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Abstract

The purpose of this study is to analyze realignment expectations in the exchange rate mechanism of the European Monetary System (EMS), in particular with reference to the five year period (1987–1992) during which no realignments were done. The period chosen for this study provides us an interesting sample in this respect, because, in mid-1990, the EMS faced a historical asymmetric shock of German Monetary Unification (GMU). Dramatic changes in the fundamentals of the anchor country of the system can help us to detect channels through which macroeconomic developments affect the pressure to realign and, therefore, expectations of such realignments.

By using a model that breaks the interest rate differential in two components, the expected rate of depreciation within the allowed fluctuation band and the expected rate of depreciation of the central parity rate, we get a measure for the credibility of the exchange rate. We estimate the expected rate of depreciation of the exchange rate within the band, subtract the results from the interest rate differential and obtain values for the expected rate of devaluation. Finally, the estimated values for the expected rate of devaluation are regressed on selected macroeconomic variables in order to find out to which extent the expected rate of devaluation depends on economic fundamentals. The model was built by including the commonly most important factors for exchange rate determination.

We observed increased exchange rate credibility in the form of decreasing devaluation expectations over the period 1987–1992. The explanation for this increase in the stability of the EMS is that German interest rates and inflation, were moving upwards and hence, approaching the corresponding variables of the other EMS countries. It was the convergence of these variables that eased the pressure on the nominal exchange rates. Therefore, signs of the 1992 crisis could not be seen in advance in expectations.

Our results emphasize the role of the relative cyclical positions of the pegging countries vis-à-vis the anchor country of the system. Thus, expectations of possible realignments as a means of adjustment became actual first after it could be seen that there was a discrepancy between the cyclical needs of the economies in the other EMS countries and the high interest rates imposed on the ERM by Germany. These discrepancies became visible first in the traditional weak-currency countries that faced the most difficult domestic economic situation. This is mirrored by the fact that for these countries the government deficit, relative to Germany, clearly affected devaluation expectations. The divergence of the business

cycles added to this effect. The level of foreign exchange reserves of the central bank was observed by the markets, which indicates the praneness of these currencies to get under a speculative attack. In the hard-currency countries, by contrast, devaluation expectations could not be seen even in the very eve of the crisis. For these countries, we obtained the inverse result that a growing government domestic deficit as compared to Germany tends to strengthen the currency of the home country. Markets also seem to observe the inflation rate differential. For the crisis, however, this factor could not play a crucial role because the inflation rates of the hard-currency countries were practically at the German inflation rate level. All in all, the results of this study suggest that the crisis was due to the reversal in the German business cycle in a situation where the anchor country conducted a strict monetary policy to fight domestic inflation pressures.

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Tiivistelmä

Tutkimuksen tavoitteena on analysoida devalvaatio-odotuksia Euroopan valuuttajärjestelmän vaihtokurssimekanismissa erityisesti aikavälillä 1987–1992. Jakso on mielenkiintoinen, koska silloin hallinnollisia kurssimuutoksia ei tehty ja koska heinäkuussa 1990 järjestelmää kohtasi epäsymmetrinen sokki, Saksojen valuuttaunioni. Tutkimalla ankkurimaa Saksan talouden perustekijöiden muutosten vaikutuksia voidaan löytää kanavat, joita pitkin makrotalouden muutokset aiheuttavat devalvaatio-paineita ja devalvaatio-odotuksia.

Analyysissä lasketaan ensin kattamattoman korkopariteetin avulla luottamuskäytävä ERM:ään osallistuvien valuuttojen jäsenmaiden kotimaisille koroille käyttäen hyväksi tietoa, että valuuttakurssin tavoite-vyöhykkeen ollessa uskottava valuuttakurssi ei koskaan ajaudu ilmoitetun putken ulkopuolelle. Kotimaiselle korolle määräytyy valuuttaputken leveyden mukaan raja-arvot, joiden välissä valuuttakurssivyöhyke on uskottava. Tämä yksinkertainen menetelmä ei kuitenkaan ennusta syksyn 1992 valuuttakriisiä.

Tutkimuksessa estimoidaan odotettu putken sisäinen valuuttakurssi-muutos, vähennetään tämä korkoerosta ja saadaan näin mitta vallinneille devalvaatio-odotuksille. Nämä pyritään selittämään käyttämällä tärkeimpiä makromuuttujia, jotta löydettäisiin talouden perustekijöiden yhteydet devalvaatio-odotuksiin. Havaitut devalvaatio-odotukset pienenivät kaudella 1987–1992, mikä viittaa valuuttakurssien uskottavuuden kasvuun. Selityksenä voidaan pitää sitä, että järjestelmän keskuksena toimivan Saksan korot ja inflaatio nousivat ja siten lähenivät muiden EMS-maiden vastaavien muuttujien arvoja. Tämä vähensi valuuttakursseihin kohdistuvaa painetta, minkä vuoksi vuoden 1992 kriisi ei ennakkoon näkynyt odotuksissa.

Tutkimuksen tuloksissa korostuu jäsenmaiden suhdannetilanteen merkitys suhteessa ankkurimaahan. Odotuksia ERM-valuuttojen devalvaatioista ilmeni vasta, kun markkinoilla havaittiin, että jäsenmaiden suhdanteista johtuvat politiikkatarpeet alkoivat erota Saksan tarpeista. Nämä erot tulivat ensin näkyviin perinteisissä heikon valuutan maissa, joissa taloudellinen tilanne oli vaikea. Näiden maiden makromuuttujista erityisesti valtion budjettivaje oli ratkaiseva devalvaatio-odotusten selittäjä. Suhdannetilanteen ero Saksan suhdanteeseen voimisti näitä odotuksia. Markkinat seurasivat myös heikkojen valuuttojen maiden keskuspankkien valuuttavarannon suuruutta, mikä kertoo heikkojen valuuttojen alttiudesta spekulatiivisille hyökkäyksille. Kovan valuutan maissa sitä vastoin devalvaatio-odotuksia ei ollut nähtävissä edes aivan valuuttakriisin aattona. Näille maille saatiin odottamaton tulos, että kasvava budjetti-

vaje vahvistaisi luottamusta valuuttaan. Toiseksi keskeiseksi devalvaatio-odotusten selittäjäksi osoittautui inflaatioero Saksaan nähden, joskin kovan valuutan maissa tämä ero oli käytännössä vähäinen. Kaiken kaikkiaan tutkimuksen tulokset viittaavat siihen, että vuoden 1992 valuuttakriisin laukaisi Saksan suhdanteen käänne huonompaan tilanteessa, jossa se taisteli kotimaista inflaatiota vastaan kireän rahapolitiikan asein. Muut ERM-maat menettivät Saksan yhdistymistä seuranneen kysyntäimpulssin samalla kun ne joutuivat heikossa suhdannetilanteessa seuraamaan ankkurimaan kireää rahapolitiikkaa.

Asiasanat: ERM, tavoitevyöhykejärjestelmä, devalvaatio-odotukset, valuuttakurssi, Saksan valuuttaunioni

Contents

1   Introduction

1.1   Background

The countries of the European Communities (EC) have traditionally cooperated in the monetary field, even if the start was quite modest. In the Treaty Establishing the European Communities, the Treaty of Rome from 1957, monetary coordination was only mentioned vaguely as an aspect of economic policy cooperation. A decade later, in 1969 in the Hague, member countries agreed that a plan should be drawn up with a view to the creation, in stages, of economic and monetary union within the EC. This initiative was taken against the background of major achievements by the EC in the 1960s: the early completion of the transitional period leading to full customs union, the establishment of the common agricultural policy and the creation of a system of its own resources. The Werner report, prepared in 1970, presented a plan for the attainment of economic and monetary union. Yet, by the mid-1970s the process of integration had lost momentum under the pressure of divergent policy responses to the economic shocks of the period. Early attempts to stabilize intra-European exchange rates during the Bretton Woods era were unsuccessful, as was the Snake in the Tunnel agreement of the 1970s.

The European Monetary System (EMS), set up in 1979 proved to be most durable. It has been praised as a successful system of fixed, but adjustable, exchange rates promoting monetary and exchange rate stability throughout the EMS area.

The EMS, like the Bretton Woods system, represents an agreement among the participating countries to set exchange rate parities, to manage intra-European Community exchange rates and to finance exchange market intervention. Like Bretton Woods, it is an adjustable peg system. EMS, however, was designed to prevent the defects of the Bretton Woods system, mainly the asymmetric adjustment mechanism and the problems associated with growing capital mobility. Created for balance, the EMS reflects the search for a suitable mix between rigidity and flexibility; a hyperbola between fixed peg and free floating systems. The members maintain their currencies within narrow bands of fixed central parities. The EMS established intervention rules that would produce a symmetric system of adjustment, create a mechanism to finance exchange market interventions and set out a code of conduct for realigning parities. There have, indeed, been a number of realignments of these central

parities. Because the timing and the magnitude of adjustment are determined by monetary authorities and because adjustments have frequently been large relative to the width of the bands, these realignments resemble devaluations and revaluations of fixed exchange rates. At the same time, the system does allow for some exchange rate flexibility. This means that the exchange rates can be adjusted if needed. This is expected to occur when the underlying economies differ too much, so that internal stability can only be re-established by using the exchange rate tool.

When the system had been working for more than a decade, it became widely accepted that, within the framework of the EMS, the EC countries had succeeded in creating a zone of monetary stability at the same time as gradually relaxing capital controls. Although the agreements establishing the EMS do not specify that the system should be asymmetric, it has been claimed that EMS has de facto worked asymmetrically. Germany has become the central country. Its monetary policy deeply affects the monetary policy of other participating countries. Since the exchange rates were fixed and the other countries had a higher inflation rate than Germany, they lost competitiveness in the goods markets. In the early 1980s there were two pools: the low-inflation pool around the DEM and the higher-inflation pool around the FRF. Realignments of the exchange rates were frequent, and inflation rate differentials remained considerable. In the mid-1980s, however, realignments became rare and inflation became the variable that was adjusted. Since the German inflation remained low, the other central banks could buy credibility from the Deutsche Bundesbank by pegging their currencies to the DEM. As a result, the inflation rate differentials started to decline, which in turn increased the long-term credibility of the whole system. Hence, both monetary stability and exchange rate stability in the EC area increased.

After the realignment in January 1987, the EMS experienced its most successful period. Inflation rates were converging, the EMS countries enjoyed economic growth and interest rate differentials narrowed. It seemed that the preconditions for exchange rate stability would be reached successfully, so that the participating countries could proceed along the path to monetary integration and fix their exchange rates irrevocably within a reasonable time horizon. Such a plan was included in the Treaty on European Union, according to which the member states should aim at forming economic and monetary union (EMU) by 1999. After thirteen years of success, however, the system fell into turmoil in the autumn of 1992. The liberalization of capital movements made speculation possible to an unprecedented extent. Since the participating countries had different economies, the

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divergencies finally resulted in heavy attacks on some of the currencies. The difficulties lasted one year, until in August 1993 the EMS was radically changed. A joint decision of the member states led to the fluctuation bands around the central parities being extended from ± 2.25 % to ± 15 %. Market agents became doubtful about the willingness of some EMS countries to continue their commitment to the exchange rate rule.

1.2   Purpose of the study and methods of analysis

The purpose of this study is to analyze the credibility of the EMS in the five-year period during which no realignments were made. In its early years the EMS served as a flexible system that allowed for a nominal exchange rate adjustment when the real variables so indicated. In the mid-1980s, attitudes changed. Exchange rate realignments were no longer an automatic solution to domestic economic needs; rather, the EMS was used as a disciplinary framework to support the stability-oriented goals of domestic monetary policy makers. Hence, it is of general interest to understand how nominal exchange rates remained unchanged in the late 1980s and early 1990s. If the exchange rates remained unchanged for five years because of a stronger political commitment to the EMS, stability was due to an administrative decision to keep the parities unchanged, regardless of how the economies of the member states developed. In this case, one could have expected greater interest rate differences as a result of increasing devaluation expectations. On the other hand, if the reason truly was increasing convergence and stability in the underlying economic factors, then one wonders what actually caused the upheavals on the European foreign exchange markets in the autumns of 1992 and 1993.

Assuming that the member states experienced economic convergence, and that the EMS exchange rates remained stable because of such a favourable development, something must have occurred to explain the exchange rate crisis after so many years of calm. In this study we want to focus especially on the unique event that occurred during this five-year period of nominal exchange rate stability. Germany, the central country, was hit by a large shock that affected the entire economy, German Monetary Unification (GMU). The monetary aspect of GMU centred on the problem of converting the money stocks in East Germany so that inflationary pressures could be avoided. On the real economy side, in turn, public expenditure

grew rapidly. In order to avoid increased pressure on prices, a budget deficit should be financed by increasing tax revenues rather than by borrowing. These problems, however, could not be solved; inflation accelerated in Germany, and the Bundesbank reacted by tightening monetary policy. This together with an increased demand for capital raised interest rates in Germany. Given the central position of Germany, it could be expected that these changes would have a greater effect on the EMS than if they had occurred in some other member state.

In a situation where changes in variables are immediately and correspondingly transmitted through financial markets, the monetary autonomy of the participating countries in the system is considerably reduced. This implies that the system must be looked on as meaningful in order for the domestic monetary authorities to be ready to give up their autonomy. If the system does not contribute to the goals of the domestic authorities, then the willingness of the authorities to commit themselves to the system decreases. Such a situation could be one where an asymmetric shock hits the system. Within the EMS GMU was such an asymmetric shock: it reversed the business cycle in Germany, and the effects spilled over into other EMS countries in the short term, (but this could not prevent recession in the rest of the EMS). As a consequence, Germany conducted a monetary policy adequate to cope with its domestic problems, whereas the other countries could only let the effects be transmitted into their domestic economies.

The reader is first provided with some background information, ie the institutional framework of the EMS is described, literature on the German dominance hypothesis is surveyed and some major macroeconomic changes in Germany, caused by GMU, are described. In the empirical part, methods familiar from target zone literature will be used. We start the analysis with a simple method, namely calculating, on the basis of the uncovered interest rate parity theorem a credibility corridor for the domestic interest rate. If a target zone is credible, then the exchange rate can never exceed the upper limit or fall below the lower limit of the fluctuation band. By using this information, we can calculate limits for the domestic interest rate within which the interest rate differential indicates full credibility of the announced target zone.

This simple method is then developed further. By using a model that breaks the interest rate differential into two components, the expected rate of depreciation within the allowed fluctuation band and the expected rate of depreciation of the central parity rate, we arrive at a measure for the credibility of the exchange rate. We estimate the

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expected rate of depreciation of the exchange rate within the band, subtract the results from the interest rate differential and obtain values for the expected rate of devaluation.

Finally, the estimated values for the expected rate of devaluation are regressed on selected macroeconomic variables in order to find out the extent to which the expected rate of devaluation depends on economic fundamentals. Since we know that no exchange rate model performs perfectly, we build the model here by including the most common important factors for determining the exchange rate. Judgement is based on information from previous theoretical and empirical works within exchange rate theory.

1.3   Outline of the study

The study first provides the institutional background of the EMS. This is done in Chapter 2, where the main elements of the EMS are described and discussed. The literature on the de facto functioning of the system is reviewed. In this context, the anchor country role of Germany is given special emphasis.

Chapter 3 describes the basic macroeconomic changes in Germany after GMU relevant to this study. We concentrate on inflation and interest rates. It would be out of the scope of this study to prove that the changes observed depend on GMU; it is simply assumed that the changes are to a large part due to GMU.

In Chapter 4 the long-term implications of GMU for the EMS are discussed. Because insufficient time has elapsed since GMU, empirical tests on the effects cannot yet be conducted. Instead, we discuss the overall macroeconomic effects and exchange rate development. A survey of previous studies on the effects of GMU on exchange rates is also done.

In Chapter 5 a model to measure the credibility of the EMS exchange rates is constructed. The model is based on a standard model from target zone literature, developed step-by-step from a naive to a more sophisticated model. The more sophisticated version is presented and tested in Chapter 6. The aim is to find out whether GMU has awakened expectations of parity changes within the system. When GMU was established, there was strong anticipation of a considerable change in the external value of the DEM, which then cast doubt on the ability of the EMS to absorb the asymmetric shock.

In Chapter 7 potential explanations for the behaviour of the expected rates of devaluation are analyzed. We use standard exchange rate theories in order to find macroeconomic variables that affect the

actors' devaluation expectations. The results indicate that the role of GMU in the 1992 EMS crisis was such that, because of it, the needs for monetary policy in Germany had become very different from those in the other countries. Germany's economic policy on the eve of the crisis was characterized by slightly loose fiscal policy and tight monetary policy. Despite a slow growth in output in Germany, the chances of German interest rate cuts seemed bleak. The growth of the German money supply was still above the target range and the inflation rate was considered too high. Markets are sensitive to such conflicts over the appropriate course of monetary policy in an area of fixed exchange rates, and may have reasoned that the anchor country would have preferred a realignment of the DEM to a reduction in German interest rates. That, in addition to the cumulative losses of competitiveness in some EMS countries with relatively high inflation rates and the constraints on interest rate increases in some weak-currency countries, clearly presented speculators with a "one way bet" that merely fuelled exchange market pressures. The rejection of the Maastricht Treaty in the Danish referendum in June 1992 finally triggered the first crisis, raising expectations among speculators that EMU would be delayed beyond the date set by the Maastricht Treaty. This would make commitment to the EMS meaningless in a situation where the anchor country was experiencing recession and applying a policy mix that did not correspond to the needs of the partner countries.

Finally, Chapter 8 provides a summary of the study, concluding with a discussion of the main results of the empirical aspects of the study. In general, the spot exchange rate can remain stable quite independent of devaluation expectations, and devaluation expectations, in turn, are not observed as long as certain underlying macroeconomic variables converge. If the empirical results of this study can be generalized, they indicate that devaluation expectations become visible first when there are obvious policy conflicts, and these conflicts are considered as unsustainable over the longer term. Moreover, it is natural to think that devaluation expectations relate to the attractiveness of a system as a whole rather than a single exchange rate. In other words, a system must be experienced as meaningful: if it does not contribute to the goals of domestic authorities, the willingness of those authorities to commit to the system decreases. When the market agents think that that threshold has been exceeded, devaluation expectations arise.

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2   The European Monetary System

The European Monetary System (EMS) was established in 1979 as an attempt to create a zone of relative monetary stability in Europe. It was also seen as a further step of EC members towards monetary union. The EMS has three main goals:

*   create a zone of internal and external stability; ie to lead to lower inflation rates and increased exchange rate stability
*   contribute to increased convergence of the economies and stronger growth
*   facilitate the conduct of a common policy towards third countries.

As stated earlier, EMS members maintain their currencies within narrow bands around fixed central parities. Vis-à-vis third currencies, the exchange rates may move freely. There have, however, been a number of realignments of the central parities. Because the timing and magnitude of the adjustments are determined by monetary authorities and because the adjustments have frequently been large relative to the width of the bands, these realignments resemble devaluations and revaluations of fixed exchange rates. At the same time, the system does allow for some exchange rate flexibility.

   The EMS has three elements that are used to reach the above goals. First, there is a common unit of account, the ECU. Second, there is the parity grid in which the central rates and the fluctuation limits are given. Third, there are credit arrangements between central banks participating in the parity grid in order to support the maintenance of the fixed exchange rates. Finally, collective decision-making can be mentioned as a tool to make the system work symmetrically. In the following the system will be presented by reviewing these elements. For the purpose of this study we will concentrate on the functioning principles of exchange rate cooperation.

2.1 The European Currency Unit, ECU

The European Currency Unit (ECU) acts as a:

* numerator for fixing central rates
* reference unit for the operation of the divergence indicator
* denominator for operations in the intervention and credit mechanisms
* means of settlement between the monetary authorities of the EC.

The ECU is a composite monetary unit defined as a weighted basket of the currencies of the EC countries. Earlier, the composition of the ECU was revised every five years, or if necessary on request, when the weight of any currency changed by 25 %. In the Treaty on European Union, also known as the Maastricht Treaty, the composition of the ECU basket was frozen and since November 1993 it has been as illustrated in Figure 2.1.

Figure 2.1   **The percentage shares of the EC currencies in ECU basket, calculated on average central rates for January 1992 and the shares of the realignment in January 1987**
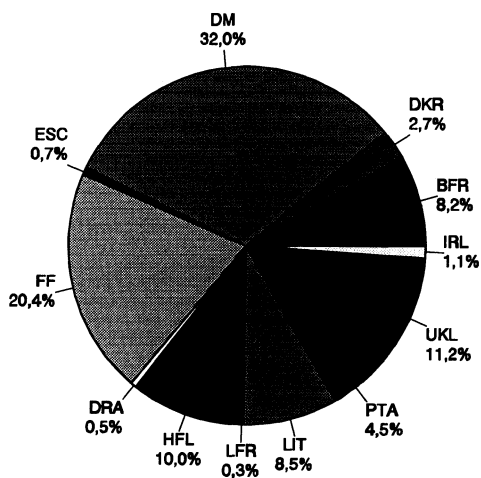
Source: Deutsche Bundesbank, author's calculations

Table 2.1   **ECU central rates for EC currencies,**
                   January 1987

Currency	January 1987	September 1992	August 1993
BEF	42.4032	40.6304	40.2123
DEM	2.05586	1.96992	1.94964
DKK	7.84195	7.51410	7.43679
ESP	133.631	143.386	154.250
FRF	6.89509	6.60683	6.53883
GBP	0.696904	0.805748	0.786749
GRD	205.311	254.254	284.513
ITL	1538.24	1690.76	1793.19
NLG	2.31643	2.21958	2.19672
PTE	178.735	182.194	492.854

(ECU Central Rate spans the three date columns.)

