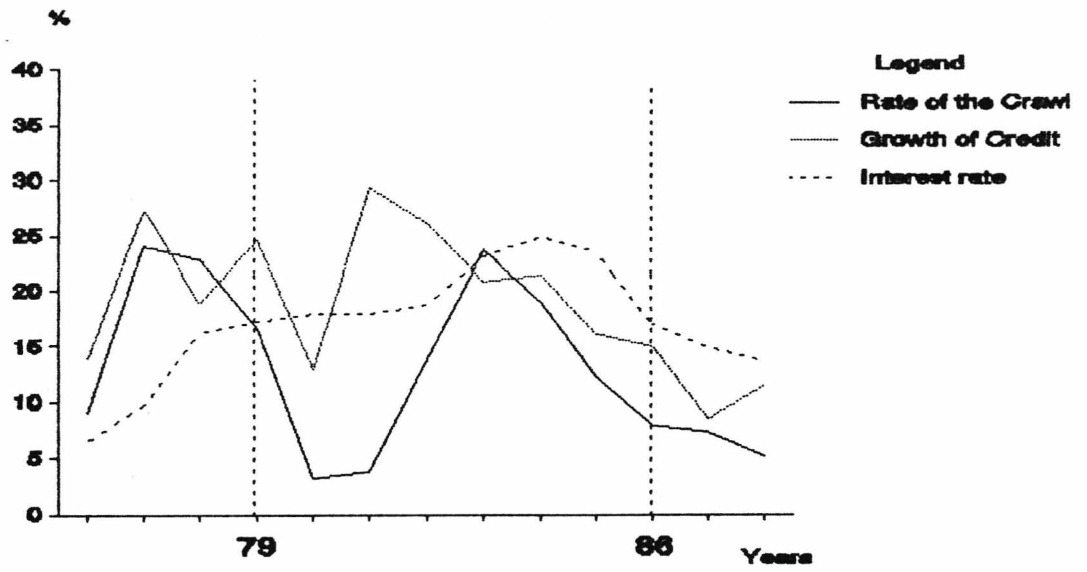


Figure 14 Long-term real interest rates

(1976-1988)

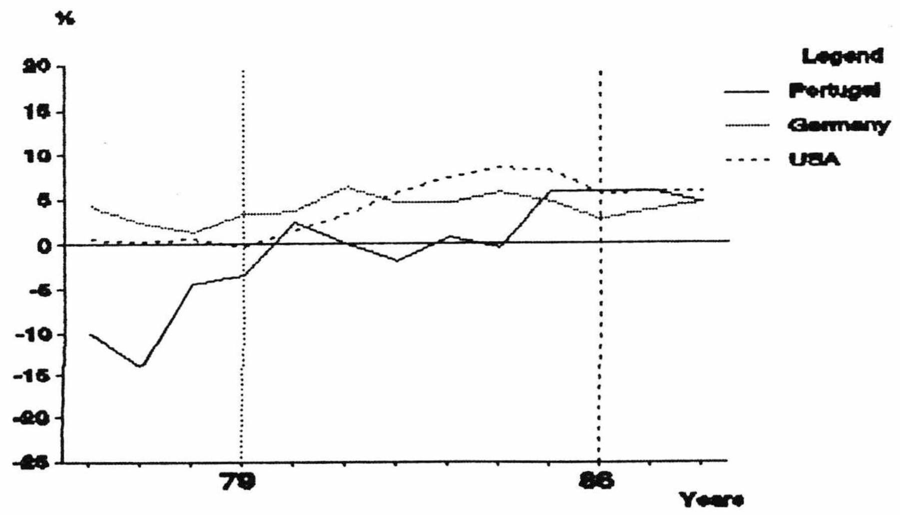


Figure 15 Rate of growth of real M1

(1976-1988)