Source: Deutsche Bundesbank

All EC currencies have an ECU-related central rate[1]. The central rates are expressed as a certain quantity of currency per ECU, as shown in Table 2.1.

Over the years the ECU has been a viable medium for financial transactions, even in private markets[2]. Official ECUs were originally created via the European Monetary Cooperation Fund (EMCF): when a country enters the EMS, its central bank has to deposit 20 % of the country's convertible foreign exchange reserves in gold and USD with the EMCF. In the Maastricht Treaty this task has been given to the European Monetary Institute (EMI), the newly established institution managing cooperation between the central banks of the member states. In exchange, the central bank receives ECUs by means of three-month swaps.

There is no official regulation prescribing private sector use of the ECU. Although originally intended primarily as an instrument for payments between monetary authorities, as Louis (1990) states, the market found in the ECU a useful instrument for commercial transactions. As a result, private banks began to take deposits in ECUs, and private ECUs were created. The private ECU deposit and bond markets experienced spectacular growth in the late 1980s. In

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[1] For currencies not participating in the ERM, a notional central rate has been assigned for the purposes of the operation of the divergence indicator.

[2] Detailed analyses of ECU markets are provided by eg Micossi (1985), Louis (1990) or Tullio & Contesso (1990).

1987 Germany was the last EC country to allow private market participants to borrow in ECUs[3]. Nowadays there are altogether about 500 banks accepting the ECU as a transaction currency. It is just as any other currency on the foreign exchange markets with only one distinguishing feature: because it is a basket of currencies its price (or the interest rate paid for ECU deposits and loans) cannot diverge from the aggregate of the individual currencies by more than is motivated by transactions costs. The basket composition provides the ECU with low risk-high return characteristics and is, hence, one main reason for the growing popularity of the ECU. The low risk-high return characteristics have been a cause of its development, thanks to the existence of transaction costs. With zero transaction costs investors and borrowers could have diversified their risk by forming their own preferred basket of currencies, and the private ECU would never have developed. Also the growing credibility of the ECU supports the increasing usage of this artificial currency. As noted by eg Louis (1990) and Lybeck & Lindahl (1991), this confidence has resulted in the general use of the "open ECU" as opposed to that of the "closed" basket based on the composition of the ECU at the time of signing of a contract. By specifying the "open ECU" in their transactions, the parties to a contract signal their intention to automatically accept any changes in the composition of the basket. However, if a currency with a large weighting were to became unstable, this could reduce the attractiveness of the ECU as a portfolio investment. In order, however, for the ECU to become the European vehicle currency, and in the future eventually even the common EC currency, the private ECU has to succeed in developing as a medium of exchange.

2.2 The Exchange Rate Mechanism, ERM

The Exchange Rate Mechanism (ERM) is the central element of the EMS. It has two parts:

1. The maintenance, by way of unlimited compulsory intervention on the exchanges, of bilateral limits of fluctuation between participating currencies;
2. Application of divergence indicators, the purpose of which is to establish a presumption to take action on the part of the authorities responsible for the currency whose rate exceeds certain limits

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[3] Louis (1990) discusses the difficulties of ECU recognition in Germany.

fixed in terms of the ECU. Generally speaking, since divergence indicators are set narrower than those limits demarcating the bilateral margins of fluctuation, they will be reached before the latter.

2.2.1 The parity grid

Each currency has a fixed ECU-related central rate with a fluctuation band around it. Originally, the width of this band was ± 2.25 %. In exceptional cases, a currency with a weaker underlying economy was permitted a wider band of ± 6 %. In August 1993, however, major upheavals on the foreign exchange markets forced the monetary authorities to widen the bands to ± 15 % around the central rate. By linking these central rates, one obtains a series of bilateral central rates for each currency participating in the EMS. These constitute the parity grid set out in Table 2.2.

The participating countries are obliged to keep the rates of their currencies within these given bilateral limits. Although the central rates are expressed in terms of the ECU, the compulsory intervention rates are defined on a bilateral basis. In a situation where two currencies are in opposition to each other, ie at opposing intervention limits, the issuing banks of these currencies are required to intervene to ensure that the currencies are kept within their respective margins.[4] None of the participating states can unilaterally devalue or revalue its currency, but there will be reciprocal consultation in the Community framework: adjustments of central rates will be subject to mutual agreement by a common procedure which will comprise all countries participating in the ERM and the Commission.

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[4] A description of the intervention regulations and mechanisms is given in eg Bofinger (1991).

Table 2.2   The bilateral central rate parity grid positions

Source: Deutsche Bundesbank   12.1.1987

	BEF 100	DKK 100	DEM 100	FRF 100	IEP 1	ITL 1000	NLG 100
BEF	–	553.00	2109.50	628.970	56.5115	30.387	1872.15
	–	540.723	2062.55	614.977	55.2545	28.6187	1830.54
	–	528.70	2016.55	601.295	54.0250	26.953	1789.85
DKK	18.9143	–	390.16	116.32	10.4511	5.620	346.24
	18.4938	–	381.443	113.732	10.2186	5.29268	338.537
	18.0831	–	373.00	111.20	9.9913	4.985	331.02
DEM	4.959	26.810	–	30.495	2.740	1.4735	90.770
	4.84837	26.2162	–	29.8164	2.67894	1.38754	88.7526
	4.740	25.630	–	29.150	2.619	1.3065	86.780
FRF	16.6310	89.925	343.05	–	9.1890	4.9410	304.44
	16.2608	87.9257	335.386	–	8.98480	4.65362	297.661
	15.8990	85.970	327.92	–	8.7850	4.3830	291.04
IEP	1.8510	10.0087	38.1825	11.3830	–	0.549952	33.8868
	1.80981	9.78604	37.3281	11.1299	–	0.517943	33.1293
	1.7695	9.5683	36.4964	10.8825	–	0.487799	32.3939
ITL	3710.2	20062.0	76540.0	22817.0	2050.03	–	67912.0
	3494.21	18894.0	72069.9	21488.6	1930.71	–	63963.1
	3290.9	17794.0	67865.0	20238.0	1818.34	–	60241.0
NLG	5.5870	30.21	115.235	34.36	3.0870	1.660	–
	5.46286	29.5389	112.673	33.5953	3.01848	1.56340	–
	5.3415	28.8825	110.1675	32.8475	2.9510	1.4725	–

                                                              2.8.1993

	BEF 100	DKK 100	DEM 100	ESP 100	FRF 100	IEP 1	NLG 100	PTE 100
BEF	–	627.880	2395.20	30.2715	714.030	57.7445	2125.60	24.2120
	–	540.723	2062.55	26.0696	614.977	49.7289	1830.54	20.8512
	–	465.665	1776.20	22.4510	529.660	42.8260	1576.45	17.9570
DKK	21.4747	–	442.968	5.59850	132.066	10.67920	393.105	4.47770
	18.4938	–	381.443	4.82126	113.732	9.19676	338.537	3.85618
	15.9266	–	328.461	4.15190	97.943	7.92014	291.544	3.32090
DEM	5.63000	30.4450	–	1.46800	34.6250	2.80000	(103.058)	1.17400
	4.84837	26.2162	–	1.26395	29.8164	2.41105	88.7526	1.01094
	4.17500	22.5750	–	1.08800	25.6750	2.07600	(76.4326)	0.87100
ESP	445.418	2408.50	9191.20	–	2739.30	221.503	8153.70	92.8760
	383.589	2074.15	7911.72	–	2358.98	190.755	7021.83	79.9828
	330.342	1786.20	6812.00	–	2031.50	164.276	6047.10	68.8800
FRF	18.8800	102.1000	389.480	4.92260	–	9.38950	345.650	3.93700
	16.2608	87.9257	335.386	4.23911	–	8.08631	297.661	3.39056
	14.0050	75.7200	288.810	3.65050	–	6.96400	256.350	2.91990
IEP	2.33503	12.6261	48.1696	0.608731	14.3599	–	42.7439	0.486881
	2.01090	10.8734	41.4757	0.524232	12.3666	–	36.8105	0.419295
	1.73176	9.3640	35.7143	0.451462	10.6500	–	31.7007	0.361092
NLG	6.34330	34.3002	(130.834)	1.65368	39.0091	3.15450	–	1.32266
	5.46286	29.5389	112.6730	1.42413	33.5953	2.71662	–	1.13906
	4.70454	25.4385	(97.0325)	1.22644	28.9381	2.33952	–	0.98094
PTE	556.890	3011.20	11481.10	145.180	3424.80	276.938	10194.30	–
	479.590	2593.24	9891.77	125.027	2949.37	238.495	8779.18	–
	413.020	2233.30	8517.90	107.670	2540.00	205.389	7560.50	–

	BEF 100	DKK 100	DEM 100	FRF 100	IEP 1	NLG 100	ATS 100	PTE 100	ESP 100
BEF	– – –	627.880 540.723 465.665	2395.20 2062.55 1776.20	714.030 614.977 529.660	57.7445 49.7289 42.8260	2125.60 1830.54 1576.45	340.42 293.163 252.47	23.3645 20.1214 17.3285	28.1525 24.2447 20.8795
DKK	21.4747 18.4938 15.9266	– – –	442.968 381.443 328.461	132.066 113.732 97.943	10.6792 9.19676 7.92014	393.105 338.537 291.544	62.9561 54.2170 46.6910	4.3210 3.72119 3.2046	5.2064 4.48376 3.8614
DEM	5.6300 4.84837 4.1750	30.445 26.2162 22.575	– – –	34.625 29.8164 25.675	2.8000 2.41105 2.0760	(103.058) 88.7526 (76.4326)	16.505 14.2136 12.241	1.1328 0.975561 0.8401	1.3650 1.17548 1.0123
FRF	18.880 16.2608 14.005	102.10 87.9257 75.72	389.480 335.386 288.810	– – –	9.3895 8.08631 6.964	345.65 297.661 256.35	55.3545 47.6706 41.0533	3.7992 3.27188 2.8177	4.5778 3.94237 3.3951
IEP	2.33503 2.01090 1.73176	12.6261 10.8734 9.36403	48.1696 41.4757 35.7143	14.3599 12.3666 10.6500	– – –	42.7439 36.8105 31.7007	6.84544 5.89521 5.07688	0.469841 0.404620 0.348453	0.566120 0.487537 0.419859
NLG	6.3434 5.46286 4.70454	34.3002 29.5389 25.4385	(130.834) 112.673 (97.0325)	39.0091 33.5953 28.9381	3.1545 2.71662 2.33952	– – –	18.5963 16.0149 13.7918	1.27637 1.09920 0.946611	1.53793 1.32445 1.14060
ATS	39.6089 34.1107 29.3757	214.174 184.444 158.841	816.927 703.550 605.877	243.586 209.773 180.654	19.6971 16.9629 14.6082	725.065 624.417 537.740	– – –	7.97000 6.86356 5.91086	9.60338 8.27008 7.12200
PTE	577.090 496.984 428.000	3120.50 2687.31 2314.30	11903.30 10250.50 8827.70	3549.00 3056.35 2632.10	286.983 247.145 212.838	10564.00 9097.55 7834.70	1691.80 1456.97 1254.70	– – –	139.920 120.493 103.770
ESP	478.944 412.461 355.206	2589.80 2230.27 1920.70	9878.50 8507.18 7326.00	2945.40 2536.54 2184.40	238.175 205.113 176.641	8767.30 7550.30 6502.20	1404.10 1209.18 1041.30	96.3670 82.9927 71.4690	– – –

The ECU also has a market rate in terms of each EC currency. This rate is determined by the sum of the equivalents in that currency of the units of each of the EC currencies entering into the composition of the ECU. When the other currencies making up the ECU basket show an appreciation vis-à-vis one of the basket currencies, the ECU rate in terms of that currency will also appreciate, and vice versa for a depreciation.

Since this study concentrates on the period from 1987 to 1992, when narrow bands were valid and the properties of the ERM with the original narrow bands merit discussion. In theory, a currency can fluctuate within a band of ± 4.5 %, ceteris paribus. In practice, an individual bilateral exchange rate seldom hits the limits of its band simply because the maximum movement room is affected by all the other ERM currencies. In other words, a currency can appreciate or depreciate vis-à-vis another currency (given that the two respective currencies initially are in opposition) by 2.25 % only if it does not reach the maximum fluctuation limit vis-à-vis a third currency. Hence,

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the movements of the other currencies are always restricted by the weakest and strongest currencies. This is illustrated below.

Since the ECU-related central rate is a fixed value while the market rate of the ECU fluctuates, the latter rate, in terms of a specific currency, will stand at a premium or discount against that currency's ECU-related central rate. By definition, however, there is identity between the two rates when the currency in question is at its par with each of the other currencies. If the degree of bilateral appreciation or depreciation is fixed at $\pm$ 2.25 %, it is possible to calculate accurately the maximum and minimum rates the ECU can show against any of the EC currencies. These rates, or intervention points, are reached when all the other EC currencies simultaneously show an appreciation or depreciation of 2.25 %. Table 2.3 illustrates the situation by comparing the rate of the ECU in terms of the DEM as it appears in a parity situation and its rate in a situation of maximum appreciation.

The price of an ECU in the DEM can be calculated through the shares and the bilateral parities. In the table below, the numbers in the first column are the weighted shares of the respective currency in the ECU basket, ie they are attained with the following formula

$$_G W_i = w_i^* \left(\frac{c_G}{c_i} \right) \tag{2.1}$$

where w_i is the weight of the i'th currency, c_G and c_i are the central parities of the DEM and the i'th currency respectively.

The result, $_G W_i$, is the weight of the i'th currency in the ECU basket, expressed in DEMs in the second column. The third column is attained when the DEM is allowed to appreciate by the maximum 2.25 % vis-à-vis all other currencies.

This movement makes it 2.25 % "heavier" in the composition of the ECU basket. Vis-à-vis the ECU, the DEM has appreciated 1.57 % from the central parity.

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Table 2.3   **The maximum fluctuation band vis-à-vis the ECU calculated for the DEM**

		Share	
Currency	(s_i)	DEM	DEM appr.
BEF+LUF	3.301+0.13	0.1663	0.1626
DKK	0.1976	0.0518	0.0506
DEM	0.6242	0.6242	0.6242
FRF	1.332	0.3972	0.3881
GBP	0.08784	0.2591	0.2533
IEP	0.008552	0.0229	0.0224
ITL	151.8	0.2029	0.1983
NLG	0.2198	0.1951	0.1907
ESB	6.885	0.1059	0.1035
PTE	1.393	0.0160	0.0157
GRD	1.44	0.0144	0.0141
	1 ECU	2.0558	2.0235

Source: Deutsche Bundesbank, own calculations

2.2.2 The divergence indicator

The divergence indicator was assigned a key role in the EMS. It should provide the system with the symmetry that the Bretton Woods system[5] was missing. It was created to make it possible to trace the movement in the exchange rate of each EMS currency against the average movement and thereby identify a currency deviating from that average. This should have reinforced symmetry in the system.

The value of the divergence indicator for a currency i at each point in time is

$$d_i = (1 - w_i)\left(\frac{s_i - c_i}{c_i}\right) \cdot 100 \qquad (2.2)$$

where w_i is the weight of a currency i in the ECU basket, and the term in the parenthesis is the difference between the bilateral central parity and the actual bilateral spot exchange rate. The threshold of divergence is set at 75 % of the divergence that would be observed if

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[5] For descriptions of the Bretton Woods system, see eg Chacoliades (1981), Claassen (1988), Copeland (1989), Baillie & McMahon (1990) or Bofinger (1991).

the currency i had deviated by the full 2.25 % margin from all other currencies in the system, ie

$$d_i = 0.75 \, (2.25 \, (1 - w_i)) \tag{2.3}$$

Due to the different weights of the individual currencies in the ECU basket, the resulting divergencies become different for the member currencies. The more important currencies, ie those with greater weighting reach the threshold of divergence earlier than currencies with smaller weights. For example, the threshold of divergence for the DEM lies at 1.18 %[6], whereas, for the PTE, the smallest currency it is 1.35 %.

If a diverging exchange rate cannot be brought back to balance despite heavy marginal interventions,[7] then a realignment of the parity values can take place. Such a realignment is an outcome of multilateral negotiations among EMS members and the Commission. In practice, however, fluctuations in the currencies have been restricted by bilateral parities rather than the central parity against the ECU. Hence, as stated by Rogoff (1985) and Louis (1990), the divergence indicator has been of little importance for the practical function of the EMS[8].

2.3   Credit arrangements

The EMS incorporates three credit mechanisms: very short-term financing (VSTF) and short-term monetary support (STMS), both of which are the responsibility of the central banks, and medium-term financial assistance (MTFA), which is granted by the Council. According to Louis (1990) the aid mechanisms have not assumed the

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[6] It is actually a curiosity that the DEM has hardly ever been at the upper border of its fluctuation band. The EC Member States seem, as explained in Artis & Taylor (1988), to prize the role of the DEM as the nominal anchor so much that they would rather protect the DEM than let it a diverge.

[7] For studies of interventions, see eg Sommer-Herberich (1983), Klein (1985), Micossi (1985), Giavazzi & Giovannini (1987), Claassen (1988), Mastropasqua et al (1988). See also section 2.3.4.

[8] Advantages and disadvantages of the divergence indicator are further discussed in eg Vaubel (1980).

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importance their creators had in mind. STMS and MTFA have not been used since 1979, and there has been little recourse to VSTF.

2.3.1 The very short-term financing mechanism

This is a reference to very short-term credit which participating central banks grant to each other for interventions in Community currencies. Since intervention is compulsory and must be carried out on an automatic basis and for unlimited amounts by each central bank, access to the VSTF is also automatic and unlimited. The resulting debtor balances may be settled in convertible currencies or ECUs. For the purpose of the EMS, the duration of such financing is 105 days end of month.[9] The repayment period may be automatically extended to the debtor quota of the central bank concerned under the short-term monetary support arrangement, provided this does not result in the relevant debt remaining continuously outstanding for six consecutive months. This ceiling may be raised and the period for repayment extended with the agreement of the creditor(s).

2.3.2 Short-term monetary support

The purpose of this mechanism is to help meet financing needs arising from temporary balance of payments deficits caused by unforeseen difficulties or cyclical divergences. The mechanism is based on a system of debtor and creditor quotas which determine each EC central bank's borrowing entitlement and financing obligations. The duration of these credits is three months, and up to two three-month credit extensions are permitted.

2.3.3 Medium-term financial assistance

MTFA is mutual assistance granted to any member country seriously threatened or experiencing difficulties with its balance of payments. Each member state is only required to grant credits up to a specific commitment ceiling. As a rule, no country can be granted loans

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[9] Prior to the repayment period extension in the Basle-Nyborg agreement of 1987' the duration of VSTF was first 45 and then 75 days end-of-month. The Basle-Nyborg agreement sought to promote the coordination of economic and monetary policies, and to improve the credit and intervention mechanisms.)

amounting to more than 50 % of the total amount of the commitment ceiling. Assistance is conditional, with a borrower country having to agree to certain economic and monetary conditions. The assistance is denominated in ECUs and repayable within two to five years.

2.3.4 Intra-marginal interventions

Apart from the compulsory intervention at the bilateral limits described in section 2.2.1, there is provision for intervention before these limits are reached. Intra-marginal interventions are optional operations initiated by any central bank. The aim of these interventions is to bring back the bilateral exchange rate to its central rate and prevent the build-up of speculative pressures. Intra-marginal interventions do not enjoy automatic access to the VSTF, although in the Basle-Nyborg arrangements of 1987 the VSTF was extended (with a limit) for this kind of intervention. The only regulations for intra-marginal interventions are that first, if EC currencies are used, the central bank issuing the intervention currency must give its authorization, and the interventions should be discontinued if they cause undesirable effects on that currency. Second, USD interventions in are involved only to prevent EMS cohesion weakening or to accentuate USD trends on the foreign exchange markets. In the early years of the system intra-marginal intervention was mostly in USDs; it was only in the second half of the 1980s that EC currencies became more common in intra-marginal interventions.[10]

The central bank can try to prevent an imbalance of payments from affecting the domestic money supply through sterilization. But, for example, sterilizing the effects of a surplus on the balance of payments involves increasing the proportion of bonds-to-money held by the non-bank private sector, which in turn means raising the rate of interest. This attracts more funds from foreign financial investors, thus reinforcing the balance-of-payments surplus.[11] Because of the existence of the exchange risk, capital mobility within the EMS can be

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[10] At the beginning of the 1980s the USD appreciated vis-à-vis European currencies. Under those circumstances it was appropriate to support weak currencies by selling USD. However, as pointed out in Micossi (1985), the same results could have been obtained with smaller interventions in EC currencies, which have a larger impact on private portfolios in these currencies.

[11] The offset of the sterilization via the capital account depends on the substitutability of bonds denominated in different currencies. For studies of the effectiveness of sterilization, see eg Obstfeld (1982) and Mastropasqua et al (1988).

assumed to be imperfect so that an eventual offset can be expected to be only partial. Given the assumption that domestic and foreign assets are imperfect substitutes, it is possible in the short run to sterilize the effects of a change in the foreign exchange reserves on the money supply through open-market operations (provided that the change in reserves is not too large). Empirical studies have shown that the Bundesbank usually sterilizes changes in its foreign exchange reserves. Moreover, it has been said that Germany would have taken the role of the n-th country within the EMS: it manages the float between the DEM and the USD and remains passive with respect to the intra-EMS exchange rates between the DEM and other EMS currencies. In the following section studies of the role of Germany on the EMS financial markets will be reviewed.

2.4 How has the EMS been working?

The EMS has been called a "greater DEM area", meaning that the DEM is considered as the monetary anchor of the system. Institutionally, the EMS does not induce an asymmetric working of international adjustment. As a result, however, of the DEM's reputation as a low-inflation currency, a standard of level pegging the DEM exchange rate emerged over the years. Evidently, the DEM has been the "hard currency" of the EMS, since throughout the EMS period all the other currencies have depreciated against it. According to the hypothesis of German dominance, it sets the growth rate of the money supply which the others must follow; otherwise the threat of realignment arises. Hence, if it is possible to set credible anti-inflationary targets for inflation-prone members of the EMS, then the result is convergence of the EMS inflation rate towards the German one. Below, views about the de facto working of the EMS are briefly presented, and literature about the German dominance hypothesis is examined.

2.4.1 Competitiveness versus discipline

Two opposite views have been presented about the EMS and its implications ie competitiveness and discipline.[12] The idea of the competitiveness, or shock-absorber, aspect is that policy coordination in the EMS improves the group's response to aggregate shocks from outside the region. That is, exchange rate policies in the EMS serve as a shield against external disturbances. At the same time, the EMS has no obvious mechanism for changing the members' inflation trends. As long as realignments are possible, inflation trends can be chosen in accordance with national preferences. Consequently, high-inflation EMS countries have experienced a real appreciation vis-à-vis the strongest currency in the ECU basket, the DEM. The realignments are justified so as to maintain purchasing power parity, ie inflation differentials are fully taken into account when adjusting the nominal parities. Moreover, forward-looking policy makers can even factor in extra devaluation to account for anticipated future inflation rates.

The discipline aspect represents the opposite view, which argues that real appreciation is not compensated for in realignments. As a consequence, the competitiveness of the economy remains worse as long as the domestic inflation rate is reduced. Here the real appreciation punishes the domestic economy, by dampening the foreign component in aggregate demand and reducing the pressure on domestic goods markets. The public is aware of this punishment, which makes it easier for the central bank to gear the domestic monetary policy towards lower inflation.

A third view, the credibility approach[13], is similar to the disciplinary approach in that it also assumes an asymmetric working of the EMS. There is, however, a crucial difference between these two arguments. The "disciplinary" argument states that the EMS may have *raised* the cost of inflation, while the "credibility" argument states that the EMS may have *reduced* the cost of inflation. According to the credibility approach, the EMS represents an institutional arrangement which has enabled other EMS member countries to take advantage of the Bundesbanks counter-inflation reputation by credibly pegging their bilateral exchange rates relative to the DEM. The Bundesbank then independently chooses its monetary policy, while all other EMS member countries simply target their bilateral DEM exchange rates.

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[12] See eg Giavazzi & Giovannini (1988), von Hagen & Fratianni (1989), Collins (1990) and Hughes-Hallet et al (1991).

[13] The credibility aspects of the EMS are studied in eg Alesina & Grilli (1991), Weber (1991) and Welfens (1991a).

The fact that the public is aware of this mechanism helps the authorities to conduct an anti-inflationary policy at a lower cost than through a purely domestic policy[14]: they act as if their hands are tied and cannot use inflation as a policy tool.

2.4.2 The German dominance hypothesis

Every fixed exchange rate system raises the question of symmetry attached to the conduct of monetary policy among the participating countries. The German dominance hypothesis states that Germany is the central country in the EMS, ie Germany determines its monetary policy more or less independently of what happens in the rest of the EMS; whereas the other countries, given the bilateral DEM parities, subordinate their monetary policies to German policy.

To date, no consensus in the literature exists about whether the EMS has been working asymmetrically or symmetrically. There are studies that find a rich structure of cross-country policy interactions: whilst Germany exerts a significant influence on many EMS countries, it is itself not immune from influences in the opposite direction. In addition, the other EMS countries are also found to transmit their policy impulses to each other. This suggests an almost symmetric functioning of the EMS. The most important empirical contributions to the research around this asymmetric interpretation of the EMS are reviewed below.

Giovannini (1988) studies the behaviour of interest rates in correspondence with parity realignments. His test is based on the premise that, while in a symmetric regime international portfolio shifts are reflected in both countries' interest rates, in an asymmetric regime the central country's rate is unaffected, and international portfolio disturbances perturb only the other countries' rates. Hence, he uses a simple test of the asymmetry hypothesis, based on the observation of countries' interest rates in correspondence with observable international portfolio shifts, ie when there are parity realignments. The data shows large swings in the offshore interest rates of the other EMS countries and a strikingly stable pattern in the domestic and offshore German rates. He then constructs objective functions for the central banks and tests the hypothesis that in the central country the deviations of the

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[14] How public expectations affect the possibilities of the central bank to conduct a certain monetary policy is explained in eg Barro & Gordon (1983), Giavazzi & Giovannini (1988) and Alesina & Grilli (1991). The concepts of reputation and credibility are defined in Weber (1991).

domestic target from its desired value are white-noise errors. The results debunk the hypothesis of white noise significance for other countries, but not in the case of Germany. Hence, the empirical evidence in his study agrees with the German dominance hypothesis. In their study of interventions within the EMS, Mastropasqua et al. (1988) have arrived at a similar result. They claim to have found ample evidence that Germany has played the n'th country role of supplying the system with a nominal anchor.[15]

De Grauwe (1988a, b) also uses estimates of the behaviour of interest rates, but in a different way. He separates the short- and long-term offshore and domestic interest rates respectively. He then tests whether expected exchange rate devaluations of an EMS member country against the DEM affect short-term interest rates only in a given country or both in Germany and the depreciating country. The empirical evidence presented suggests that the EMS has led to constraints on short-term interest rates, but has not added significant constraints to long-run interest rates. He concludes, however, that the EMS works de facto in a very symmetric way and rejects the German dominance hypothesis.

Giavazzi & Giovannini (1989) study the volatility of interest rates (one month) innovations and obtain a result suggesting that only Germany sets monetary policy independently. In the absence of capital controls, other members can only accommodate German monetary policies.

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[15] Welfens (1991a) conducts or a provocative discussion on the reasons for German dominance.

Table 2.4   **Studies testing the German Dominance Hypothesis**

Study	Test object(s)	German Dominance yes: +, no: −
Giovannini (1988)	interest rates and realignments	+
de Grauwe (1988a, b)	interest rates − short-term − long-term	(+) − −
Mastropasqua et al. (1988)	interventions	+
Giavazzi & Giovannini (1989)	interest rates	+
von Hagen & Fratianni (1989)	interest rates and money supply growth	(−)
Honahan & McNelis (1989)	realignments and exchange rate predictability	+
Fratianni & von Hagen (1990)	monetary base growth	−
von Hagen & Fratianni (1990)	interest rates	(−)
Kartakis & Moschos (1990)	interest rates	+
Kirchgässner & Wolters (1991a)	interest rates	+
Kutan (1991)	money growth rates	−
Koedijk & Kool (1992)	interest and inflation rates	−

von Hagen & Fratianni (1989) focus on monetary policy actions. Their test is based on the premise that the German dominance hypothesis implies a specific structure of central banks' reaction functions in the EMS. They construct a policy matrix and study the properties of this matrix. They formulate the hypothesis of German dominance in four separate hypotheses. The first is that German dominance implies that other countries do not react directly to monetary policies occurring outside the EMS. Second, German dominance implies that each EMS country reacts only to Germany's and not to other members' policies. Third, German dominance implies that monetary policy in a member country depends on German policy, and finally, to make German dominance meaningful, Germany itself must not be influenced by the monetary policy actions of other members. As "other countries" they choose France and Italy. They then model monetary policy actions and interactions on the basis of money market interest rates in the short-term, and the growth rate of the monetary base in the long-term. They

provide empirical evidence to test two forms of German dominance: the strong form stating that deviations of the other members' policies from the path prescribed by the Bundesbank are not allowed either in the short- or long-term; the weak form allowing deviations in the short, but not the long-term. The results speak against German dominance in the EMS both in the strong and the weak form. Overall, their results suggest that the system is more interactive than hierarchical. The German position is best described by long-term independence, which they distinguish from dominance. They give the existence of realignments and capital controls as the explanation for German long-term independence not being equivalent to German dominance.

Honahan & McNelis (1989) test the effect of EMS realignments on the ability to forecast the exchange rate. They find no evidence for the DEM/USD rate to be affected whereas the ability to forecast the USD exchange rate against other EMS currencies is significantly affected by realignments. They conclude from this that the DEM serves as the dominant EMS currency.

Fratianni & von Hagen (1990) focus on the interaction of monetary policies looking at the evidence from the growth of the monetary base standardize these terms. Their tests give a strong rejection of German dominance. von Hagen & Fratianni (1990) look at the evidence from the interest rate perspective and find that Germany is a relatively strong player in the system, although its independence has diminished over time. Kartakis & Moschos (1990) have shown that German interest rates heavily influence interest rate movements in other EMS countries.

Kirchgässner & Wolters (1991) pose the question whether German interest rates dominate Euromarket rates. The methodological difference between theirs and other interest rate studies is that they explicitly take into account the non-stationarity of the interest-rate time series and check for the possibility that the time series is co-integrated. This approach provides possibility to obtain information about adjustment processes and the long-term equilibrium relations between interest rates. They formulate the German dominance hypothesis in the fashion of Fratianni & von Hagen (1990), ie consisting of four hypotheses: dependence on Germany, German independence, EMS insularity and world insularity. In terms of Granger causality, dependence on Germany implies that there exist Granger causal relations between German interest rates and those of other member countries and/or instantaneous causal relations between Germany and other countries. German independence is defined as the non-existence of Granger causal relations between the interest rates of other member

countries and German interest rates. EMS insularity means that besides the relations with Germany, there are no Granger causal or instantaneously causal relations between the other member countries of the EMS. Finally, world insularity implies that if German interest rates are included in the information set, there are no Granger causal or instantaneous relations between countries outside the EMS and the interest rates of other member countries. German dominance implies that all four conditions hold. For the long-term, the authors reformulate the hypotheses slightly: dependence on Germany now means that German interest rates are included in the error-correction terms of the equations of other member countries of the EMS. German independence implies that the interest rates of other member countries are not included in the error correction terms of the German equation. EMS insularity means that interest rates of third countries in the EMS are not included in the error-correction terms of the equations of other EMS member countries, and finally, world insularity is defined so that the interest rates of countries outside the EMS are not included in the error-correction terms of the equations of EMS member countries other than Germany. Further, if there exists only one stochastic trend within the EMS, and if this is the one which drives German interest rates, then Germany controls the long-term development of interest rates in other EMS countries. Their results from the period 1980 to 1988 show that Germany – which is in a feedback relation to the United States – actually has a quite strong position in Europe. The dominance observed in the long-term is not restricted to countries in the EMS. The authors note, however, that because of capital controls, their findings concerning German long-term dominance do not necessarily imply German policy dominance in the sense that other European central banks cannot follow an independent monetary policy and choose their own preferred rate of inflation. This is due to the fact that the EMS allows realignments of exchange rates.[16]

Kutan (1991) looks at the evidence from the growth in the monetary base and interest rates. He assumes that central banks in the EMS peg short-term interest rates and that the leading country is Germany, which sets its money supply target independently. The rest of the EMS countries fix their exchange rates at a given level and intervene in the foreign exchange market to keep them in place. A

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[16] See also the earlier work of Kirchgässner & Wolters (1991a), where they investigate interest rate linkages between the USA and Europe and within the EMS between 1974–1989. In that study, they show a strong German influence on the development of other European countries. They conclude that Germany does not dominate the other countries totally but that there are significant relations between EMS countries which are not influenced by Germany.

reduced form of the model is estimated using block-exogenity tests[17]. The results suggest that monetary policies in the EMS are relatively interactive. Yet, since the EMS has not caused a greater co-movement in money demand functions between the participating countries in the "hierarchical" structure claimed by German dominance, the author rejects this hypothesis.

Finally, in a more recent study Koedijk & Kool (1992) assess the timing and speed of monetary convergence between the EMS countries, focusing on bilateral interest and inflation differentials. Their study differs from most of the others in that they do not use Germany as the benchmark country. Hence, if other EMS countries passively follow Germany's lead, inflation rates should converge and given the integrated financial markets, so would interest rates. For comparison they take the British variables: as an outsider to the ERM, Great Britain should have had more freedom in determining an independent monetary policy. A second distinguishing difference of their study is that instead of VAR regressions, the authors apply a modified version of principal component analysis. They observe that after March 1983 the inflation differentials in Belgium move more to the high-inflation French/Italy bloc, whereas Great Britain moves in the direction of the low-inflation Germany/Netherlands bloc. In the interest rate analysis, no apparent shifts take place. They conclude that the most important differences within the EMS are between Germany, the Netherlands and Great Britain on the one hand, and Belgium, France and Italy on the other. The results indicate that France and Italy may have been able to avoid part of the negative consequences of their deflationary policies because of the borrowed credibility of their exchange rate commitment, but since large differences in independent interest rate and inflation differentials with Germany have persisted, they reject the German dominance hypothesis.

An interesting comment on the German dominance hypothesis is provided by Bofinger (1991). He argues that the eventual leading position of the DEM is, in practice, due to the asymmetric intervention mechanism of the system. The interventions imply an asymmetric sterilization behaviour among the member countries so that the liquidity effects of interventions are unevenly distributed. As a consequence, in order to prevent major foreign exchange reserve losses, the other EMS countries have had to conform their monetary policies of the strong-currency country, ie Germany. The German authorities have, in turn, as the providers of not only the strongest but

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[17] A block-exogenity test has the null hypothesis that the lags of one set of variables do not enter the equations in a system for the remaining variables.

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the most important currency in the ECU basket, never had to face monetary pressure from other EMS countries.

Yet another view of the EMS is offered by Weber (1991). He argues that after a short initial transitional phase the EMS has functioned as a bipolar system with a "hard currency" option offered by the Bundesbank and a "soft currency" option supplied by the Banque de France. Even though the bipolar working was supported by empirical results, they also indicated that the French commitment towards the "hard" option has increased in the latter half of the 1980s, pulling other currencies along and making the "soft" bloc around the FRF shift towards the "hard currency" standard. At the end of the 1980s this rendered the fixed parities more credible and prevented inflation from emerging as strongly as it did outside the system.

The effect of EMS membership on monetary policy-making remains a controversial issue. As stated in Cohen & Wyplosz (1991), few doubt that the EMS entails a tightening of the external constraints, yet how this tightening actually operates is never fully elucidated. The debate over the German dominance hypothesis still revolves around the effects of interdependence and the channels through which this interdependence operates. To sum up, the results of the studies presented above seem to indicate that the disciplinary effect of the EMS is not due to the anti-inflationary policy per se; The hands of the other central banks are not tied by the Bundesbank via the ERM. Rather, the disciplinary participating effect comes from the fixity of exchange rates. Within that framework. The EMS central banks have voluntarily tied themselves to the Bundesbank. This has happened at various times in different countries, indicating that up to the point when the opinion in the respective country shifts towards lower inflation rates the domestic central bank has been able to conduct an independent monetary policy. Consequently, central banks should also be able to return to independence whenever they feel that the tie with the Bundesbank becomes – for one reason or another – undesirable.

3 Expected and actual changes in relevant macroeconomic factors in Germany

As was shown in the previous chapters, Germany plays a major role in the workings of the EMS. Not only does the business cycle in Germany affect growth prospects in the other member states, but also German monetary policy is decisive for the policy of the other EU central banks. Given this central role of Germany in the EU the major economic shock experienced in the form of German unification must also have had wide spillover effects on the EMS. GMU had an impact that jolted the whole economy in Germany. When two complete national economies are totally integrated, there is hardly any sector that is not involved. GMU included both monetary and real changes that would have a number of implications for both short- and long-term development. At the time there were fears about inflationary pressures stemming from GMU. Partly in connection with this high and rising interest rates were expected, stimulated by expectations of a high demand for capital in East Germany. Moreover, it was expected that inflation might also rise in the long-term due to heavily increased social security and subvention payments for the unemployed, and decommissionary production plants in East Germany. The amount, and possible persistence, of social costs was expected to result in larger budget deficits in Germany. In this chapter the main features of changes in certain macroeconomic variables considered essential for this study are discussed.[18]

3.1 The monetary shock

The integration of the East German economy with the West German economy was expected to lead to a monetary overhang which in turn, was expected to create inflationary pressure. There were two forces causing this pressure. First, the monetary assets in East Germany reflected, in part, forced savings. These "excess balances" were expected to cause an inflationary demand push. In addition, there was no reliable data available on the size of the East German money stock. Second, even

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[18] Brezinski (1992), for example, concentrates on the effects of GMU.

though there was no data available about the output capacity of the East German economy either, the increase in the money supply would certainly be relatively larger than the additional production capacity gained.

In East Germany the financial sector was organized as a single stage banking system, with banks functioning essentially as branches of the central bank[19]. A market for the efficient allocation of capital did not exist. Because of the banking system, money balances in relation to income were relatively high in the socialist countries, and GMU could have been expected to lead to a considerable monetary overhang. 80 % of total savings were held by just 20 % of the East German population. Part of an initial excess supply of money, however, had been already absorbed by the socialist shadow economy, where prices were much higher than in the official sector. Further, a switch to the higher (West German) market interest rate implied that the real desired per-capita amount of money translated into lower real balances.

The East German money stock to be added to the West German stock was exogenously given – in DDMs, so there was only one way to manipulate what the amount would be in DEMs, namely the conversion rate[20]. If one takes into consideration that the money stock is set in relation to the national economic potential, a rate which leads to a proportionally higher growth of the money stock will create a monetary overhang. Such an extraordinary increase in liquidity may cause inflation. Therefore, it was important that the conversion rate was chosen correctly.

Finding the right rate wasn't an easy task: the black market exchange rate had hovered at 1:7 (DEM:DDM); East Germany had officially fixed the rate at 1:1 for many years; internally East Germany applied an exchange rate of 1:4.4 in state-administered trade with West Germany. In the final decision made on May 2, 1990 the following conversion rates (DEM:DDM) were agreed:

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[19] The banking system in East Germany is described in *Monatsberichte der Deutschen Bundesbank*, 1990:7.

[20] The transformation problem of the East German money stock is discussed in eg Läufer (1990), Ohr (1990), Kantzenbach (1990), Berzinski (1991), Ranki (1991a), Willms (1991) and Welfens (1991b).

* wages, salaries, rents and other recurring payments (as of May 1, 1990) were converted at 1:1
* permanent residents of East Germany could exchange the following amounts at the conversion rate of 1:1:
  - children up to 14 years   DDM 2 000
  - persons between the ages of 15 and 59   DDM 4 000
  - persons older than 60   DDM 6 000
  - in other cases, such as firms, organizations, etc. the conversion rate 1:2 was applied
* non-permanent residents of the GDR could exchange their income at 1:3.

As can be seen, in order to eliminate the excess purchasing power of East German citizens, flow magnitudes were distinguished from stock magnitudes. Stock magnitudes include simply the assets and liabilities of the private sector that go through the banking sector. These could have led to inflationary pressures if suddenly utilized for consumption purposes because of the change in the marginal propensity to consume. Flow magnitudes, on the other hand, are wages and salaries, rents and transfer payments, which determine the income level of the residents and also the cost level, and hence the competitiveness, of firms. Through the average conversion rate of 1 DEM:1.83 DDM it was estimated that the money stock would increase by no more than the initially estimated East German production capacity of 10 % of the West German level.

The effects described above gave reason to fear accelerating inflation in Germany. Inflation refers to a sustained increase in prices, and inflationary problems result only from a rapidly growing money stock in combination with relatively slow rising output. In principle, the conversion rates chosen could have resulted in inflationary pressures throughout Germany.

Figure 3.1 **Growth of the German money supply (M3)
before and after GMU**
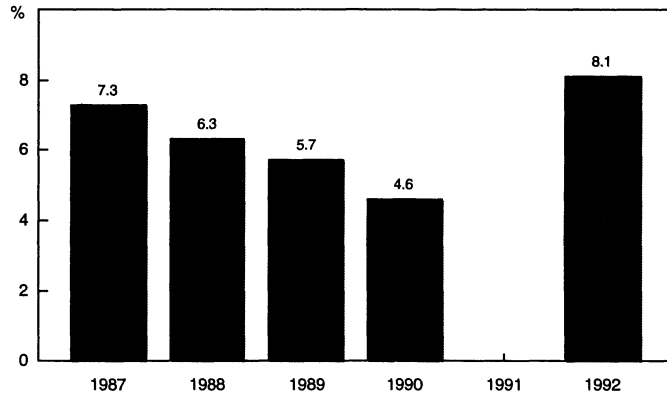
Source: Deutsche Bundesbank

Despite the collapse in domestic production, demand in East Germany rose sharply. This surge in demand came at a time when the economy was already operating at a high level of capacity.

GMU implies, at the conversion rate chosen, that the increase in the DEM stock of M3[21] was roughly 15 %. Potential output in East Germany was about 7 % of the West German level. In other words, if the money stock could have been increased equiproportionally to an expansion in the production (or national income) of a country, then GMU induced an unanticipated monetary shock where the money stock was increased by 8 % in excess of the production capacity. On the other hand, with an East German population of 26 % of the West German, per capita money balances were actually reduced on average.

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[21] M3 consists of currency in circulation, sight deposits, and time deposits under four years.