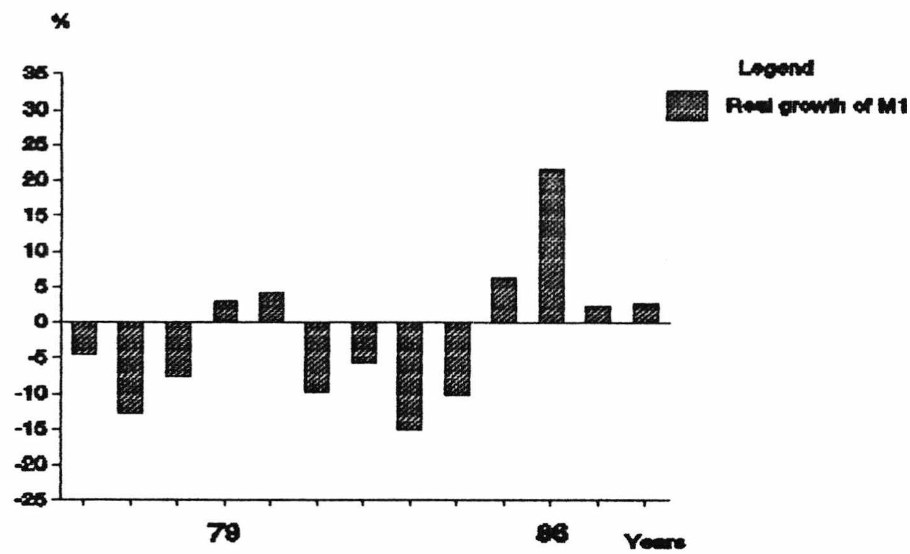
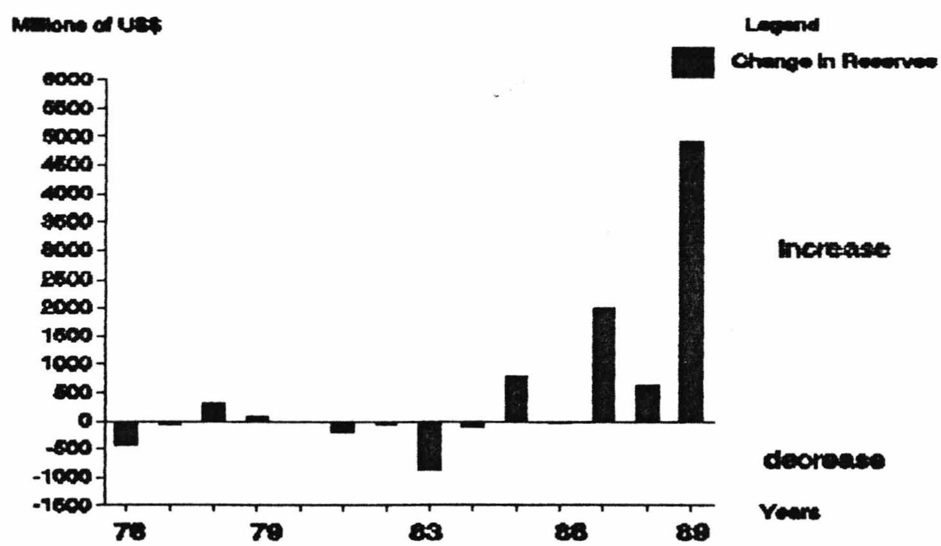


Figure 16 Changes in Foreign Exchange Reserves

(1976-89)



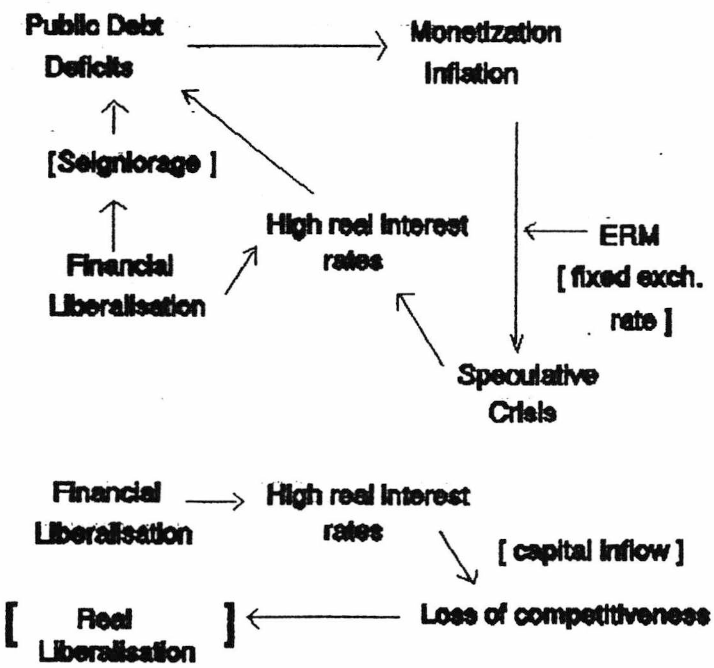
CONCLUSIONS

In this thesis we have emphasized that whilst joining the ERM in the 1990s means, among other things, maintaining the exchange rate within fixed narrow bands and the full liberalisation of capital movements, the previous 1979-89 experience of the ERM suggests that realignments and capital controls played an important role in the success of the arrangement.