Figure 3.2   **Annual percentage change in the West German
                     consumer price index. Period January 1987 to
                     August 1992**
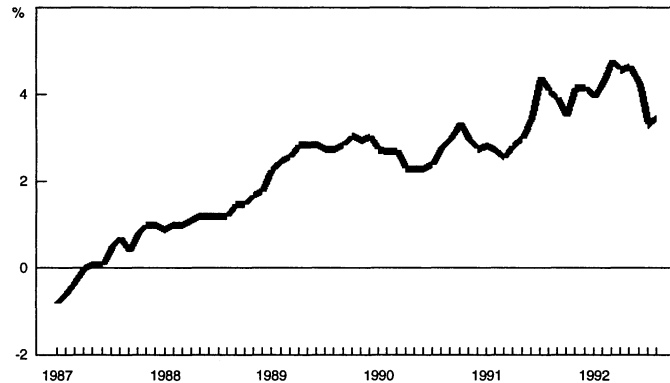
Source: Deutsche Bundesbank

Figure 3.2 shows the German inflation rate since 1987. It has indeed
gone up since GMU. Previous statistical studies have shown that it
usually takes about a year for a monetary overhang to show in the form
of higher prices. As can be seen from the curve, the major rise occurred
one year after GMU.

One should, however, strictly distinguish two effects: relative,
regional and systematic price adjustments that concern East Germany, on
the one hand, and, on the other, inflationary pressures that might result
from the mismatch between an increasing aggregate nominal demand and
supply of money. Reducing subsidies changes relative prices: regional
price changes are relevant in the context of spatial arbitrage in newly
established markets; systemic price increases occur because of the switch
from a command economy to a market economy.[22] Consumer prices in
East Germany were, for example, 26 % higher at the end of 1991 than a
year before; this high rate, however, is not a result of inflationary
pressures but mirrors the transformation of a previously planned
economy with highly subsidized prices into a market economy. The
increases are only corrections of reversed prices: 10 % of the changes
can be explained through the outfall of subsidies. Inflation in East
Germany should, therefore, remain significantly above West German
levels. It still continues to be fuelled by increases in regulated prices,

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[22] Relative price adjustment and inflation in the case of GMU are discussed in eg Welfens
(1991). Price effects are also studied in Gebauer (1990) and Lang & Ohr (1991).

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particularly rents. Of course, only inflation as a macroeconomic phenomenon is of interest to the Bundesbank.

In Keynes' money demand equation, money demand is a function of income and interest rate:

$$M^d = 1(y,r)$$

$$\frac{\partial M^d}{\partial y} > 0, \quad \frac{\partial M^d}{\partial r} < 0 \qquad\qquad (3.1)$$

For a given interest rate, the money demand adjusts to a change in income. In the case of Germany, it is clear that, in order to avoid an excess supply of money for the initial interest rate level, the increase in the money supply should be restricted to meet the estimated 10 % increase in output capacity. But the Bundesbank has also been trying to depress inflationary expectations by raising interest rates.

Since money demand is a positive function of income and since the transition from a socialist system to a more efficient market economy increases both the value and the range of assets available to the population, the demand for money should increase. Or, as Welfens (1991) puts it in terms of the permanent income hypothesis: The transition to a market economy implies a rise in permanent income and hence an increase in the demand for money. In the longer term one can expect that part of the East German saving deposits will be shifted into higher-yielding long-term assets such that the currency conversion should finally decrease below the initial increase of M3 by 15 %. Welfens (1991) also points out that there was not necessarily a sustaining monetary overhang in the sense of a disequilibrium in the East German money market. Extremely high prices in the price-flexible shadow economy and expected devaluations on the black currency market were likely to have absorbed at least a part of what otherwise would have been excess money supply. Gebauer (1990) suggests that portfolio diversification into real and financial assets, which became possible, absorbed part of the monetary overhang. New investment opportunities in interest-bearing financial assets also dampen inflationary pressures. In addition Brezinski (1991) refers to the behaviour of East German households, which were, for the first time, able to make financial investments, when explaining the reduction in the excess money supply. By the end of 1990, the East German share in M3 had dropped from 14.7 % in July to 12.3 %.

3.2 The output shock

One aspect of German unification is the addition of output capacity from the new eastern parts to the unified economic area. At that time it was estimated that East Germany would produce the equivalent of 10 to 12 % of West Germanys GNP. In the short-term, the implication of additional output capacity compared to capital should be questioned.[23] The socialist economy was having big problems long before GMU. With unification, it was found that production machinery was often damaged and had very low, if any, residual value. Environmental pollution made land worthless, or worse. A large number of plants were useless[24]. Further, introduction of the DEM increased production costs, causing considerable losses and bankruptcies, so production overall fell dramatically. Figure 3.3 illustrates the development of East German production as semi-annual percentage changes. The production level during the first half of 1992 was on average 62 % of the second half of 1990, which corresponds to about 59 % of the level in 1985.

Figure 3.3   **Net industry production in East Germany**
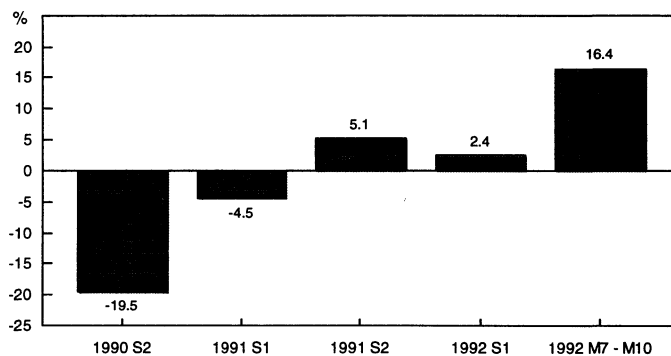
Source: Deutsche Bundesbank

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[23] As Siebert (1991) points out, the output will probably pick up with the prospect of a J-curve, the shape of which depends on the inefficiency of existing firms, the speed and methods of privatization, and the speed under which restructuring occurs.

For a discussion of the relative shifts in aggregate demand and aggregate supply (within a simple Keynesian world) see eg Gebauer (1990b), who also discusses the appropriateness of applying traditional macroeconomic frameworks to GMU.

[24] The eastern economy is described in eg Siebert (1991) and Burda (1990a). Burda (1990a) compares GMU with the postwar *Wirtschaftswunder* in West Germany and questions the possibility of a similar development in the case of GMU. He concludes that the flow of resources to East Germany and the use to which they are put play a central role. This is also discussed in Lang & Ohr (1991).

The other immediate effect was the increase in the labour force. The population of around 17 million corresponds to 26 % of that of West Germany. Labour productivity in the East Germany was about 30 % of that in West Germany while industrial incomes reached 40 %. The labour productivity gap may reflect a deficiency in disembodied efficiency. It is, therefore, reasonable to believe that the application of improved management techniques and the introduction of market incentives could significantly increase East German productivity without additional investment. The gap in labour productivity may also reflect a shortage of capital, due in part to out-of-date production technologies used in existing plant and equipment. Then a high volume of additional investment will be required to raise labour productivity in East Germany to West German levels.

Productivity can, hence, be expected to increase for several reasons: process improvements will lead to a medium-term increase in worker productivity. New fixed investment will embody the most modern forms of technology and further stimulate overall productivity. In the long-term, even the infrastructure will improve. All these factors should enhance the attractiveness of investment in East Germany and hence open up new employment opportunities.

Figure 3.4   **The unemployment rate in East Germany from March 1990 to April 1993**
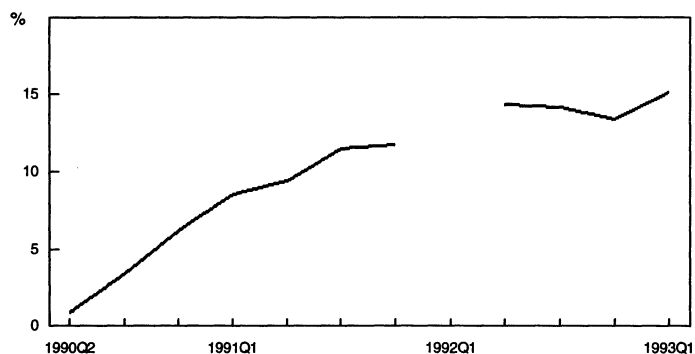
Source: Deutsche Bundesbank

Hitherto, however, the labour market has been clearly divided, although the trend seems to look better now and migration has slowed. In eastern parts, unemployment was worsened with the shutting down of unprofitable factories. As can be seen from Figure 3.4, the unemployment rate started to rise after the introduction of GMU. A peak of 17 % was reached in January 1992. Since then there has been a slight decline in the East German unemployment rate, so that in April 1993 the

rate was 15.4 %. Conditions on the East German labour market, however, have been exacerbated by rapid wage growth which, more than doubled in the two years after GMU. The employment outlook remains problematic as several collective wage agreements provide for a rapid closing of the gap between East and West Germany, even though the average productivity gap is still wide and unlikely to be closed quickly.

The initial outcome of the high unemployment was a sizable westward migration of unemployed. The migration increased potential output in the western parts of Germany so that the combined output capacity of Germany, for a given capital stock, was increased.[25] The increased labour supply was also expected to have desired anti-inflationary effects through moderating wage increases. That, in turn, would lead to higher employment, which again would lead to a higher marginal productivity of capital (MPC) and hence, more investment. The labour market, however, seems to be too deeply divided to have this positive effect. In contrast, the workers in the western parts expect higher inflation in the future and demand correspondingly higher nominal wages, which raises real production costs. In the East those who are employed can, despite the high unemployment, require nominal wage increases, too, by referring to their much worse standard of living. According to *European Economy* 1991: 50, by the end of 1991 East German enterprises had not achieved a productivity level in line with salary developments. This, of course, is a burden in the face of worldwide competition.

3.3   The demand shock

The main reason for the larger increase in aggregate demand was increased investment and consumption. Due to the difference between the sudden increase in demand and the sticky supply, short-term interest rates in Germany had to increase to offset the corresponding effect on prices. Another effect of GMU was an increased need for government expenditure and investment. This increased need for capital should be satisfied on the financial markets. At the same time the household saving quote decreased significantly. This induced an upwards pressure on interest rates.

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[25] The huge migration accelerated the decision to create a Germany that was both economically and politically unified. The unification process is described in eg Kantzenbach (1990) or Ranki (1991a). The positive effects of increased labour supply in Germany are analyzed in detail in *IW-Trends*, 1991:3, and in Masson & Meredith (1990).

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3.3.1 Government expenditure shock

The success of GMU will depend to a large extent on the flow of resources from West to East Germany. Massive infrastructural investment will be necessary: new plant and equipment (especially the technology it embodies) must be acquired.[26] Transfers from West Germany – from private households, business enterprises, the government – are needed for financing most of the expenditure of the new state and local government in the East. For example, in 1992 every fourth DEM in the budget went to GMU, and the expenditure remained at this high level through 1995. Long-term revenue on public expenditures was low, mainly relying on value added tax and excise taxes. Expenditure was high, not only for administration but also for the infrastructure and environment. The favourable conversion rate for the flow incomes made the size of such transfers relatively high. In addition, massive subsidies were needed to compensate for the lack of competitiveness of industry and agriculture.[27] Explicit transfers to the new parts did not represent the only transfers to East Germany. The social security system (mainly old-age pensions, unemployment or short-time employment benefits) represented a transfer. The needs of Treuhand[28] came up in these figures. Moreover, the banking system inherited from East Germany brought with it "equalization claims", which arose when assets and liabilities (savings of the population) were converted at different rates[29].

GMU gave rise to a large fiscal expansion to support incomes and to encourage investment in East Germany. Figure 3.5 shows the general government budget deficit. The fiscal costs of GMU in the form of transfers to East Germany have been running at about 4 to 5 % of GNP since 1990. Thus, despite restrained federal expenditure and tax increases

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[26] Burda (1990a) examines factors that influence capital flows to East Germany. Lehment (1990a) analyzes the excess German demand for capital, and its consequences on the international financial markets.

[27] Such subsidies should definitely only be temporary, and their temporary nature should be announced in advance in order to force out real improvements in efficiency and, hence, competitiveness.

[28] Treuhand was founded to privatizise old state-owned production units. Its task is to improve their competitiveness and then sell them to domestic and foreign investors. For a description of the Treuhand and its assignments, see eg Siebert (1991).

[29] Household savings were converted at a rate of 1:1 whereas the liabilities of the firms were converted at 1:2, which created an unbalanced position in the book-keeping of the banks. To cover this, the East German government issued debt certificates for the banking sector.
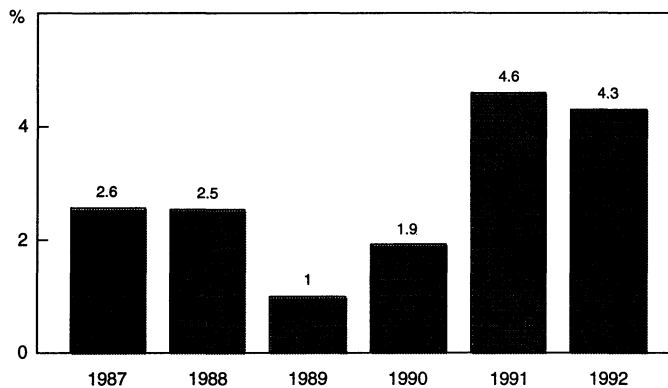
in West Germany, general government finances moved from a rough balance in 1989 to a deficit of about 3 % of GNP in 1992.

Figure 3.5a **German general government budget balance in DEM billion**
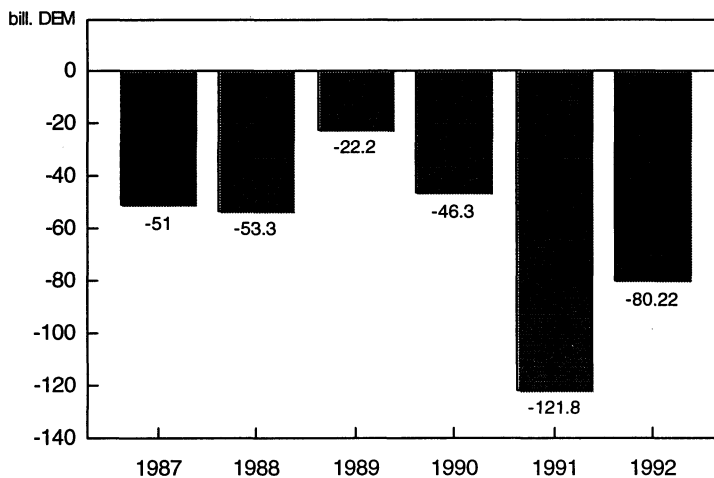
Source: Deutsche Bundesbank

Figure 3.5b **German general government budget balance as percentage of GNP**

Source: Deutsche Bundesbank

In principle, a temporary budget deficit may not be a matter of concern[30]. It is estimated, however, that only about 30 % of the transfers can be considered as return-yielding in the future. Even if establishing an efficient administration could be considered as an investment, the overwhelming share of transfers have been used for consumption. Thus, a large part of the transfers will not generate future tax revenue[31], so one should be cautious about allowing any significant increases is the non-productive part of the budget deficit. The key factor for interest rates is how the budget deficit is financed. There are, in theory, three ways of doing this: (1) let the central bank print new money, (2) raise taxes, and (3) sell bonds to the private sector. In the case of Germany, the first option was ruled out at once – there is a law prohibiting the financing of government deficits by printingpress. The second has already been used: at the beginning of 1991 taxes were raised, and another rise was announced at the beginning of 1993. The figure below shows tax revenue in relation to gross expenditure. As the East German economy gradually increases output and unemployment decreases, the tax revenue from the new states will increase. Higher wages also result in greater tax revenue.

The third option is the one affecting interest rates: selling government bonds to the public sector. An increased supply of bonds will, because of the inverse relation between bond prices and interest rates, drive up interest rates. Of course, the more bonds that are sold, the larger the rise in interest rates. This approach to financing has already been used. Figure 3.6 illustrates the percentage change in the sales of state bonds (Bundesobligationen), and, as can be seen, in the year of GMU there is a clear peak. The debt ratio, ie the proportion of public debt to GNP from 1987 to 1991 ran between 40 to 45 %.

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[30] A summary of the theoretical distinction between "good" and "bad" budget deficits is given in eg Wyplosz (1991a).

[31] The issue of the government budget deficit and its financing is further discussed in eg Siebert (1991). The role and development of tax revenues is analyzed in *IW-Trends*, 1991:4.

Figure 3.6   **Percentage change in government bond sales in Germany between 1987 and 1991**
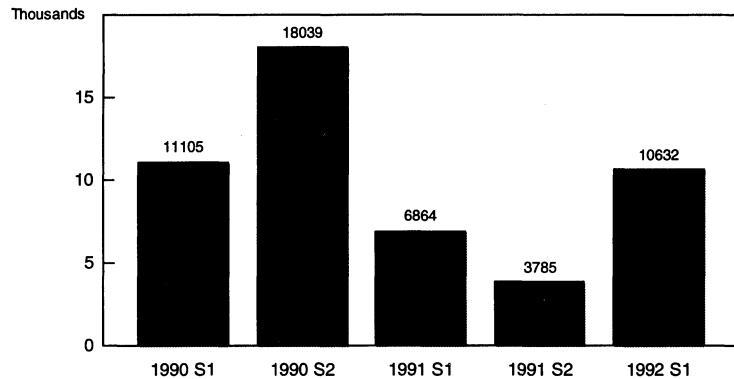
Source: Deutsche Bundesbank, own calculations

3.3.2 Investment shock

GMU has also brought about a large shift in the pattern of savings and investment. In order to ease the burden of official financing of the rebuilding of the eastern economy and to speed up recovery, private investment from both the home country and abroad was and is needed.[32] In an attempt to encourage investment, the government has introduced investment subsidies.[33] Such arrangements, together with the increased profit opportunities in Germany, have attracted investment, but the savings behaviour has not changed.

As the potential marginal efficiency of capital in East Germany has increased, the real interest rate has been pushed up from the supply side. The effect on the real interest rate of this supply shock can be viewed as an increase in the marginal productivity of capital (MPC). Increased investment is only a response to the gap between MPC and the real interest rate. The real interest rate will rise, but only so that it is above the

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[32] For a more detailed theoretical argument refer to Gebauer (1990b) who provides a clear explanation for the reaction of the interest rates.

[33] Welfens (1991) presents an estimation that favourable depreciation allowances for investors, tax-free periods of newly established enterprises, subsidies for ailing industries as well as necessary expenditures to rebuild the East German infrastructure could add to public authorities' credit demand in Germany for at least a decade. Such subsidy arrangements have been critized because they make it possible to carry on with inefficient projects. Siebert (1991) argues that lack of investment incentives would not be the decisive factor for slow growth in East Germany.

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MPC in the rest of the world but still below the MPC in Germany. The capital flow from the rest of the world into Germany will, however, accumulate capital in Germany and reduce the stock in the rest of the world. Therefore, in the long run, interest rates will be equalized.

Another factor that contributes to investment exceeding savings is the increase in government (social) transfers to East Germany. Such transfers crowd out savings in the economy. An expansionary fiscal policy, with the transfer payments being largely financed by bonds, will put demand-side pressure on the interest rate. Because the Bundesbank sticks to a strict monetary policy aimed at maintaining non-inflationary growth, an increase in the interest rate will choke off demand. The budget deficit leads to reduced national savings, unless private savings are simultaneously increased, ie the Ricardian equivalence[34] holds.

3.3.3 Rising market rates

As a consequence of higher anticipated borrowing, nominal (and real) interest rates have been rising in Germany. The interest rate may, of course, reflect inflationary and exchange rate expectations[35], but the increases are mainly due to the monetary policy of the Bundesbank. The major fiscal expansion that accompanied the GMU caused overheating of the economy. With the Bundesbank restraining the growth of the money stock, this overheating led to a gradual tightening of monetary conditions, with increases in interest rates being particularly marked for short maturities. By raising short-term interest rates it tried to shift liquidity from long maturities to short maturities. By making savings attractive, demand on the goods markets was diminished, and consequently, the inflationary pressure decreased. Simultaneously, by making long-term investment relatively profitable, the central bank can try to stimulate growth. When short-term interest rates are raised, however, savings are turned away from longer maturities at the same time as demand for long-term capital increases. Hence, even long-term interest rates will rise during the period of adjustment to the excess demand for capital.

[34] Ricardian equivalence states that a government budget deficit at the present is anticipated to lead to increased taxes in the future. Therefore, the public will start saving today in order to be prepared to pay for the taxes in the future. However, as stated in Wyplosz (1991a), the Ricardian equivalence has been repeatedly disproved empirically.

[35] Lehment (1990a) and Gebauer (1990b) note that especially the long-term interest rates would largely reflect inflation expectations rather than demand and supply conditions on the financial markets.

Therefore, it is hard in the long run for the central bank to try to control short-term interest rates without affecting long-term rates as well.

Figure 3.7   **Euromarket interest rates for DEM, three months, twelwe months and five years maturities**
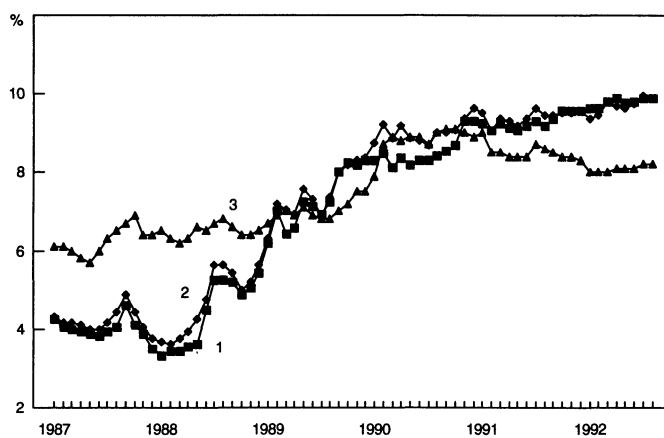
1 = three months
2 = twelwe months
3 = five years

Source: Reuters, OECD

4 Implications of the disturbance for the EMS

To the extent that GMU generates positive or negative spillover effects on other EC countries, it presents challenges that can potentially influence the speed and degree of European economic integration. In general terms, GMU had both real effects through intra-Community trade impulses and monetary effects via alterations to interest rates and exchange rates, induced by capital movements. Here, we will concentrate on the monetary side of the economy.

The purpose of this chapter is to describe the external monetary effects of GMU. The monetary consequences of GMU in Germany have spillover effects on the other EMS countries via both interest rates and exchange rates. In principle, if the EMS is a credible fixed exchange rate system, all the adjustment burden should fall on interest rates. On the other hand, if interest rates are not allowed to absorb the disturbance to a sufficient degree, pressure is put on the exchange rates. As Owen (1991) notes, a nominal exchange rate realignment associated with GMU within the EMS has the potential for reducing the credibility of the system. Therefore, rather than permitting a realignment that could be perceived as weakening the prospects of attaining EMU, other EMS currencies may be allowed to accommodate the movements of the DEM. As, in addition, (German) interest rates are rising in the aftermath of GMU, the implication could be a slowdown of economic activity elsewhere in the EC.

Section 4.1 it will explain why an interest rate increase in Germany forces the other EMS countries to follow the German policy, assuming that the German dominance hypothesis holds[36]. In this money-market model the effect of changes in the demand and supply of the currency that arise from changes in the trade patterns are not considered, because they are basically long-term effects and only about 5 % of the daily transactions on the international foreign exchange markets have a commercial background. An overview of the expected long-term effects of GMU will be provided in section 4.2. Section 4.3 reviews the existing academic literature on the effects of GMU on exchange rates.

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[36] See section 2.4.2 Mastropasqua et al. (1988) consider Germany as the monetary leader in their study. Also Gebauer (1990a) assumes German dominance when discussing the effects of the GMU on the EMU.

4.1 Expected short-term effects

An important channel of interdependence in a world with capital mobility is the close linkage between interest rates in different economies established by highly mobile flows of financial capital. As shown by Uctum (1991), an increase in the foreign interest rates (which may be due to a rise in the marginal product of capital), reduces domestic investment and hence the capital stock in a small, open economy, depreciates its currency and increases its foreign indebtedness. Under a fixed exchange rate regime, the adjustment of the exchange rate to such a shock is, of course, limited. The variable that will take over the adjustment is the domestic interest rate. In this case the main short-term difficulty arises from higher real interest rates that have pushed up nominal interest rates in Germany. The assumption of German leadership in monetary policy implies that European monetary policy is set on the basis of German domestic considerations. This increase will be transmitted to other (European) countries via the integrated capital markets. To counteract the negative effects, given the hard ERM arrangements[37], European countries have to implement a policy package with restrictive monetary policy and decreased government expenditure. The consequence of such an inappropriate policy outside Germany would be the loss of welfare is other EMS countries relative to Germany. Because nominal interest rate increases are not tied to increased inflation, they imply a rise in real rates as well. Higher domestic real interest rates may increase the fiscal burden of domestic debt and the cost of working capital with potentially recessionary consequences. Further, since the governments in several EMS countries have borrowed extensively on international financial markets, the cost of servicing domestic debt increases. Such an increase in the rate of interest must lead to a reduction in government expenditure, an increase in taxes, or a combination of these. Both alternatives are, of course, politically unattractive. As described in chapter 2, in the ERM the exchange rates had a fluctuation band of ± 2.25 % around their central parity. Because of this fluctuation band, though it is small, the actors have to take it into account when making short-term investment decisions. When the investment period becomes longer, the variation of the currency within the band becomes less important, but more consideration is placed on the probability of an eventual realignment. The probability of moving a fluctuation band becomes larger, the longer the currency has

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[37] With hard-ERM is meant the ERM as it is considered to be today, ie the system delivers low inflation on the back of the Bundesbank's reputation. For an analysis of various degrees of the discipline the ERM could provide see eg Currie (1992).

been very near the upper or lower limit of the band. In the short-term, if the currency tends to approach, say, the bottom of the band, the central banks have to intervene in order to keep the exchange rate within the allowed limits. Interventions cannot, however, go on for ever. In the long-term, unless there is no change in the fundamentals pushing the exchange rate towards the limit, the band has to be adjusted.

Section 4.1.1 will show what will happen to interest rates in an asymmetric system such as the present EMS, where one country, i.e. Germany, conducts an autonomous monetary policy, and the others try to keep their exchange rate fixed by intervening in the foreign exchange markets.

4.1.1 Interventions in an asymmetric system

Here, the model presented in Giavazzi & Giovannini (1989)[38] is applied. In it money demand equations in the home and foreign country (foreign variables are marked with an asterisk) depend negatively on an exogenous velocity shock v, and nominal interest rate r, whereby

$$M^d = -v - ar \tag{4.1}$$

$$M^{d*} = -v^* - ar^* \tag{4.2}$$

The money supplies are obtained from the central banks' balance sheets:

$$M^s = DC + FX \tag{4.3}$$

$$M^{s*} = DC^* + FX^* \tag{4.4}$$

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[38] Giavazzi & Giovannini (1989) use the model to study whether the intervention rules of the EMS really guarantee the symmetry of the system. They show that, in the presence of domestic sterilization, intervention rules are useless in determining whether an exchange rate union is symmetric or not. They call the model for an "accounting" model of international money market equilibrium with two countries; "accounting" because all the stress of the model is on the accounting relationships between foreign exchange reserves, domestic credit, foreign exchange intervention, and sterilization.

where DC is the domestic credit and FX the foreign exchange reserve component of the total money supply. The model assumes that DC and DC* are the sum of an exogenous component, D, and a component that is proportional to change in foreign exchange reserves:

$$DC = D - b\Delta FX \tag{4.5}$$

$$DC^* = D^* - b^*\Delta FX^*$$
$$(0 \leq b, \ b^* \leq 1) \tag{4.6}$$

where b and b* are the sterilization coefficients. If the central bank chooses complete sterilization to keep the money supply constant, b equals unity. A reduction (increase) in the foreign exchange reserve is then compensated by an equiproportional increase (decrease) in domestic credit.

If we assume risk neutrality[39], international portfolio equilibrium can be specified as depending solely on interest rates:

$$r = r^* \tag{4.7}$$

Finally an equation for intervention rules[40] is added into the model. If the value of the domestic currency has to be increased (decreased), the supply of the domestic currency has to be decreased (increased) by exchanging it against (for) the foreign currency. These transactions must be financed from the central bank's foreign exchange reserves. If the foreign central bank is not willing to increase its foreign exchange reserve, the domestic authority will have to carry the whole burden of the intervention. The domestic reserves will be diminished by the amount of the intervention. If, however, the foreign central bank contributes to the intervention, the change in the domestic reserves is less than the total intervention. At the other extreme, no change in the domestic reserves will occur if the

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[39] A term representing shifts in investors' preferences (due to risk associated with assets denominated in different currencies) can easily be incorporated into the model. However, it does not change the implications of the result for the present purposes, and is left out for simplicity.

[40] According to empirical evidence, interventions in EMS-currencies have increased within the ERM, and therefore we will here consider interventions as transactions in EMS-currencies. For the present purposes we do not have to care how the intervention rule is determined.

foreign central bank takes care of the entire intervention procedure and lets its foreign exchange reserve fluctuate. Hence, if we denote the intervention rule by g, we can write

$$\Delta FX = g(\Delta FX - \Delta FX^*) \qquad (0 \leq g \leq 1) \tag{4.8}$$

$$\Rightarrow \Delta FX = \left(\frac{g}{(g-1)} \right) \Delta FX^* \tag{4.8a}$$

$$\Rightarrow \Delta FX^* = \left(\frac{(g-1)}{g} \right) \Delta FX \tag{4.8b}$$

If $g = 0$, all the adjustment needed is borne by the foreign country; if $g = 1$, only the home country adjusts. By inserting (4.8b) into (4.5) and solving (4.5) and (4.6) for DC, we arrive at

$$DC = D - \left(\frac{b}{b^*} \right) \left(\frac{g}{(1-g)} \right) (DC^* - D^*) \tag{4.9}$$

As g becomes larger, i.e. the more the domestic central bank is involved in the intervention actions, the larger the effect of the foreign exchange market transactions on the domestic money supply and, hence, the greater the need for sterilization, i.e. to have a small value on b. The country having the appreciating currency will experience an expansion in the domestic money supply, unless the effect is sterilized.[41] Hence, one could expect that countries with strong currencies tend to sterilize the effects of interventions, independent of who has intervened.

The solution of the model yields

$$M = (1-c)D + cD^* - c(v-v^*) \tag{4.10}$$

$$M^* = (1-c)D + cD^* + (1-c)(v-v^*) \tag{4.11}$$

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[41] Germany has very long has an appreciating currency, and as the empirical evidence on interventions shows (see section 2.3.4 above), Germany has sterilized practically all intra-EMS) interventions.

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$$r = -a^{-1}((1-c)(D+v) + c(D^*+v^*))$$ (4.12)

$$r^* = -a^{-1}((1-c)(D+v) + c(D^*+v^*))$$ (4.13)

where

$$c = g\frac{(1-b)}{(g(1-b)+(1-g)(1-b^*))}$$ (4.14)

If $b = 1$, c becomes 1, too, indicating that the foreign country sterilizes all flows in the foreign exchange reserves. When the home country sterilizes all changes in the foreign exchange reserves, the foreign country has to accommodate domestic monetary policy entirely and has no control over its own money supply.

As was shown in section 4.4.2, the Bundesbank has intervened only intramarginally in EC currencies in the early years of the EMS at times of DEM weakness. It has been involved in substantial interventions at the margin in EC currencies. The bulk of its interventions, however, has been in the USD market and for the most part they were not ERM-related. There have been sizeable interventions in EC currencies by other participating central banks especially in periods when the DEM has hovered in the central region of the band. This is interpreted as a sign of the role of the DEM as the pivot within the ERM.

Against this background we can make the following assumptions: b* is close to zero because the Bundesbank sterilizes all intra-EMS foreign exchange fluctuations. We can assume that g is close to one since Germany does not intervene in the ERM markets. If we denote Germany as the foreign country and the EMS partner country as the domestic country, and differentiate the solution with respect to D*[42], we obtain

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[42] D is chosen arbitrarily just to pinpoint the maybe most important of the effects, when talking about the capital markets, namely the increase in the government expenditure. One could also choose another variable but the implications of the results will be the same. For example, if the GMU is considered as a portfolio shock, where preferences shift towards German assets (say, due to the better return prospects), this would imply only slight changes in the German variables but large in the foreign (EMS) ones.

$$\frac{\partial M}{\partial D^*} = c$$

$$= g \frac{(1-b)}{(g(1-b)+(1-g)(1-b^*))}$$

(4.15)

$$\frac{\partial r^*}{\partial D} = -a^{-1}c$$

$$= -a^{-1}g \frac{(1-b)}{(g(1-b)+(1-g)(1-b^*))}$$

(4.16)

If b* is (close to) zero, and g is (close to) unity, (4.15) will approach unity and (4.16) a negative constant, $-a^{-1}$, indicating that Germany is the only country able to control its money supply independently. The other countries should be forced to follow the changes in the German money supply/interest rates. Given the macroeconomic effects of GMU within Germany, according to this model, they should appear in the EMS through corresponding changes in the money supplies and/or interest rates of other member countries.

4.2 Long-term convergence prospects

At the time of forming GMU there was discussion about the significance of GMU for the EMS and, hence, for EMU. Of course, GMU took place during a critical transitional period of monetary integration among EC countries. The opinion of the other EC countries about GMU was not self-evident. Clearly, GMU created new risks, but it also offered new opportunities for monetary integration within the EC. A widely held view is that the determined strict monetary policy of the German central bank has been, as stated in Chapter 2, the anchor of the system. Now there were fears of inflation problems for Germany that would induce upward inflation pressures for the whole of the EC and eventually increase tensions in the EMS.

The fact that part of the regional and social EC funds would be allocated to the economically backward East German regions gave reason to expect new antagonism between the Mediterranean EC regions and Germany. Further, the public deficits in Germany are important in the context of EC fiscal policy coordination. The German position that

countries with a high public deficit have to reduce their budget deficits relative to their GNPs becomes less credible if sustained high budget deficits are observed in Germany.

On the other hand, there has been a positive demand injection from Germany. West German industry was operating at about 90 % capacity utilization and had, therefore, little scope for further expansion. Hence, increased consumer demand from East Germany after GMU and booming demand for capital equipment and intermediary goods had to be satisfied from abroad, primarily from partners in the EC. Thus, GMU was expected to reduce the German current account surplus and rebalance the intra-European trade structure. Figure 4.1 illustrates the development of the German current account balance after GMU.

Figure 4.1   **The German current account balance in DEM million, 1987 to 1992**
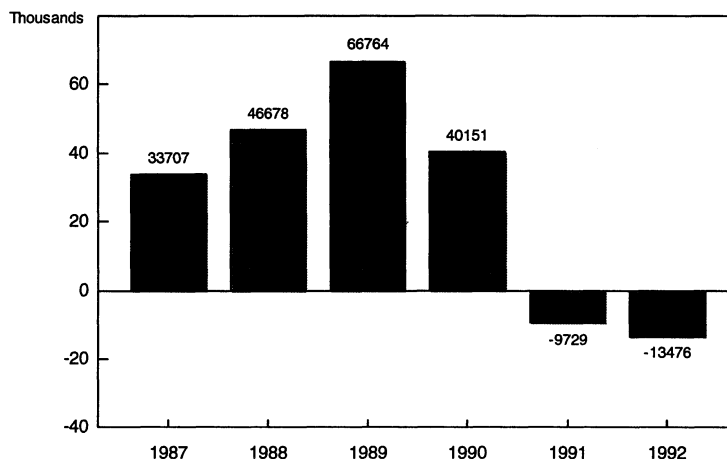
Source: Deutsche Bundesbank

4.2.1   Shock adjustment within the EMS

For the EMS, GMU was an asymmetric shock hitting initially only one of the member countries. Asymmetric shocks are not dealt with optimally by monetary union since they require an asymmetric policy response. In a fixed but adjustable exchange-rate system like the EMS, a prominent form of asymmetric monetary policy response is realignment. In a monetary union, asymmetric fiscal policies can potentially substitute for realignments. At this stage of the integration process of the EC countries, realignments are still possible, though undesirable. As Weber

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(1991) states, however, realignments have been used in the EMS primarily to compensate (partially) for accumulated inflation differentials. If the long-term net effect of GMU remains increased German inflation, corrective realignments are not needed; the German inflation rate is brought closer to the average EC inflation level, leading to higher average EC inflation but also greater convergence.

If GMU implied a realignment but the EC countries decided to stick to the present parities, their response to GMU should be a counteracting change in fiscal policy. GMU being an expansionary shock, this would mean contractionary fiscal policies in the other member countries. When, however, Europe is in recession, such a solution is hardly desirable.[43] Hence a realignment could turn out to be a very attractive policy option indeed.

4.2.2 Competitiveness versus discipline approach revisited

Returning to the competitiveness versus discipline approach, we can see what the possible implications of GMU are under these alternative assumptions. If the competitiveness principle holds, GMU can have a stabilizing effect on the EMS. Because of GMU the German inflation rate rises. This means that, for the present, given inflation rates in the other EMS countries, their competitiveness is not eroded as strongly as before. If the inflation rates in the other EMS countries remain at the present level, this implies that their competitiveness will improve relative to the pre-GMU period. This should be seen in the trade flows: as long as the German inflation rate is higher than before, exports to Germany should increase while imports from Germany should go down. If, instead, the competitive positions within the EMS are held unchanged, the effect should be higher average inflation in the EMS as the same competitiveness effects can be attained at a higher domestic inflation rate in other EMS countries. This, in turn, should affect the overall position of the EMS in world markets; ie the EMS would suffer from deteriorating competitiveness which could be eliminated through a depreciation of the ECU on the international foreign exchange markets.

If we assume that the discipline aspect of the EMS holds, the effects should be very similar. As German prices rise and, hence, the real appreciation vis-à-vis the DEM becomes less dramatic than before, the punishment becomes less severe. This has two effects on the inflation convergence within the EMS. First, the convergence towards low inflation rates could be expected to slow down. Second, average inflation

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[43] For an economic overlook see eg *European Economy,* 1990:46.

rates could be expected to rise, which, in turn, would result in similar developments on the international goods markets as explained before.

Of course, one could ask if it were not possible to use some other currency as the anchor when the DEM weakens. Lehment (1990a) poses this question, and discusses the possibilities of the FRF assuming the anchor role of the DEM. Since 1989 the growth in the French monetary base has been stable enough to support the FRF as an anchor, if needed, but as Lehment (1990a) states, such a change in the role of the anchor currency would disrupt money demand, which could make it difficult for the French monetary authorities to provide the necessary stability. The DEM is, seemingly, the heaviest currency in the ECU basket, and thanks to GMU it will become even heavier. Therefore, every change in DEM value tends to dominate development of total EMS units on the foreign exchange and goods markets. For example due to the very positive performance of the domestic monetary policies the NLG, the BEF and, to some extent, the DKK, are all strong currencies. These currencies have represented countries with the lowest inflation rates, recently. They are, however, all too small to be used as an anchor. The economies of Denmark, the Netherlands and Belgium are too small to create capital flows that could have the same effects on the other countries as do (the very large) transactions in the DEM. In addition, Filc (1991) points out that changing the anchor currency of the EMS cannot be done overnight. Even though the interest rate level in the EMS area could presumably be lowered if another currency (with a lower inflation rate) was chosen as the nominal anchor, the DEM-denominated assets, liabilities and intervention arrangements of the central banks are so extensive that the EMS could not possibly sustain the pressure created by the consequent capital flows. Hence, the position of the DEM is hardly threatened; it will influence the EMS as strongly as before.

4.3   Previous studies on the exchange rate effects of the GMU

Given the important role of the DEM in international foreign exchange markets, especially within the ERM, GMU aroused speculation about exchange rate behaviour. Some believed there would be a depreciation because German inflation would accelerate; others believed there would be an appreciation because the German economy would become even more powerful. As seen in section 4.2, the views of the academic community also differed considerably. Since the shock only a few studies have yet formally modelled GMU or impacts or applied econometric

methods. The bulk of the literature consists of ex ante discussions on the possible outcomes of various scenarios. While, highly speculative, they provide a wide basis with qualitative results on which empirical work can be built. Below, the most important studies are arranged according to the qualitative expected change in the real exchange rate of the DEM.

4.3.1 Appreciation

In previous studies, Burda (1990a) and Lehment (1990a, b) conclude within a theoretical model that the demand side of the economy induces an appreciation of the DEM due to impacts on capital and the current account. Specifically, appreciation is due to a higher marginal efficiency of capital, i.e. higher rates of return in East Germany prompting a larger capital inflow and/or a reduced capital outflow from Germany and consequently raising demand for the DEM.[44] With regard to the current account, appreciation is needed to bring about a reduction in the overall trade surplus. A reduction is necessary because, when calculated separately, the east German states have a trade deficit. Given the fixed exchange rate parities, a real appreciation of the DEM has to appear so that the inflation rates in the other EMS countries stay below the German inflation rate. If the other member countries are unwilling to deflate while the Bundesbank maintains its traditionally strict monetary policy, the only solution is nominal appreciation of the DEM.

Masson & Meredith (1990) discuss the economic effects of GMU in the context of a global savings/investment model. In their analysis, in the first instance GMU takes the form mainly of a positive demand shock; in the medium to long term they expect the supply effects to strengthen. Hence, they treat the amount of East German spending in excess of its output as the main shock. They then make simulations of MULTIMOD[45] within different scenarios. The increase in investment leads to excess demand for German goods. Given that the stance of monetary policy is adjusted appropriately by the Bundesbank, inflation is unlikely to accelerate markedly and for an extended period of time. Furthermore, crowding out foreign demand for German goods is a mechanism to

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[44] Pöhl (1985) argues that the real interest rates are practically unimportant for the international capital flows; the inflation rates are important only in so far as they can be considered as good indicators of the future nominal exchange rate development.

[45] MULTIMOD is one of the macroeconomic computer models of the International Monetary Fond.

satisfy the excess demand. Consequently, their results suggest a modest real appreciation of the DEM.[46]

Siebert (1991) explains the appreciation of the DEM by comparing the prices of tradeables and non-tradeables. The price of tradeables is, as usual, dictated by the world market, whereas the price of non-tradeables is determined on domestic markets. In this case, the price of the non-tradeables should rise because demand will increase (for reasons such as transfers to East Germany, higher incomes as a result of supply-side growth, etc.). On the cost side, wages and production costs will rise, creating pressure on non-tradeables. The shift in relative price in favour of tradeables will imply a real exchange rate appreciation.[47]

The need for a real appreciation of the DEM is addressed by Svensson (1993) and Eichengreen & Wyplosz (1993). They claim that the real appreciation required to accommodate GMU could have been achieved with many combinations of price inflation in Germany and the rest of the EMS. Feasible options include a burst of inflation in Germany and stable prices elsewhere, a constant price level in Germany and a burst of deflation elsewhere, and moderate inflation in Germany combined with moderate deflation elsewhere. The authors argue that GMU necessitated a decline in prices and costs in other EMS countries relative to those prevailing in Germany. Because a realignment was ruled out, the real appreciation of the DEM could only be achieved by increasing the level of German prices relative to price levels in other EMS countries. Further, since Germany uses its monetary leadership to ensure domestic price stability, real appreciation is accomplished through disinflation and recession in the rest of the EMS. In other words, because other EMS countries peg their currencies to the DEM, they import the tight monetary policy pursued in Germany.