The experience of the last decade has shown that, with periodic realignments, even countries with substantial inflation differentials could tie their currencies for some time. Whilst not allowing any major real exchange-rate misalignment to develop, high inflation countries could still enjoy some of the discipline imposed by the "hard currency" peg. However, around the time of the realignments large onshore-offshore interest rate differentials emerged suggesting that capital controls or dual exchange-rates insulated the domestic financial systems of the high inflation countries from full-scale speculative pressures. We have also seen that the width of the fluctuation band and marginal and intra-marginal foreign exchange market interventions have also been important for the stability of the ERM. Meanwhile, the participating countries either reduced (gradually) their inflation rates towards the "German standard" or substantially narrowed their inflation differentials.

The new stage of policy coordination in Europe which aims at achieving the near fixity of exchange rates implies that, from now on, participants in the ERM have to show the markets that they are determined to live without realignments and one way to send the message to foreign exchange markets is not to realign now. Under these circumstances we think that the commitment to a definite upper limit[1] of the escudo against the deutchmark seems premature. In this thesis we have attempted to explain why this is so, and, more generally, why the challenge of joining the ERM for Portugal is a major one.

In the first part of the thesis we reviewed several theoretical arguments that suggest caution in moving too quickly towards full liberalisation of the capital account and irrevocable fixing of the level of the exchange rate starting from a situation of high inflation, a large fiscal deficit financed by money creation, an under-developed financial system, high barriers to international trade and stringent capital controls. We took two different perspectives: one is more "public finance" oriented and the other is "structuralist". The various parts of the "public finance" perspective, presented in chapter 2, can be linked as follows.



[1] - We mean a level depreciated relative to the central rate - the upper limit of the fluctuation band.

A first set of arguments led us to the conclusion that public finances must be under tight control for successful financial liberalisation (internal and external). With financial liberalisation, real interest rates rise and the collection of seigniorage is more difficult. Under these circumstances the switch to bond financing of a largely unchanged deficit will eventually lead to monetization and inflation.

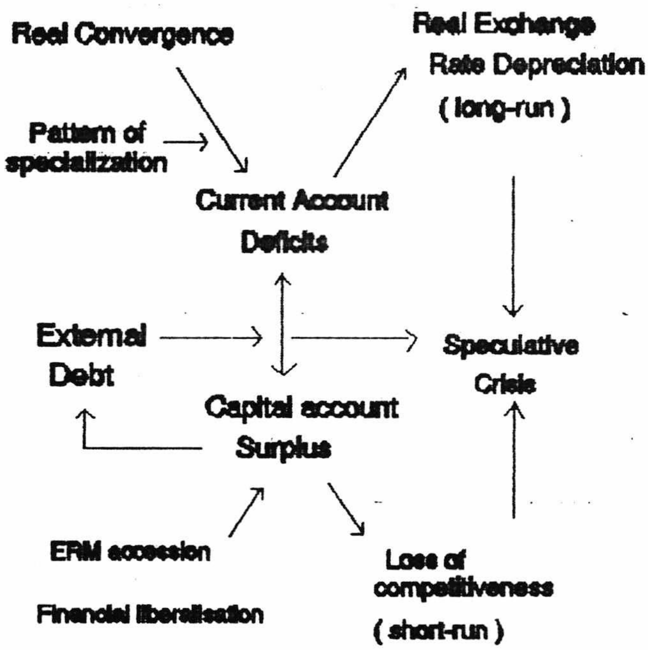
A country where the government relies heavily on seigniorage revenues to finance the budget is prone to balance of payments crisis if it opens up the capital account, pegs the exchange rate, and does not engage in major fiscal reform. With a policy of domestic credit expansion that, ultimately, is inconsistent with the fixed exchange rate regime, foreign exchange reserves will be declining over time and, at a certain moment, will be exhausted. This forces the authorities to switch the exchange rate regime from pegging to floating. The change in regime implies a reduction in the demand for real balances because the domestic interest rate increases (and there is inflation). This means that monetary equilibrium must be achieved through a discrete devaluation of the currency. To avoid capital losses speculators mount a run on the foreign exchange reserves. The speculative attack must occur when foreign exchange reserves are still sufficiently large to allow a smooth transition from pegging to floating. This ensures that monetary equilibrium is achieved through a discrete reduction in the nominal money stock and that the path of the exchange rate will not have any discontinuity. With foreign borrowing the options of the authorities are enlarged. This might be important when the authorities need time for fiscal adjustment because the attack will be postponed if borrowing occurs just before the run would have occurred in the absense of borrowing. But the authorities may also announce a currency band. The dynamics of the exchange rate within the band is a non-linear combination of fixed and flexible rates. If time is needed for a decisive action on the fiscal side, keeping the exchange rate within a band seems preferable to fixing the parity through borrowing because it avoids an early fixing of the parity without eliminating the incentives to act on the fundamentals.