Owen (1991) takes up the possibility of a temporary exchange rate overshoot. In the short term, the inflationary impact of the additional German demand for consumer goods implies a real appreciation of the DEM. This appreciation is compounded by capital inflows, induced by favourable investment opportunities and higher real interest rates. In the

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[46] The authors also note that the movements in exchange rates can be expected to be largest in the early stages of the GMU. As capital accumulation proceeds, exchange (and interest) rates move back towards their initial values.

[47] Owen (1991) has compared several econometric simulations of the international effects of the GMU. He found that the most pervasive characteristic of these studies is the relatively small magnitude of the estimated effects (these are a potential pressure for a real appreciation of the DEM, an increase in real interest rates, a German fiscal deficit, and a foreign capital inflow to Germany). He also criticizes the results for being based on preunification models that do not incorporate estimates of the costs associated with the restructuring of east German industry, or the transfers.

longer term, the excess demand on the goods market leads to a deteriorating trade balance that together with a lower per capita GNP, entails depreciation. This scenario is, however, valid only for the situation where Germany does abandon strict monetary policy. It is further assumed that the fiscal deficit is financed by raising taxes. The assumption that the DEM will not appreciate in real terms implies that prices as well as interest rates will remain at a higher level for a long time. The expected nominal depreciation compensates, at least in part, for the higher prices. Moreover, it has a negative effect on the expected yield from foreign investments made by Germany. As a consequence, unless the prospects of a good return are improved in terms of higher interest rates, capital inflow should diminish and, hence, the appreciating force on the DEM lessen. Therefore, the net effect of the overshoot should be minor.

4.3.2 Depreciation

Wyplosz (1991b) analyzes the effects of GMU by using a two-goods version of the standard infinity-lived representative consumer model. He, hence, concentrates solely on the real exchange rate, leaving out the nominal exchange rate, which is determined primarily by monetary policy. GMU is characterized as a West German takeover of a country with no initial capital stock but a labour force identical to its own. He assumes full employment throughout the analysis, which can be justified in order to point out the significance of the capital stock but is, of course, far from reality. Within this framework, there are two transitory effects that permanently reduce the per capita wealth in Germany: the lower capital-labour ratio reduces per capita GNP; and the need to accumulate capital lowers net personal disposable income. Wealth reduction then leads to permanently lower aggregate real consumption. During the adjustment path, German consumers, faced with a temporary fall in net income, borrow from abroad to smooth out spending. Therefore, in the final steady state, the trade balance must be in surplus to service the accumulated debt. But over time, as net disposable incomes rise, a continuous real depreciation is needed to boost exports and to maintain the goods market equilibrium.[48] An additional reason for real depreciation is the fall in German per capita exports. In contract to other studies the analysis focuses on both supply conditions and inter-temporal considerations. Because of the very narrow approach the results are not

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[48] In the discussion part of the study is stated that the fact that Germany becomes larger increases the long-run depreciation.

representative of the overall development of the real exchange rate but they give a clear picture of the significance of the capital stock in the total process. Similar arguments are found in Melitz (1991), stating that investment in East Germany will accumulate foreign debt. In the long run, the current account surplus required to repay the debt necessitates a depreciation in the real exchange rate.[49]

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[49] Siebert (1991) criticizes the prediction of a depreciation of the DEM for hinging very much on the assumption that west German productivity will simply be extended to a united Germany. It neglects the integration gains and the effect of new technology through investment in east Germany, which very probably changes the German productivity.

5   Indicators of credibility of
the EMS

In this chapter the credibility of the EMS during the period between 1987 and 1992 will be measured by applying the methods developed in target zone literature. In Section 5.1, the "credibility" of a fixed exchange rate system is discussed. In Section 5.2 a naive measure of credibility is created and illustrated with data to shape the developments on the foreign exchange markets after GMU. A preliminary conclusion is drawn in Section 5.3.

5.1   Aspects of credibility in
the EMS framework

The asset market characteristics of foreign exchange markets have attracted researchers towards modelling exchange rates with standard models suited for volatile asset prices strongly influenced by expectations. Underlying factors are commonly collected into a set of variables called "fundamentals". The future development of these variables is only implicitly included in the expectations. When analyzing long-term developments, however, one always has to return to the fundamentals. In the following discussion we focus on "credibility", making a distinction between the credibility of a fixed exchange rate, or target zone, in a general sense, and the system "credibility" traditionally associated with the EMS.

A fixed exchange rate system can be sustained over the long run only if the economies of the participating countries are convergent. From this, we define "credibility" in general as exchange rate stability resulting from the convergence of economic factors so that ultimately no discrepancies exist. Here, the fixed exchange rate can be said to accord with the underlying fundamentals. When talking about the EMS, however, it is crucial to note that the EMS has been strongly associated with the notion of a nominal anchor currency.

According to the disciplinary approach presented in Chapter 2, the main reason for high-inflation countries joining the EMS was to benefit from low German inflation. The view was that high inflation is harmful for an economy. By fixing the exchange rate of the domestic currency

vis-à-vis the DEM, they would bind domestic monetary policy to an anti-inflationary course.

When the EMS was established in 1979, Germany had of all participants the lowest inflation. When oil prices shot up in the early 1980s, inflation rates increased in all countries. Yet among EC countries, the increase was smallest in Germany. Thus, in the early years of the EMS, inflation differences between the participating countries were considerable and, consequently, the long-term credibility of the exchange rate parities was very low. Therefore, in order to protect parity, every other EMS country was forced to maintain an interest rate gap with Germany. The higher domestic interest rate was compensation for the expected devaluation associated with the domestic currency.

Because of this link between the exchange rate and the domestic interest rate, participation in the EMS and stabilization of the nominal exchange rate vis-à-vis the DEM became the signal for an anti-inflationary course in domestic monetary policy. Essentially the EMS changed from a system to stabilize nominal exchange rate movements to a tool for domestic monetary policy making. Domestic monetary authorities can "borrow" on the anti-inflationary reputation of the anchor country, thereby reducing the cost of lower domestic inflation. Such thinking assumes first that the participating countries remain committed to pushing inflation to low levels and, second, that German inflation remains low.

In other words, the disciplinary benefits of the EMS, when considered as a system with the DEM as the nominal anchor, stem from Germany's continued low inflation, and hence, low interest rates. Only in such a situation can the other countries use the DEM as an anchor to draw their inflation levels down. Accordingly, the exchange rates become more credible only when the other countries succeed in adjusting their economies to the German "norm". The analysis assumes that Germany is the central country in the system and the other countries attempt convergence. The DEM represents, in other words, the low-inflation currency to which the other countries peg their national currencies (indirectly via the ECU central rate) in order to be able to conduct a more efficient domestic anti-inflationary monetary policy. By this practice the other countries' inflation rates should be expected to approach the low German inflation rate level.

If, however, inflation convergence is instead achieved, so that the German inflation rate approaches the inflation rates of the other countries there is an improvement in the economic long-term requirements for the system to remain in place. Yet part of the attractiveness of the EMS is its anti-inflationary effect. When doubts arise about the ability of the

Deutsche Bundesbank to keep inflation low, the incentives of the other countries to follow the monetary policy of the leader country may diminish. If Germany cannot serve the "public good" though maintaining a low inflation reputation, other countries will understandably want to regain monetary autonomy to concentrate on their domestic economies. As a result, the system can become very sensitive to political events: the markets start to anticipate that a country might want to leave the system.

Hence, in a general sense, a fixed exchange rate can be defined as credible once the underlying economies of the relevant countries converge. In theory, it does not make any difference how the convergence is achieved. When credibility is associated with the EMS, however, it does matter how convergence is established. Long-term credibility can be achieved only when the economic indicators of the other countries approach those of the anchor currency country. Convergence based on changes in the economic indicators of the country that provides the anchor currency in relation to those of other countries is not necessarily sustainable in the long run.

5.2 Interest rate parity revisited

Let us assume that the relation linking the exchange rate and interest rates is the uncovered interest rate parity, stating that in equilibrium the return on a financial investment at home (the known domestic interest rate) equals the return on an alternative and equal investment abroad (the known foreign interest rate and the unknown change in the exchange rate)

$$(1+r) = (1+r^*)\left(\frac{S^e}{S}\right)$$
$$\Rightarrow \frac{(r-r^*)}{(1+r^*)} = \frac{(S^e - S)}{S}$$

$$(5.1)$$

where r and r* are the domestic and foreign interest rates, respectively, S^e is the expected exchange rate, and S is the actual current spot exchange rate. Risk-neutral speculation in efficient foreign exchange markets quarantees that this condition always holds ex ante. Put another way, in equilibrium the interest rate difference must always equal the expected change in the exchange rate.

In general, any difference between the domestic and foreign interest rate can be broken down into two parts[50]: the exchange rate risk premium and the expected rate of depreciation.[51] Several authors have attempted to separate the two by estimating models of the risk premium and attributing what is left over from the interest differential to expected depreciation. A large number of these studies reject uncovered interest rate parity[52]. As argued in Svensson (1990), however, the foreign exchange risk premium is likely to be small in exchange rate target zones. Because exchange rate movements are restricted by the band, the exchange rate variability inside the band is smaller than in a free float. Likewise, Ayuso & Restoy (1992) come up with estimates of the foreign exchange risk premiums in the EMS which are quite small due to the highly diversifiable nature of the exchange rate risk within the system. Hence, the component arising from exchange rate expectations due to realignments of the band will dominate the interest rate differential. Froot & Rogoff (1991) state that, if the credibility of the ERM is high, both components will be small. Hence, for our purposes it is not necessary to identify these components individually.

If we adjust the interest parity to take into account the fluctuation bands of the ERM, both factors can, under normal conditions, be captured within the band. To see this, let us first assume that the upper limit on the exchange rate is fully credible. Here, the domestic interest rate (at time t) can never exceed

$$r_u = \frac{(1 + r^*)S_u}{S_t - 1} \tag{5.2a}$$

where S_u denotes the upper limit of the exchange rate, and S_t is the spot exchange rate (at time t). Similarly, the domestic interest rate can never be lower than

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[50] In theory, there is also a third component, namely the country risk. However, as stated in Froot & Rogoff (1991), this is neglibly small within the EMS and is therefore, for simplicity, ignored here.

[51] Or, in terms of Rose & Svensson (1991), the total expected rate of exchange rate depreciation, reflected by the interest differential, is the sum of the expected rate of depreciation of the exchange rate within the exchange rate band, and the expected rate of devaluation.

[52] For a recent survey see eg. Ranki (1992b).

$$r_1 = \frac{(1 + r^*)S_1}{S_t - 1}$$

(5.2b)

Any jump outside the band should, in efficient markets, reflect prevailing expectations about the rate at which the central rate of the domestic currency will be devalued.

The interest rate parity condition describes an equilibrium: when the parity holds, capital flows are in balance. As soon as this equilibrium is disturbed, the variables immediately adjust to the new equilibrium. For example, if a foreign interest rate increases, in the new equilibrium either the domestic interest rate has to increase, or the exchange rate depreciates as capital flows to the foreign country with the higher interest rate, or both.[53]

Applied to the current case, the initial change is the increase in the German interest rate, r*. For the purpose of the current illustration we can simply assume that interest rates rose because monetary policy in Germany was tightened, and because demand for capital increased. Let us first assume that an EMS country, other than Germany, wants to keep the exchange rate completely constant. Then the right-hand sides of (5.2a–b) will have a higher value. This will be seen as an upward shift of the interest rate credibility band as a whole. The shift will be proportional to the change in the German interest rate. The domestic interest rate, r, will be forced to rise, too, in order to protect the exchange rate. The position of the curve illustrating r* should not change relative to the upper and lower limits of the interest rate corridor. This is presented graphically in Figure 5.1, panel a.

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[53] A thorough analysis of macroeconomic adjustment to foreign interest rate disturbances in the context of various models of the open economy is in Kouri (1983).

Figure 5.1   **Interest rate credibility band**
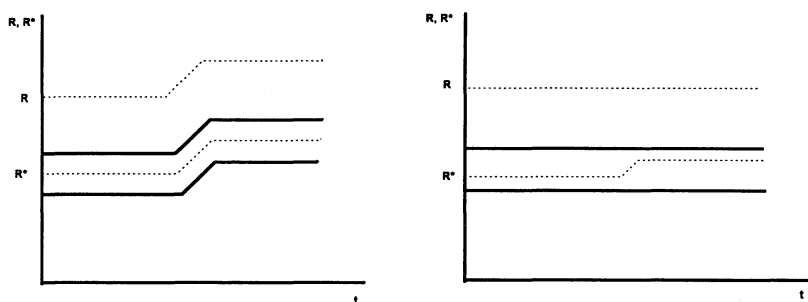
a) Interest rate credibility band when the   b) Interest rate credibility band when the
exchange rate is not allowed to react to a   exchange rate is allowed to react to
change in a foreign interest rate.   change in a foreign interest rate.

If the exchange rate is allowed to react to a change in the German interest rate, the domestic currency will depreciate as capital flows into Germany.[54] If the effect is fully absorbed by alteration in the exchange rate change, the interest rate corridor should not shift upwards, but the curve illustrating the German interest rate should move closer to the upper limit of the interest rate corridor. If the effect of a change in the German interest rate is distributed between the exchange rate and the domestic interest rate, we should see a combination where the location of the interest rate corridor shifts and the curve illustrating the German interest rate moves closer to the upper limit of the corridor. The domestic interest rate should remain at the same level, and the reaction pattern should resemble the one illustrated in Figure 5.1, panel b. In the following sections, the interest rate corridors are drawn for selected EMS countries. This simple method should provide a small insight into the behaviour of EMS exchange rates in the period January 1987 to August 1992. The interest rate data has been collected from Reuters and represents 12-month Euromarket interest rates.[55]

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[54] A depreciation of the DEM despite of an interest rate increase would mean that German assets were seen as extremely risky, and any interest rate raise as a desperate attempt to attract capital into a collapsing economy. This is a situation so unrealistic that the possibility of a depreciation of the DEM can be ignored.

[55] Long-term interest rates are more informative than short-term interest rates, because, as Svensson (1991a) notes, short maturities yield very large corridors when the results are annualized.

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5.2.1 Belgium

The interest rate corridor for Belgium is plotted in Figure 5.2a. In the early years of the EMS, the BEF belonged to the currencies following the soft pole of the system, i.e. the FRF, rather than the hard DEM. In the latter part of the 1980s, however, Belgian monetary and exchange rate policies were gradually modified. Since mid-1988, changes in Belgian official interest rates have mirrored those of German. In 1990 fundamental decisions were taken regarding the exchange rate policy, and in June the Belgian government committed itself publically to linking the BEF more tightly to the anchor currency of the EMS, the DEM. Since then the BEF has been managed inside an implicit band of ± 0.5 % around its central parity against the DEM.

This policy change can be clearly seen in Figure 5.2a. From 1987 up to the end of 1989, the Belgian interest rate lay above the interest rate corridor. This seem to imply that, prior to 1990, there were expectations that the BEF might be devalued vis-à-vis the DEM. Since the beginning of 1990, such expectations seem to have disappeared. Signalling from a consequent domestic monetary policy clearly targeted at exchange rate stability, the domestic interest rate moved inside the credibility band and finally, at the beginning of 1991, converged with the German interest rate.

If we look at the position of the German interest rate within the credibility corridor, we see that it has shifted from the upper part of the band to the middle. This indicates that the exchange rate appreciated and then settled close to the central parity. This combination of a decreasing domestic interest rate and an appreciating currency can be interpreted as supporting the view that the credibility of the Belgian exchange rate policy has successfully increased in the period under study.

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Figure 5.2a   **The credibility band for the BEF/DEM**
                     exchange rate, indicated by 12M interest rates,
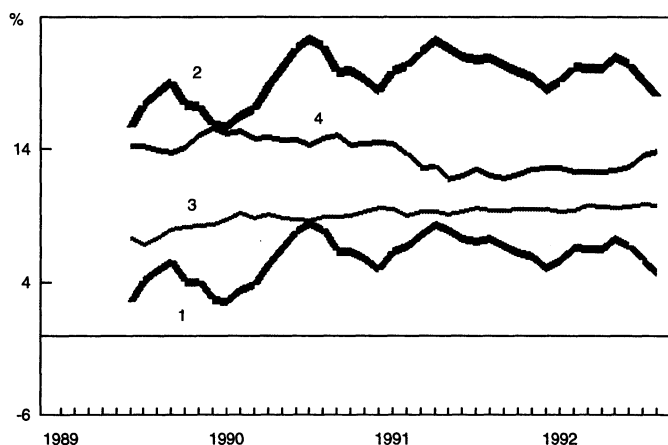   **for the period January 1987 to August 1992**
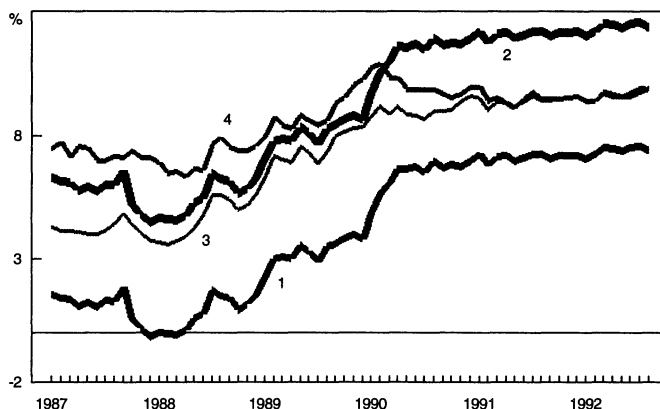
1 = lower limit for credibility
2 = upper limit for credibility
3 = German interest rate
4 = Belgian interest rate

5.2.2 Denmark

The interest rate corridor is presented in Figure 5.2b. The Danish interest rate follows the Belgian pattern. The Danish interest rate is, however, further above the upper edge of the credibility band. In Denmark the policy shift also occurred around 1990. This change was preceded by a period when the DKK was weak vis-à-vis the DEM, and at the same time, changes in German interest rates were strictly followed by domestic interest rates. This is most evident during the period between early 1989 and the very beginning of 1990, as can be seen from Figure 5.2a: the upper limit of the interest rate band is only slightly above the German interest rate, and the domestic interest rate shows the same pattern as the German interest rate. During 1990 the DKK achieved strong credibility: the domestic interest rate fell and simultaneously, the exchange rate appreciated. During 1991, however, the currency started to weaken again. Domestic interest rates were not raised and the exchange rate was allowed to depreciate. Towards the end of 1991 the domestic interest rate approached the upper limit of the credibility band. During the summer of 1992, the currency gains apparent strength, reflecting a widening gap between the domestic and the German interest rate.

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The very simple test of credibility for the DKK/DEM exchange rate indicates that at the end of the 1980s convergence was sufficient to allow exchange rate stability and falling domestic interest rates. Even though Danish monetary and economic policy gained credibility thanks to determined conduct, the credibility of the exchange rate regime was evidently affected by the uncertainty on the outcome of the Danish referendum on the Maastricht Treaty. In May 1991 the Danes voted against the Maastricht Treaty. Non-participation in the EMU cast doubts on the willingness of the Danes to continue their strict domestic economic policies. The result of the referendum is reflected in the weakness of the DKK during the summer of 1991. At the end of 1991, the DKK was also affected by the French referendum on the Maastricht Treaty. The French yes, probably relieved the pressure on the DKK.

Figure 5.2b   **The credibility band for the DKK/DEM exchange rate, indicated by 12M interest rates, for the period January 1987 to August 1992**
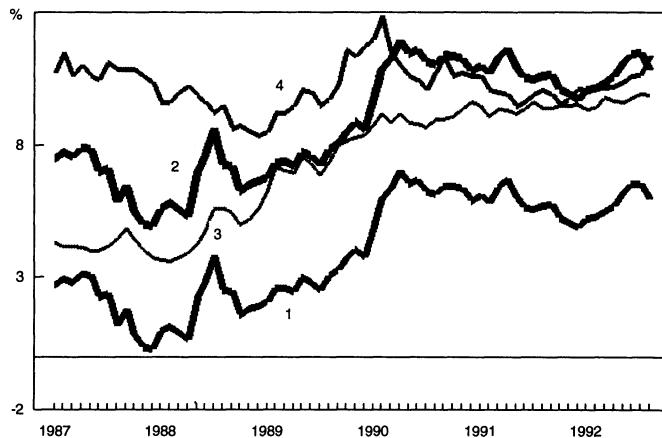
1 = lower limit for credibility
2 = upper limit for credibility
3 = German interest rate
4 = Danish interest rate

5.2.3 Spain

As shown in Figure 5.2c, the Spanish interest rate remains inside the credibility band throughout the period. This is not particularly surprising, given that the fluctuation margins for the ESP were ± 6 %. This gives a credibility band of 12 %; the interest rate differential between Spain and Germany has been around 7 % at its highest during the period under study. In addition, Spanish exchange rate policy was designed so that the exchange rate was always kept below the central parity, i.e. instead of the official central rate, an effective target rate was used. These factors should explain the ostensibly credible behaviour of the Spanish interest rate. They also explain why the German interest rate is located in the lower part of the credibility band.