A second set of arguments led us to the conclusion that the current account should be liberalised first and that the opening up of the capital account should proceed gradually. The liberalisation of the capital account appreciates the real exchange which, on impact, tends to overshoot the long-run equilibrium level. This loss in competitiveness squeezes the profitability of the export sector and thus threatens the success of the liberalisation of the current account.

Without fiscal correction the exchange rate (overshooting) effect of the liberalisation of the capital account will be magnified. Under fixed exchange rates the authorities might be tempted to realign (devalue) the parity which again brings trouble as the domestic currency becomes the target of speculators.

What do these theoretical arguments associated with the "public finance" perspective lead us to conclude? The apparent lack of control over public finances in Portugal, the expansionary pressure on the budget during the transitional period to full EC integration (1986-1996), and the overlapping liberalisation of the current account and capital account (long-term capital) all suggest caution in moving too quickly towards full liberalisation of the capital account (short-term capital) and fixing the level of the exchange rate.

The various parts of the "structuralist" perspective can be linked as follows.



Real economic convergence (defined as the reduction of existing disparities in GDP per capita between EC countries) requires, among other things, that the Portuguese economy grows faster than EC average. In this thesis we have shown that, given the income elasticities of import and export demand in Portuguese foreign trade, balance of payments equilibrium will require a long-run real exchange rate depreciation.

The simulation carried out in chapter 3 keeping the real growth rate of the Portuguese economy at 4% and the real growth rate of world demand at 2%, with constant relative prices, suggests that there will be an ever increasing need to finance the trade imbalance. Within a 10 year horizon (1990-2000) this pattern seems to be unsustainable, even without considering interest and other payments related to foreign debt accumulation. This situation is exacerbated within any of the ERM-entry scenarios considered. For example, with a gradual loss in competitiveness there will be an initial trade surplus (inverse J-curve effect) followed by a period of moderate deficits, which will give rise in the medium run to a rapidly widening payments disequilibrium (1994-2000). Thus, there will be a shift from a situation that seems to be sustainable, to a period marked by an explosive accumulation of foreign debt.

Our analysis suggests that, within a growth context, equilibrating nominal and real exchange rate changes are likely to be very large because of low-price elasticities and low income-elasticity of export demand. This also suggests that nominal and real exchange rate changes are a poor tool either to improve the competitiveness of Portuguese exports or to correct trade imbalances. However, this conclusion does not imply that the level of the real exchange rate is a matter of indifference, because major real exchange rate changes do have a long lasting impact on the equilibrium volumes (and values) of exports and imports. As the actual Portuguese pattern of international specialization tends to generate over time external deficits and/or a trend real depreciation, the sustainability of the escudo's participation in the ERM might be undermined without a rapid change in the pattern of international specialization.

The "structuralist" analysis presented in chapter 3 highlights a number of concerns as to the speed and to the extent of the adjustment required for the full participation of the escudo in the ERM.

The emergence of external deficits is the inevitable price that the Portuguese economy has to pay whenever domestic demand, particularly investment, is kept buoyant. For structural reasons, Portugal is heavily dependent on imports for its supply of energy, raw materials, investment goods and consumer durables. As its exports are still concentrated on traditional industries like textiles, clothing and footwear, the income elasticity of import demand is greater than the income elasticity of export demand, and that, on its own, tends to generate, over time, "permanent" external deficits.

The country's enhanced access to international capital markets for short-term financing, and the explosion of "autonomous" inflows of long-term capital that the Portuguese economy experienced in recent years made the financing of the external deficit easier. However, it should not be taken for granted that any current account deficit can be easily financed in the future. Neither should it be taken for granted that, by monetary and fiscal policy manipulations, a continuous inflow of funds can be maintained by offering a relatively favourable yield differential in favour of Portuguese assets. For a continuing current account deficit reflects a situation of permanent stock disequilibrium and, as such, an ever increasing yield differential would be required to finance, over time, a large and unchanged current account deficit. Moreover, if a country's accumulation of external indebtedness casts doubts on its ability to continue to service its debt, the country will face credit rationing and no funds will be made available by the financial community whatever price the country is prepared to pay. Then, external adjustment becomes a priority and a devaluation of the currency inevitable.

With monetary policy losing its effectiveness (because of the opening up of the capital account and ERM shadowing/accession) and with fiscal policy inflexible, it is increasingly difficult to control demand and cost inflationary pressures. The lack of control on demand conditions translates very rapidly into a deterioration of the current account, further aggravated if the domestic business cycle is not coordinated with the international business cycle. This underscores the necessity for budgetary correction and fiscal responsability. But it also suggests that without a more fundamental transformation of the economy a cautious approach to financial de-regulation and opening-up is necessary.

Thus the "structuralist" analysis presented in chapter 3, although from a different perspective, confirms the recommendations drawn from the more "public finance" oriented analysis presented in chapter 2.

In chapter 4 we have looked at the role of capital controls in insulating the Portuguese economy from the full strength of speculative attacks and we have shown capital controls were effective and useful in Portugal's recent experience.

Firstly, we have seen that the path of the escudo has been anticipated quite accurately. This implies that the exchange rate risk premium is (was ?) neglegible and that capital controls were needed to prevent speculative attacks.

Secondly, we have shown that the large and volatile deviations from covered (uncovered) interest rate parity reflect the anticipation of devaluations and indicate also that capital controls were effective in insulating the domestic financial system from the full effect of speculative pressures. This means that the political risk premium is (was ?) high and volatile. These speculative pressures developed because fundamental factors such as current account deficits were present. But it is also important to realize that they developed because for most of the time the Portuguese authorities followed competitiveness targets, which implied occasional large devaluations. In fact, purchasing power parity has not held and the real exchange rate depreciation of the escudo is highly correlated with deviations from covered (uncovered) interest parity. This provides evidence on the competitiveness targets pursued by the Portuguese authorities and means that in the case of the escudo the currency premium is the result of real depreciation and not of exchange rate risk premium. Taken together these results indicate a lack of real and financial market integration.

Thirdly, we have seen that speculative runs can also be caused by other events, such as, for example, the occurrence of domestic political crisis like those reviewed in this thesis. Thus, political instability might affect business confidence, the well-established reputation of the authorities for sound finance and strong currency notwithstanding. The main conclusion is that fixed exchange rates and external financial liberalisation seem to imply the need for continued political stability.

Fourth, we have argued that when "real shocks" hit the economy, like those that affected the Portuguese economy in the early 1970s (loss of markets, resources and adverse shift in the terms of trade), re-equilibrating real exchange rate changes are warranted. With nominal wage and price stickiness, nominal exchange rate changes were unavoidable. Thus, the authorities followed competitiveness targets that did indeed lead to speculation, but that was limited by effective exchange controls.

Fifthly, we have seen that in 1979-80 interest rate parity prevailed, the escudo appreciated in real terms, inflation came down and in 1980 real interest rates in Portugal were above international levels. At the same time, until 1982, external finance became readily available and the country experienced a period of relatively high economic growth whilst foreign markets were contracting under the impact of the 1981-82 world recession. By contrast, 1982-83 was a period marked by increasing current account deficits, a steadily declining level of foreign exchange reserves, and speculative pressures on the escudo as reflected in the black market and forward premia. The historical episode reviewed highlights the circumstances and the timing of the development of speculative pressures on the escudo. It is important because the recent macroeconomic performance of the Portuguese economy already shows some signs of the development of such circumstances, which can only be aggravated should Portugal proceed any further in the rapid and extensive financial liberalisation implied by Stage 1 of EMU.

We should bear in mind that Portugal joined the EC against the background of a long history of tight foreign exchange controls and more than a decade of relatively high political instability and stop-go government policy actions that included several devaluations of the escudo. This means that stopping (moderate) inflation in Portugal might involve important coordination problems that may not be solved by just implementing a new monetary and fiscal policy. After behaving in the recent past as we have seen, it is probably easier for the Portuguese authorities to play the hard currency game than to convince the markets that it is more than just a temporary game.