Figure 5.2c   **The Spanish interest rate credibility band, indicated by 12M Euromarket interest rates for the period June 1989 to August 1992**

1 = lower limit for credibility
2 = upper limit for credibility
3 = German interest rate
4 = Spanish interest rate

5.2.4 France

As was stated above, in the early years of the EMS, France preferred a looser monetary policy (and consequent devaluations of the domestic currency) to a strictly fixed exchange rate. The credibility of the French exchange rate commitment was, therefore, still rather low in the late 1980s. As Figure 5.2d shows, the domestic interest rate lay clearly above the credibility band until the beginning of 1990. During that period we see a pattern similar to the Belgian case. The German interest rate is often at the upper edge of the interest rate credibility band, indicating that the FRF was rather weak vis-à-vis the DEM. During 1990, however, the FRF seems to appreciate as French interest rates enter the credibility band and approach the German interest rates. This pattern of increased credibility is very similar to the Danish and Belgian experiences. In addition, the credibility of the FRF/DEM exchange rate was affected by the Danish referendum. The result of the Danish referendum affected expectations about the result of the French referendum. Moreover, because of the negative outcome of the Danish referendum, the importance of the result of the French referendum became even more pronounced. The uncertainty can be seen in the behaviour of the credibility band: during the summer of 1991, the FRF weakened vis-à-vis the DEM, despite the fact that economic fundamentals were developing very favourably. In 1992, the FRF gained in strength again, but the authorities had to raise domestic interest rates above German interest rates again. Overall, however, the very simple test indicates that the credibility of the FRF/DEM exchange rate also increased at the end of the 1980s. The authorities also seem to have succeeded in maintaining the credibility after 1990 and up to the crisis of 1992.

Figure 5.2d   **The credibility band for the FRF/DEM**
                     exchange rate, indicated by 12M Euromarket
   **interest rates, for the period January 1987 to**
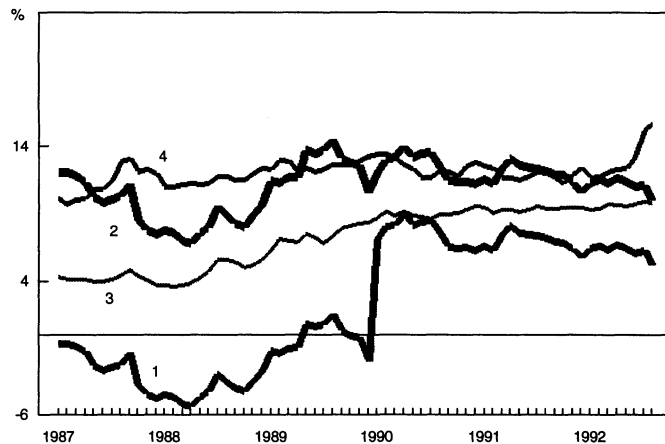   **August 1992**

1 = lower limit for credibility
2 = upper limit for credibility
3 = German interest rate
4 = French interest rate
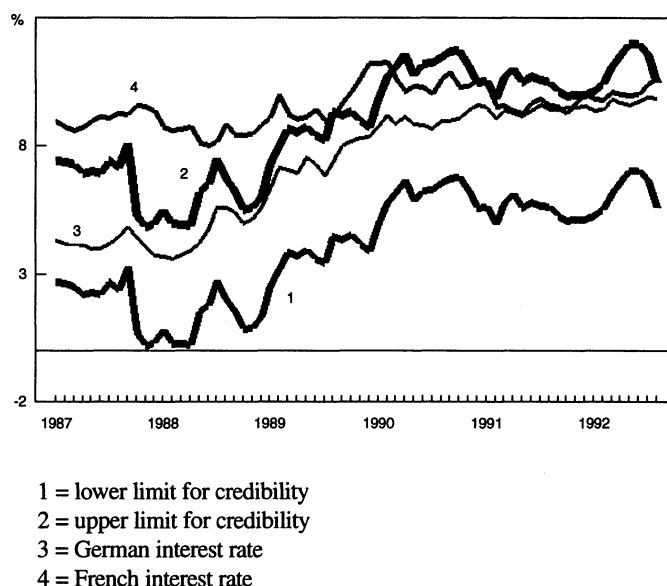
5.2.5 Great Britain

The GBP entered the ERM first in October 1990, with fluctuation
margins of ± 6 % around bilateral central rates. This, again, yields the
very wide credibility band of 12 %. The GBP was given a central parity
of DEM 2.95 per GBP, which was said to be much too high for the
staggering British economy. After Britain joined the ERM, however, the
GBP moved most of the time comfortably in the ± 6 % band around its
central rate. After a temporary appreciation, the GBP stayed for more
than one year in an implicit narrower band in the neighbourhood of
± 2.25 % around central parity. Pressure on the GBP was usually short-
lived and quickly reversed by either a slight increase in domestic interest
rates or modest interventions on the foreign exchange market. As a result
of the stability of the exchange rate, the British interest rate fell gradually
after joining. In the spring of 1992, it almost reached the German level.
On the whole, interest rates – as well as the inflation rate – decreased
substantially during the period Britain participated in the ERM. Initially,
the interest rate gap against Germany was around 4 %; by in the summer
of 1992, the differential had narrowed to less than 1 %.

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Figure 5.2e   **The credibility band for the GBP/DEM
                   exchange rate indicated by 12M Euromarket
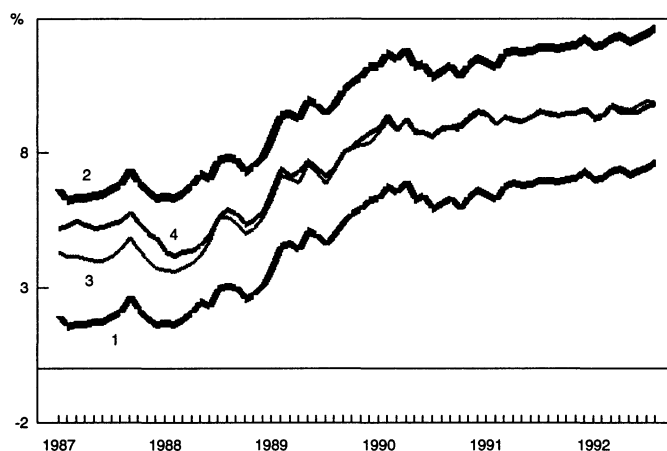   interest rates, for the period October 1990 to
                   August 1992**

1 = lower limit for credibility
2 = upper limit for credibility
3 = German interest rate
4 = British interest rate
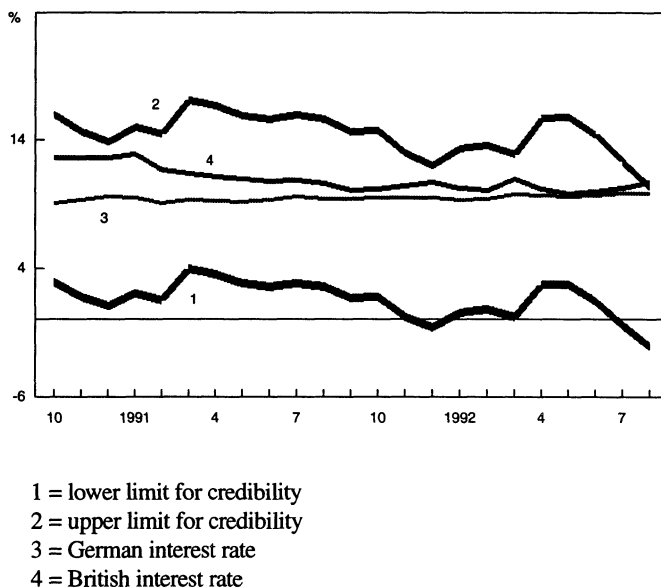
5.2.6 Italy

Figure 5.2f displays the credibility band for the Italian interest rate. Until January 1990 the fluctuation margins for the ITL/DEM exchange rate were ± 6 % around the central parity. Therefore ,the credibility band for the Italian interest rate between 1987 and 1990 is the wide 12 % band. In January 1990, however, the fluctuation band of the ITL was narrowed from ± 6 % to ± 2.25 % and in that context, the ITL was devalued[56]. This change also affects the credibility band for the interest rate. Not only does the corridor become narrower in that context, but it also shifts upwards relative to the German interest rate because of the jump of the ITL within the fluctuation margin. After that the ITL depreciates steadily, which can be seen in the movement of the German interest rate within the corridor from the lower level to the upper level.

Throughout the period studied, the credibility of the ITL/DEM exchange rate is weak. At the beginning of the period, as the credibility corridor is very wide with the Italian interest rate still outside the band. It

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[56] The central rate was not changed, but the position of the ITL was set at the lower limit of the new, narrow exchange rate band.

moves inside the band towards 1990, moving close to the limit and from time to time straying outside the corridor. From the autumn of 1991 the Italian interest rate did not stay inside the credibility band any longer, and the final conclusion was a considerable increase in the interest rate in the summer of 1992. This result from the very simple test indicates that the ITL/DEM exchange rate was the only exchange rate expected to be devalued prior to the crisis of September 1992.

Figure 5.2f　　　**The Italian interest rate credibility band, as indicated by the 12M Euromarket interest rates for the period January 1987 to August 1992**

1 = lower limit for credibility
2 = upper limit for credibility
3 = German interest rate
4 = Italian interest rate

5.2.7　The Netherlands

The credibility band for the Dutch interest rate is illustrated in Figure 5.2g. The Dutch currency has been fixed directly to the DEM since the 1970s. The Netherlands have predominantly resorted to policies targeting the interest rate. This view assumes that domestic monetary policy is primarily oriented towards keeping fixed exchange rates with a foreign country in a system of adjustable exchange rate target bands, so here foreign interest rate movements combined with projections of potential exchange rate movements within the band can be translated into a target corridor for the nominal interest rate. Since the Netherlands have been

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conducting such a policy successfully for a long time, it is not surprising to observe that the Dutch interest rate has remained inside the credibility band throughout the period under study. Moreover, the German interest rate is in the middle of the credibility band throughout the entire period. This indicates that the NLG/DEM exchange rate has been very close to the central parity throughout the period.[57]

Figure 5.2g   **The credibility band for the NLG/DEM exchange rate, indicated by 12M interest rates, period for the period from January 1987 to August 1992**

1 = lower limit for credibility
2 = upper limit for credibility
3 = German interest rate
4 = Dutch interest rate

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[57] This is accord with the results obtained in Weber (1991). He states that the smaller EMS countries appear to have adopted more credible interest targeting policies that the larger EMS countries. This indicates the attempt of small EMS countries to gear their monetary policies more toward pegging the exchange rate through interest rate targeting policies, whilst the larger EMS countries have had a stronger tendency towards more independent policies.

5.3 Preliminary conclusions

From the above graphs we can make several observations. First, the seven currencies analyzed here seem to reach full credibility in early 1990. GMU in the summer of 1990 did not, according to these preliminary results, affect the stability of the EMS exchange rates. What is surprising, however, is that there seems to be no anticipation of the currency crisis of 1992 by the markets. This contradicts what we know happening given the development on the foreign exchange market during that spring and summer.

Thus, an obvious criticism of this very simple model is that the credibility bands for the interest rates are interpreted under the hypothesis of uncovered interest rate parity and a negligible (or constant) foreign exchange premium. Although the risk premiums within the ERM have become very small, the assumption of a zero risk premium is dangerous. It is difficult to identify the risk premium component in the interest rate differential so the reliability of empirical tests must be questioned.

If, however, we assume the risk premiums within the EMS are indeed negligible, then there must be another explanation for this method of measurement showing increasing credibility – even when a severe crisis follows. One possible explanation has been given by Svensson (1991a), ie that the exchange rate may be expected to move *within the band*. Such a movement is, of course, completely consistent with the assumption of full credibility of the fluctuation margins. An expected movement of the exchange rate within the band does, however, affect the expected yield on an investment and is, consequently, included in the interest rate differential. Following this idea, a slightly more developed approach to nominal interest rate differentials and credibility corridors will be discussed in Chapter 6.

6 Testing the credibility of exchange rate bands

In this chapter, we want to expand the method of measuring the credibility of the EMS exchange rates. The graphic results of the very simple analysis in the previous chapter indicate that the credibility of the exchange rates would have improved towards the end of the period from 1987 to 1992. From the events of autumn 1992 we know this didn't happen. The following modified method will show that the interest rate differential does not yield an expected future spot exchange rate, but rather the sum of two factors: the expected future spot exchange rate if the exchange rate band is credible, and the product of the probability that it is not credible but that the exchange rate will be devalued and the expected size of the devaluation. It can be assumed that the former depends more on short- or medium-term asset market considerations than economic fundamentals. If the exchange rate is assumed to stay within the band, the future spot exchange rate is expected to move according to its position within the band and central bank interventions. Long-term economic fundamentals, on the contrary, are more crucial for expectations of a devaluation and its size. Within the framework of this study, this means that GMU might have affected one or both factors determining the interest rate differential. It may be argued that GMU could have had long-term effects on the credibility of the EMS through affecting macroeconomic fundamentals in the participating countries. Their development would be mirrored as devaluation expectations.

6.1 Survey of literature

Most target zone literature is quite recent. The approach considers fluctuation bands as valuable source of information. Because this information is known to the participants in foreign exchange markets and it affects their behaviour the very presence of the band affects the expectations about future exchange rates. It is also known that central banks intervene to manipulate exchange rates. Because of the interventions the expected exchange rate follows a different path, depending on its position in the target zone. Moreover, the effect is larger for tight bands than for wide bands. Therefore, it is important to take the

band restrictions into account, especially if the band restriction is likely to be binding.

The idea of analyzing the importance of the existence of a target for the exchange rate was introduced by Krugman (1991), who found that in a target zone, the exchange rate behaves in a very special way because of the band. Given that an announced target zone is credible, the exchange rate should follow an S-shaped path within the band. Flood & Garber (1989) introduced interventions in their analysis of exchange rate behaviour within a target zone. Their analysis allows both a discrete intervention and the possibility that intervention may be triggered randomly. The exchange rate is defined as an integral of macroeconomic fundamentals derived from a monetary model. The forcing variable, which is described as a linear combination of macroeconomic fundamentals, follows a random walk with a drift that is independent of the exchange rate. The main conclusion of the analysis is that within such a framework, the exchange rate is a non-linear function of the forcing variable. In other words, the analysis is focused on the behaviour of the exchange rate at the limits of the announced fluctuation band.

The underlying assumptions of the elegant pioneer work do not, however, reflect reality. Empirical work shows in turn that, first, target zones are not always credible and, second, central banks also intervene intramarginally.

These problems, as well as their implications have been analyzed and discussed by Svensson (1991a,b,c), whose empirical work revealed that exchange rates in target zones do not follow an S-shaped path. The analysis shows that in a target zone model, there are two main properties of expected future exchange rates: smooth pasting and mean reversion. It is pointed out that any type of intervention, including intramarginal interventions, gives rise to mean reversion.[58]

Svensson (1991c) also develops a model where interventions on foreign exchange markets are made to prevent the fundamental from moving outside a specific band. Inside the band there are no interventions. Under these assumptions, the exchange rate behaves as an S-shaped curve within the band. The density function of the fundamental is exponential or uniform, which implies that, given a target zone, the

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[58] Similar results were obtained by Miller & Weller (1991), who analyze the behaviour of the exchange rate in a target zone at the limits of the band. Their study shows that when a nominal currency band is given, the exchange rate can spend finite periods of time at the top or bottom of the band. The model also allows for discrete realignments of the band, defined so that whenever the exchange rate hits the top or bottom of the band, the band will be shifted upwards or downwards by an amount equal to half the total width of the band. This extension of the model shows that there is no smooth-pasting in the transition because of the locally irreversible nature of the regime shift.

exchange rate has an asymptotic density function. The distribution of the exchange rate is bimodal, with more mass towards the edges of the band. In other words, the exchange rate will have greater probability mass near the edges of the band.

The model is finally extended to include the possibility of devaluation. Devaluations are assumed to reoccur with some given constant probability, regardless of where in the band the exchange rate lies. The fundamental can move either to the edge of the new band, or to somewhere inside the new band. The devaluation is, however, the same jump in both the fundamental and its lower and upper bounds. The aim of the paper is to analyze the effect of such a devaluation risk on the interest rate differential. The result is that the constant expected rate of devaluation is added to the interest rate differential.

A recent finding in the target zone literature is that the interest rate differential, as such, as a measure of expected realignment, is imprecise. In their pioneer work on devaluation risk in a target zone, Bertola & Svensson (1990) and Svensson (1990, 1991), found mean reversion in the exchange rate within the band and showed that the expected rate of devaluation is very close to the interest rate differential adjusted for the expected depreciation within the band. This result is derived below following the presentation in Svensson (1991a).

6.2   Modelling devaluation expectations

A problem with measuring credibility, or devaluation expectations, with the interest rate differential as was done in section 5.2, is that the interest rate differential is affected by both the possibility of a realignment and the possibility of exchange rate movements within the bilateral ERM bands. Hence, it is necessary to adjust the interest rate differentials to obtain reliable measures of devaluation expectations.

When the uncovered exchange rate parity from (5.1) is revised for two identical investment alternatives the following equality holds

$$(r - r^*)_t = E_t \frac{(\Delta s_{t+j} | I_t)}{j} \tag{6.1}$$

where the interest rate differential, $(r - r^*)_t$, equals the expected (average) rate of depreciation of the domestic currency, $E_t(\Delta s_{t+j})$, during the time interval j corresponding to the maturity and conditional upon a given information set at time t, I_t. The expected rate of depreciation, $E_t(\Delta s_{t+j})$, can then be decomposed into two parts: expected depreciation within the

band, and expected rate of devaluation, (ie change in the central rate). Hence, we can write:

$$(r - r^*) = (\Delta s^e + \rho) + \delta \qquad (6.2)$$

where $(\Delta s^e + \rho)$ is the expected depreciation within the band, ρ is the exchange rate risk premium and δ is the expected rate of devaluation. If the exchange rate band was completely credible, δ would equal zero, and the interest rate differential be a maximum 2.25 % per respective period. In that case, the method of studying the interest rate credibility bands could be applied without further adjustments.

Equation (6.2) also shows that in order to trace devaluation expectations, the interest rate differential has to be adjusted for the expected exchange rate movement within the band, $\Delta s^e + \rho$ so that:

$$\delta = (r - r^*) - (\Delta s^e + \rho) \qquad (6.3)$$

The difficulty is, of course, finding a value for the sum $\Delta s^e + \rho$. The exchange rate risk premium, ρ, has been shown by Svensson (1991b) to be negligible. In the analysis, the risk premium is defined as proportional to the instantaneous variance of the exchange rate. These properties imply that the risk premium is bounded by the instantaneous standard deviation of the exchange rate. This means that for small bands, when the exchange rate's responsiveness is insignificant, the risk premium does not have any substantial effect on the exchange rate function. This applies also for large bands. Hence, we are left with the problem of calculating S^e. In this study, the method suggested by Lindberg, Svensson & Söderlind (1991) and Rose & Svensson (1991) will be used, because their combined results indicate that a simple linear regression of realized rates of depreciation within the band on the current exchange rate consistently generates sensible results[59]. Thus, using simple linear regression in our case expected rate of depreciation may be estimated by the linear regression model

$$\Delta s_t^e = \alpha + \beta s_{t-j} + \varepsilon_t \qquad (6.4)$$

from which the expectation Δs_t^e is the fitted value

[59] Flood et al. (1990) also report that the presence of additional non-linear terms does not produce better "ex-post" forecasts than those of linear models.

$$\Delta s_t^e = \hat{\alpha} + \hat{\beta} s_{t-j} \tag{6.5}$$

Equation (6.4), however, leaves us then with the problem of interpreting α. If α has a significant positive (negative) value, it means that the exchange rate equilibrium differs from the central rate. In other words, the spot exchange rate tends to converge at a level above (below) the central parity. A significant value for the constant would, thus, contradict the theoretical assumption that in the long run the exchange rate always converges towards the central rate – given that the announced target zone is completely credible. Hence, if we argue that it is meaningful to establish a fixed exchange rate arrangement only if the parities can be expected to hold in the long run, then we should run the regression with equation (6.4) leaving α out altogether.

In other studies the constant is included in the regression but is not the subject of special discussion. In Svensson (1991a), a regression is run for the period from 1987 to 1990. The slope is kept constant throughout the period, whereas the constant is allowed to vary between realignments. It is then interpreted as measuring the degree of mean reversion in various regimes. Rose & Svensson (1991) also use a dummy constant to characterize different regimes. As the period of the current study, however, constitutes a single homogenous non-realignment period, it is not necessary to distinguish between various regimes. Hence, dropping α we obtain a measure of the expected rate of depreciation within the band conditional upon the expectation that, at the central rate, the exchange rate will not move within the band. Such a phenomenon would imply full credibility of the target zone. Since this can be seen theoretically as a meaningful assumption, equation (6.4) is also estimated so that the constant is dropped.[60]

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[60] An attempt was also made to capture speculative pressures in the expected rate of depreciation within the band. Regressions of equation (6.4) were modified so that the level of foreign exchange reserves was included. Low foreign exchange reserves may cause doubts about the ability of the central bank to defend the exchange rate parity, provoking speculative attacks. Also the interest rate differential was included as an explanatory variable in order to capture the existence of speculative pressures. The probability of a regime change is expected to rise with an increase in the interest rate differential. As reported by Ötker & Pazarbasloglu (1994), periods immediately prior to a regime collapse are usually characterized by the existence of high domestic interest rates and increased deviation of the spot exchange rate from its central parity. The results did not, however, yield any further information on the expected behaviour of the exchange rate within the band.