In the second part of this thesis we reviewed, from a theoretical perspective, what kind of macroeconomic incentives EC countries might have to join the ERM assuming that the fundamental factors behind the inflationary process have been corrected. The argument most often referred to is related to the credibility problem facing a government at the outset of a disinflationary programme. By joining the ERM the government or the central bank of the entrant will benefit from the Bundesbank's reputation of being tough on inflation. This corresponds to achieving and sustaining the zero inflation precommitment equilibrium of the one-shot game as a non-cooperative equilibrium in a repeated game.

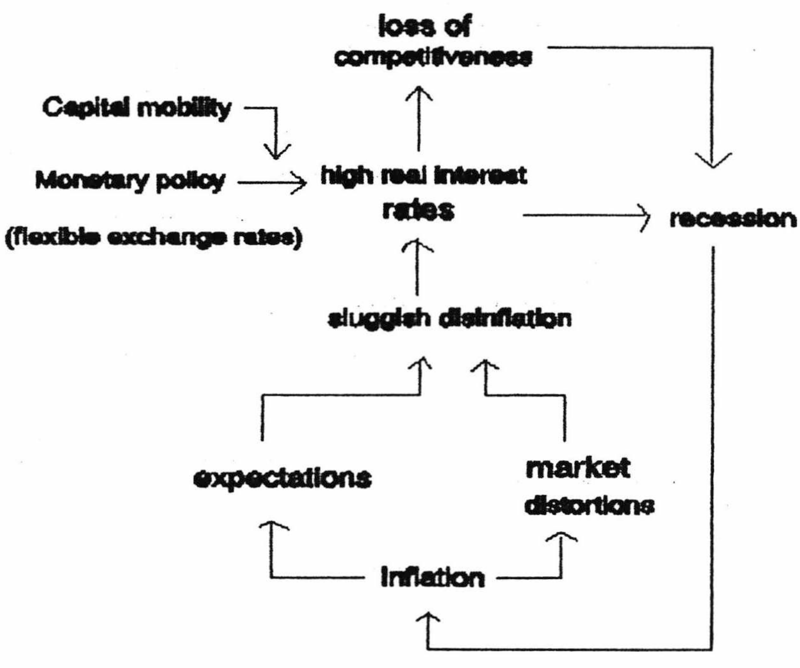
In chapter 6 we looked at the experience of disinflation in the 1980s in some selected countries. The main objective was to confront the reputational and credibility hypothesis with the empirical evidence. Several conclusions were drawn as follows.

Firstly, the disinflation of the 1980s was a global phenomenon that occurred in spite of the flexible exchange rate regime that prevailed among the main internationally traded currencies. In particular, in Europe, both participants and non-participants in the ERM reduced their inflation rates. This casts some doubts on the validity of the traditional ideas about the inflationary bias of the floating regime.

Secondly, in general, the disinflation of the 1980s was costly in terms of output and employment, even in the countries participating in the ERM. In fact, the empirical evidence suggests that the reputational effects of ERM-membership might be less important or at least more difficult to realise that the theoretical literature suggests.

Thirdly, the paths of competitiveness and real interest rates seem to have influenced the output costs of disinflation (measured by the sacrifice ratio and/or misery index), which tended to be lower under (adjustable) pegged rates (France/franc) than under floating (U.K./sterling). Disinflation under the monetary tightening-floating strategy (U.K./sterling) implied an initial large loss in competitiveness and a higher real interest rate; the peg strategy (France/franc) implied greater stability of competitiveness and a lower real interest rate. This could possibly be a justification for ERM participation, independently of any further credibility effects that might arise. But the fact that disinflation was costly, both under pegging and floating, reinforces the view that at the root of the adjustment problem may lie, either a lack of convergence or, at least, prolonged convergence to the rational expectations equilibrium or, even with rational expectations, price and wage stickiness resulting from product and labour market distortions.

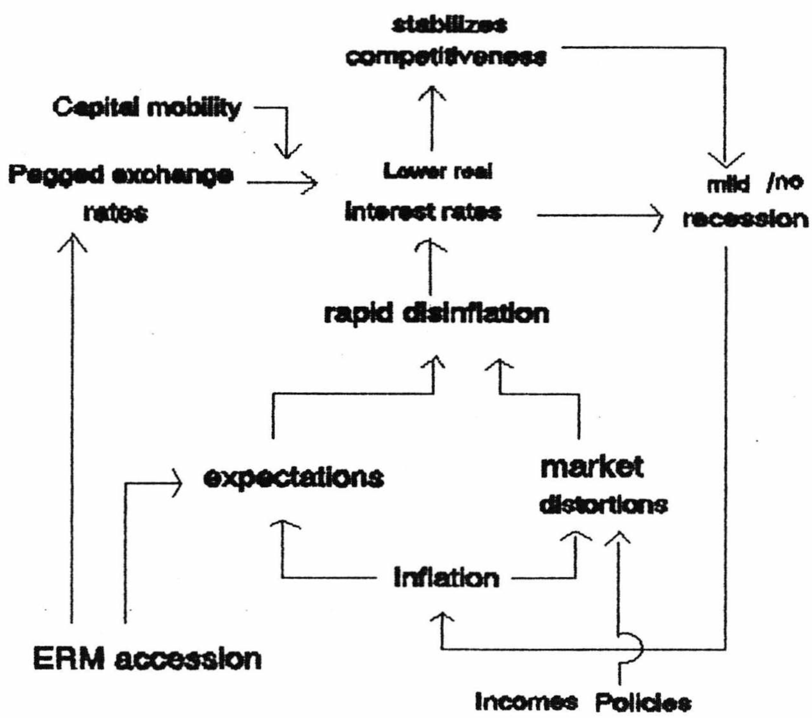
In chapter 5 we suggested that beyond reputational incentives there are other arguments in favour of joining the ERM with full capital mobility. Inflation stabilization involves in general a period of recession or real growth below potential caused by a rising real interest rate and a balance of payments surplus which tend to appreciate the real exchange rate (loss of competitiveness). The various parts of the argument can be linked as follows.



The real interest rate tends to rise in the transition from high to low inflation. There are two basic reasons for this. First, during a high inflation nominal interest rates tend to rise reflecting more or less the rate of inflation. Monetary equilibrium will imply a low level of real balances. Stabilization typically involves fixing wages, prices, the exchange rate and also restrictions on domestic credit creation. This means that real balances are frozen at its prestabilization level. Thus, with the nominal interest rate determined by monetary equilibrium approximately at its prestabilization level and with the rate of inflation falling the real rate of interest rises. Second, if the demand for real balances depends not only on the nominal interest rate but also on the expected rate of inflation, the equilibrium nominal interest rate must also rise. The expected fall of inflation raises the demand for real balances at each level of nominal interest rates. With real balances frozen at the prestabilization level monetary equilibrium requires an increase in nominal interest rates. Thus, the real interest rate rises yet further. In a small open economy under floating exchange rates and perfect capital mobility there will be a sharp loss in competitiveness. The problem of real exchange rate appreciation and high real interest rates in the aftermath of a policy of inflation stabilization explains the high unemployment/slow growth costs of disinflation.

Within this theoretical framework capital mobility appears to be detrimental because it induces real exchange rate appreciation. However there is an important link between inflation stabilization and international capital mobility. If the central bank pegs the exchange rate and does not sterilize the capital inflow that is likely to occur at the moment of pegging, the stock of nominal balances increases and domestic interest rates come down.

However, for the success of the stabilization there must be a tight synchronization of wage and price setting: incomes policies, together with fiscal adjustment, exchange rate pegging and monetization, can perform an important role in the success of the stabilization because separate nominal exchange rate and wage targets are incompatible. The incentive to join the ERM is understood if governments have decided to bring down inflation in the short-run: this is because the output costs of disinflation are likely to be lower under an immediate-peg strategy than under a floating regime. The various parts of this perspective can be linked as follows.



Though not being a formal participant in the ERM, the escudo has in practice been "shadowing" the DM within a wide fluctuation band (±6%) in a way that looks very much like the path of the Italian lira during the experience of the EMS between 1979 and 1989. We called it the soft-ERM option.

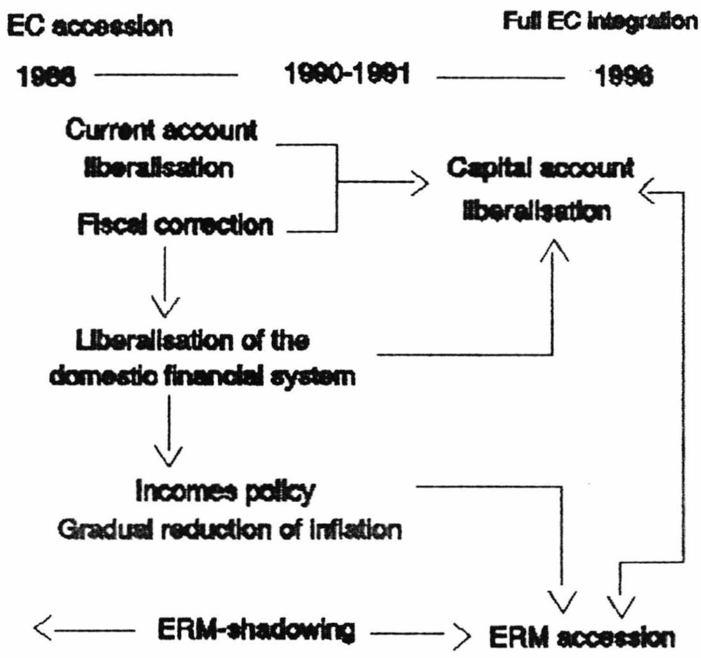
Thus, whilst we may say that for most of the recent past the exchange-rate policy followed by the various Portuguese governments is the kind of policy that invites self-fulfilling speculative attacks, the recent change in the way the escudo is managed is a step in the right direction, if financial liberalisation is to proceed. The medium-term credibility of this move can be questioned as long as the escudo remains an ERM outsider. But Prof. Cavaco Silva's reputation of being an "inflation fighter", built when he was first in office in 1979-80 and reinforced by the sharp fall of the inflation rate in the first two years of his office as Prime-Minister, might very well be a close substitute for full participation in the ERM.

In chapter 7 we presented evidence that supports the idea that a decisive turn-around in expectations occurred in Portugal, in 1987, and this could be the reason why the disinflation was costless. Such change in expectations coincided with the beginning of the implementation of an incomes policy explicitly directed at breaking inertial inflation, and can be seen as a measure of the success of that policy. These conclusions were drawn within the framework of the expectations-augmented Phillips curve and some important stylized facts about the Portuguese economy emerged, namely that although there is no long-run trade-off between inflation and unemployment, the real wage is flexible. But within this framework the interruption of the disinflationary process in 1988 cannot be understood, unless some exogenous loss of credibility happened. This is a plausible interpretation because the Portuguese escudo did not join the ERM, at least not explicitly. That is why it is important to look at the Portuguese experience from a different angle. That is why we have suggested that real wage flexibility, productivity gains, terms of trade shocks, exchange-rate and monetary policy and external financial liberalisation, may have played an important role in this "disinflation without tears". This is not in contradition with the idea that a shift in the inflationary climate occurred in 1987. But the advantage of the latter approach is that it suggests a solution for the puzzle of the interruption of the disinflationary process: it seems extremely difficult to halve the rate of inflation if a country has moderate inflation, the economy is growing at potential and the unemployment rate is below the "natural rate" and declining. And this approach is also consistent with persistent massive flows of long-term capital into Portugal a fact that seems at odds with the idea of a loss of credibility. And if reputational factors are not at the root of the present problems of the Portuguese economy, an immediate entry into the ERM and the greater fixity of nominal exchange rates that it would imply, would only force the country to discontinue the gradualist approach to disinflation. And one might wonder why should the country be forced into recession.

The very pragmatic approach to exchange rate management followed by the Portuguese authorities is a step in the right direction (though not sufficient) in order to establish a "new" reputation for the escudo, as it plays an important part in any credible commitment to greater exchange rate fixity.

What our analysis implies for the timing of the Portuguese escudo's full participation in the ERM under the conditions set out for Stage 1/2 of EMU, that is, within the narrow band, without realignments and without capital controls, is sketched below.

We have divided the transitional period - from EC accession (1986) until full EC integration (1996) - into two periods. The half-way point coincides with the beginning of Stage 1 of EMU. The



analysis presented in the second part of the thesis suggests that the escudo should join the ERM within the narrow band and with full capital mobility, perhaps, "near" 1996. We say perhaps because, as explained in the first part of the thesis, the success of that "big" step depends on the accomplishment of several tight conditions: current account liberalisation and (at least some) change in the pattern of international specialization, fiscal correction, liberalisation and development of the domestic financial system. These changes should allow a sustained reduction in the inflation differential between Portugal and the EC average. With some luck and decisive policy action we might be there (or close) in 1996 but certainly not in 1990-91.

The case, of course, is not for doing nothing: it is, rather, a question of timing. Portugal would probably be better off if "1992" were in the year 2002. Meanwhile, the soft-ERM option appears to be the second-best choice for Portugal in the early 1990s.

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