6.3 Empirical results

In order to test devaluation expectations within the EMS, we estimate equation (6.4) for a maturity of three months ie lag $j = 3$ in (6.4). Regressions are run separately for each of the seven DEM exchange rates: DEF, DKK, ESP, FRF, GBP, ITL and NLG. Since the evaluation is conditional upon no realignment, three observations before each realignment are excluded. The data is compiled as follows. The end-of-month spot exchange rates are taken from International Financial Statistics, while three-month interest rates are from Reuters. Bilateral exchange rates were obtained by calculating the cross rates over the ECU market rates. The period covers the five-year non-realignment period from January 1987 to September, 1992[61]. This is the longest contiguous interval in the EMS history without realignment. The results are presented in Table 6.1. In the case of the ITL/DEM exchange rate, we have also run a regression with a regime dummy. In October 1990 the band width was narrowed from ± 6 % to ± 2.25 %. To see whether this regime shift had any major effect on the credibility of the credibility of the ITL/DEM exchange rate we include dummy in one regression for this regime shift. Otherwise, columns 1 and 3 in Table 6.1 show the results for the regressions with a constant, and columns 2 and 4 display the results of the regressions without allowing for a constant. Plots of the resulting time series are presented in Figures 6.1a–g. Figures 6.2a–g present the results of the regressions without α. The scale is the same for all exchange rates and is constructed so that the bounds correspond to an annual expected depreciation within the band of 5 % more[62]. We see that the expected rates of depreciation within the band are sizeable, usually around one per cent annually, although occasionally they are as large as around four per cent annually. For this reason, adjusting the raw interest rate differential for the expected rate of depreciation within the band is justified.

As stated in Svensson (1991b), equation (6.4) highlights the mean-reversion in the data. The coefficient for the exchange rate within the band, α, is far less than 1. Furthermore, the Dickey-Fuller test rejected the unit root in all cases. These results, being in accordance with the results obtained by Svensson (1991b) and Chen & Giovannini (1992), imply that

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[61] The period for the ESP/DEM and GBP/DEM exchange rates is limited by the shorter participation of these currencies in the ERM. The ESP joined the ERM in June 1989 and the GBP joined in October 1990.

[62] For the ESP/DEM, GBP/DEM and ITL/DEM, the plot would have extended beyond the top edge of the graph. Therefore, the scale in panels c, d and e is extended.

the fluctuations of the exchange rate within the band are transitory mean revisory processes.

Figure 6.1a   **Belgium, expected rate of depreciation within the band**
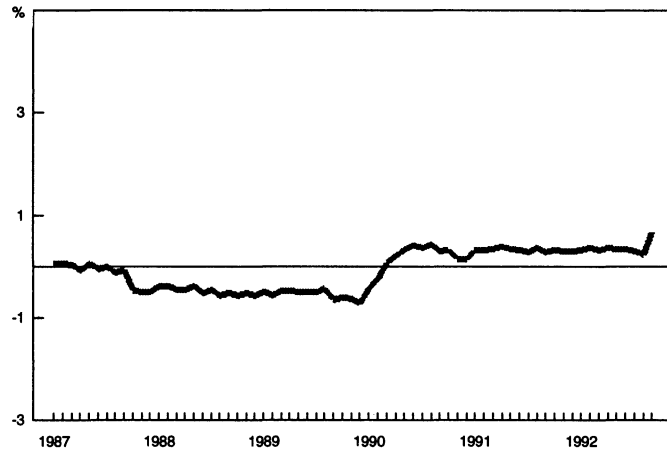

Figure 6.1b   **Denmark, expected rate of depreciation within the band**
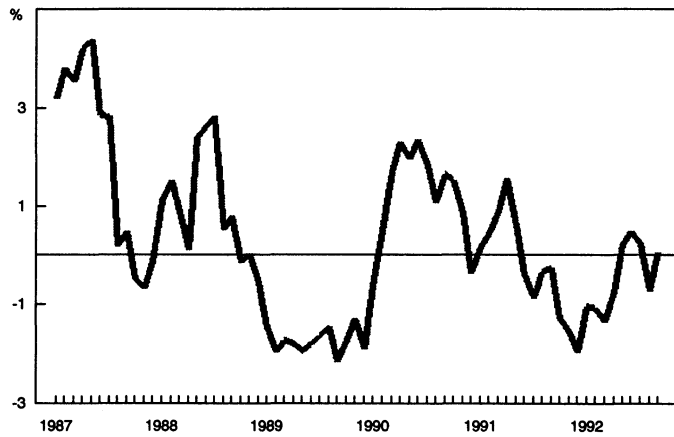
Figure 6.1c   **France, expected rate of depreciation within the band**
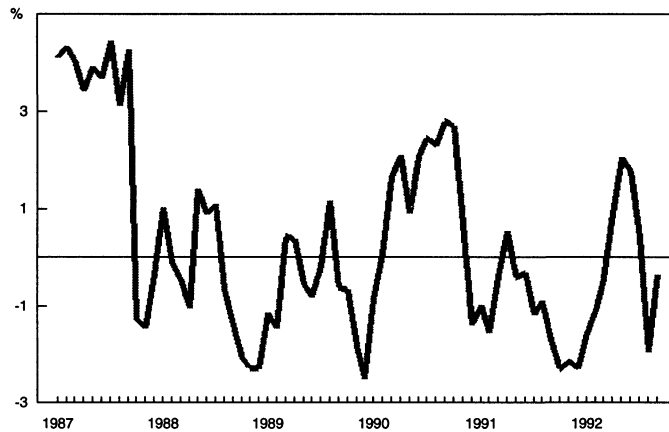

Figure 6.1d   **Great Britain, expected rate of depreciation within the band**
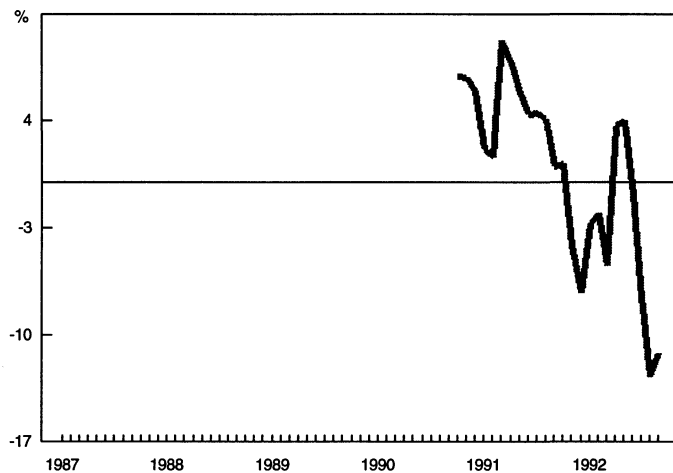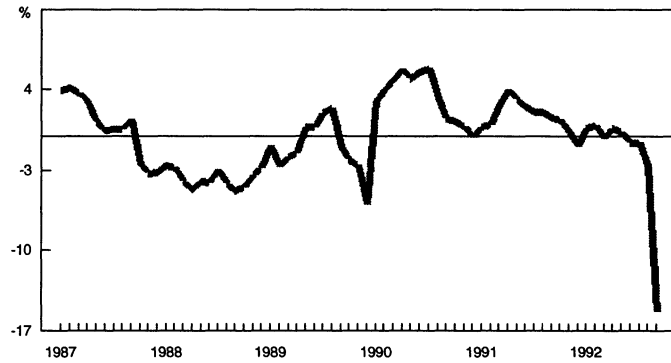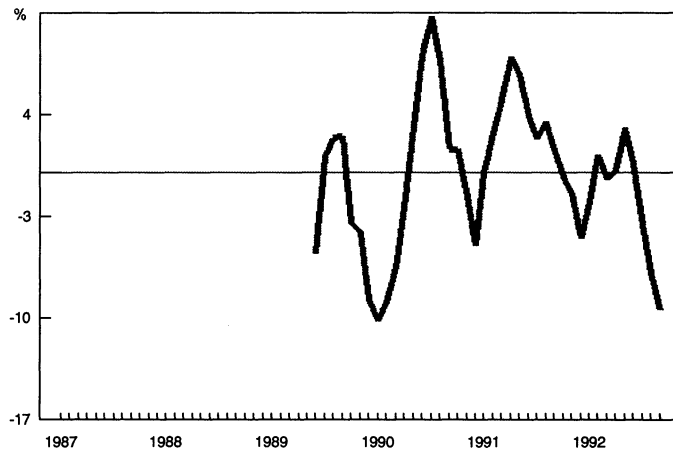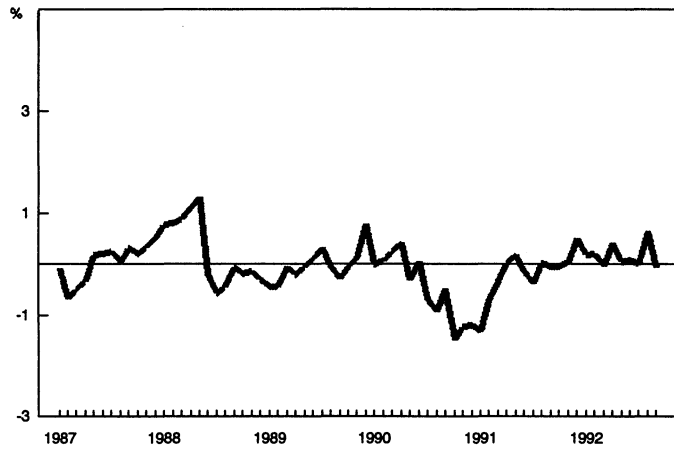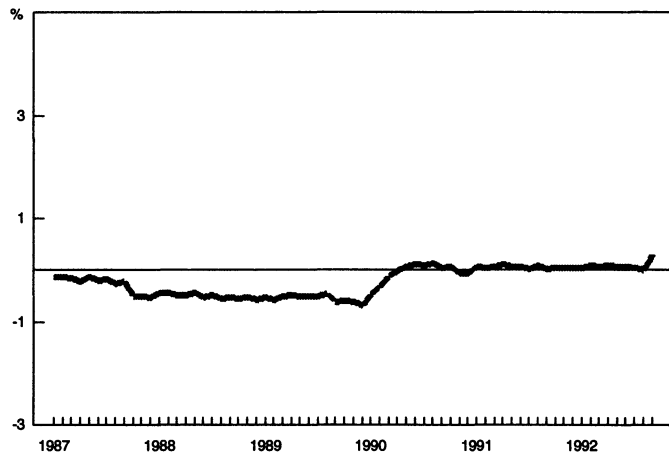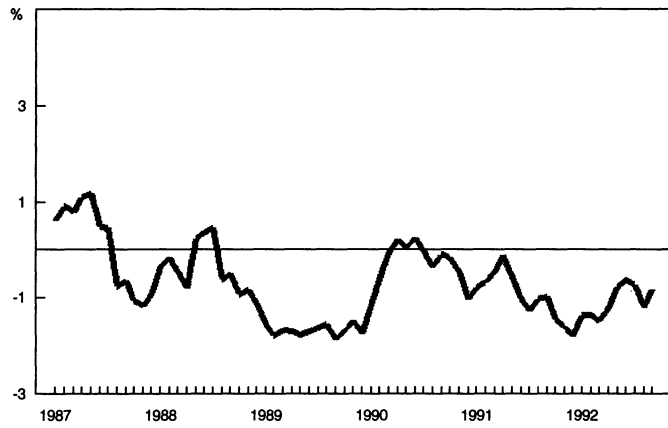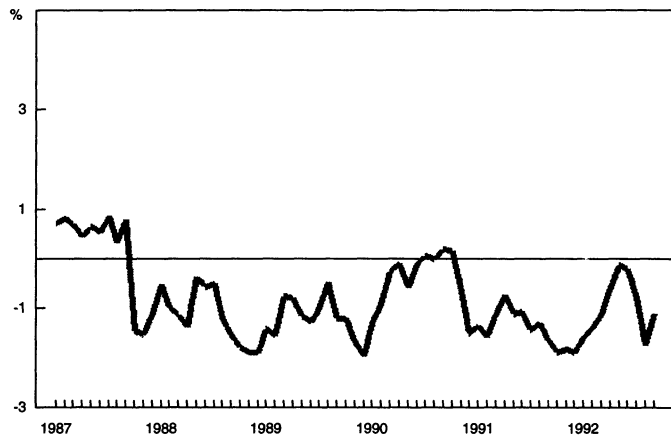
Figure 6.1e   **Italy, expected rate of depreciation**
                     within the band

Figure 6.1f   **Spain, expected rate of depreciation**
                     within the band

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Figure 6.1g   **The Netherlands, expected rate of depreciation
                   within the band**

Figure 6.2a   **Belgium, expected rate of depreciation
                   when the constant is not allowed**

Figure 6.2b   **Denmark, expected rate of depreciation**
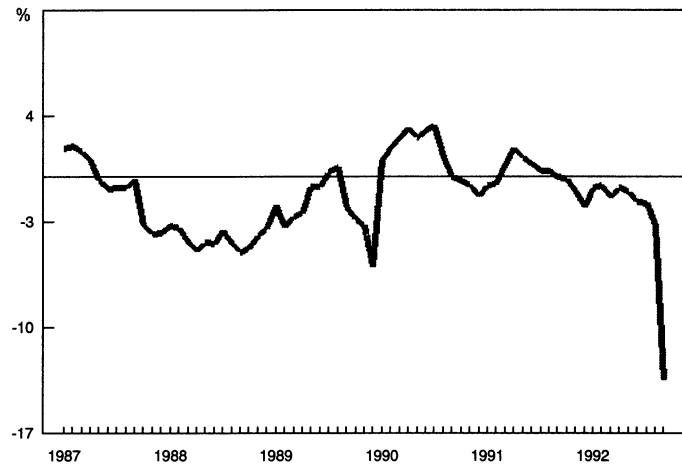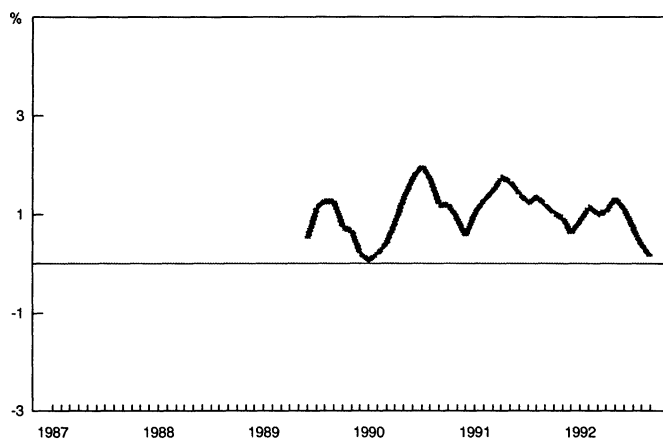   **when the constant is not allowed**

Figure 6.2c   **France, expected rate of depreciation**
                     when the constant is not allowed

Figure 6.2d   **Great Britain, expected rate of depreciation
                    when the constant is not allowed**
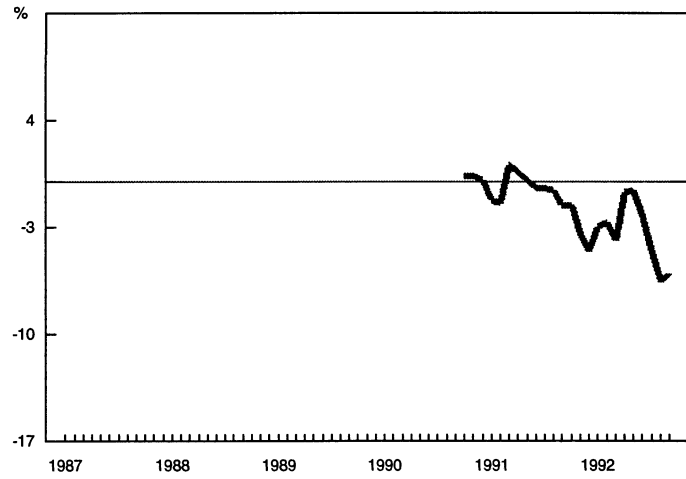
Figure 6.2e   **Italy, expected rate of depreciation
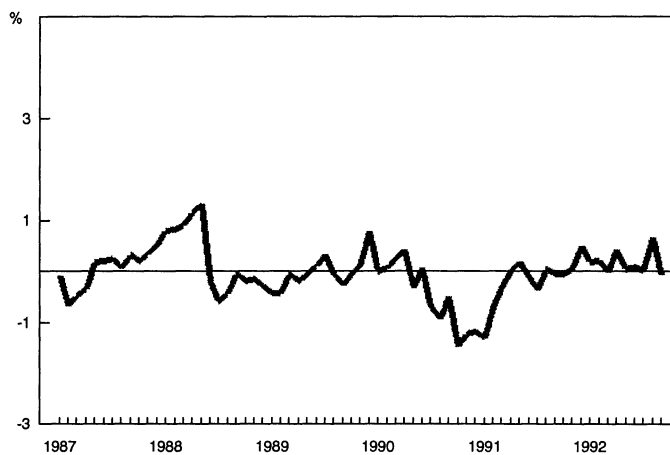   when the constant is not allowed**

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Figure 6.2f   **Spain, expected rate of depreciation**
                     when the constant is not allowed

Figure 6.2g   **The Netherlands, expected rate of depreciation**
                     when the constant is not allowed

Table 6.1

Table 6.1 Expected future exchange rate within the band. Estimation results of equation (6.4)

Exchange rate	1 α	1 β	2 β	3 α	3 β	3 D	4 β	4 D
BEF/DEM	.006 (.006)	−.12 (.08)	−.08 (.08)					
DKK/DEM	.005** (.002)	−.45** (.12)**	−.21** (.09)					
ESP/DEM	−.03** (.007)	−.93** (.18)	−.16* (.08)					
FRF/DEM	.006** (.002)	−.62** (.15)	−.26** (.08)					
GBP/DEM	−.014* (.001)	−.87** (.23)	−.31* (.18)					
ITL/DEM	.004** (.002)	−.49** (.14)	−.38** (.14)	0.004* (.002)	−.41 (.23)	−.08 (.30)	−.52** (.21)	.17 (.28)
NLG/DEM	−.00001 (.0003)	−.58** (.20)	−.58** (.19)					

1: with constant
2: without constant
3: with constant, with dummy
4: without constant, with dummy

* significant at 5 % level
** significant at 1 % level

The standard errors in the parenthesis are heteroscedastic- and autocorrelation-consistent, computed by the Newey-West method. This method also allows for serial correlation, which is necessary since the data overlap.

When the expected rates of depreciation within the band are compared with the plots of the deviation of the current spot rate from the central parity (Figures 6.3a–g), a feature supportive of mean reversion and intra-marginal interventions can be observed. When the exchange rate is above its central parity, an appreciation is generally expected, and vice versa. The larger the deviation from the central parity, the larger the expectation of an opposite movement.

Figure 6.3a   **Belgium, deviation of the current spot rate from the central parity**
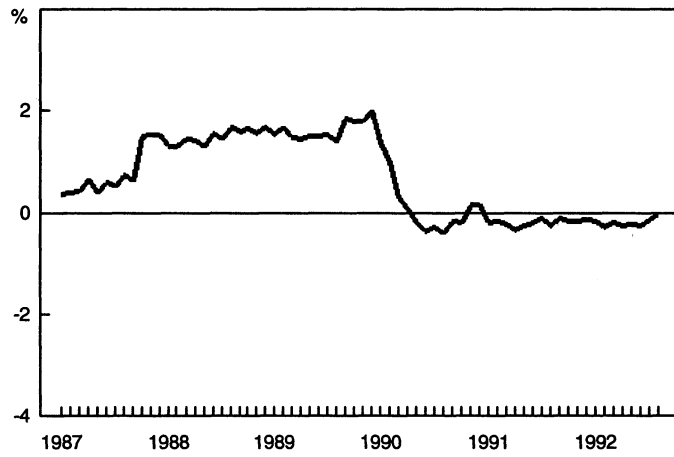

Figure 6.3b   **Denmark, deviation of the current spot rate from the central parity**
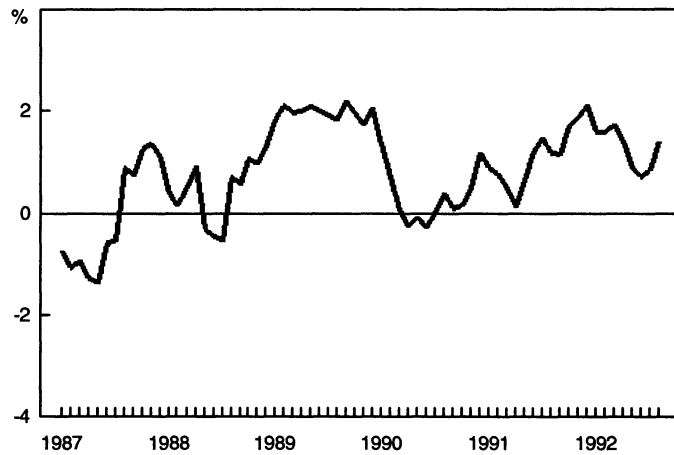
Figure 6.3c   **France, deviation of the current spot rate from the central parity**
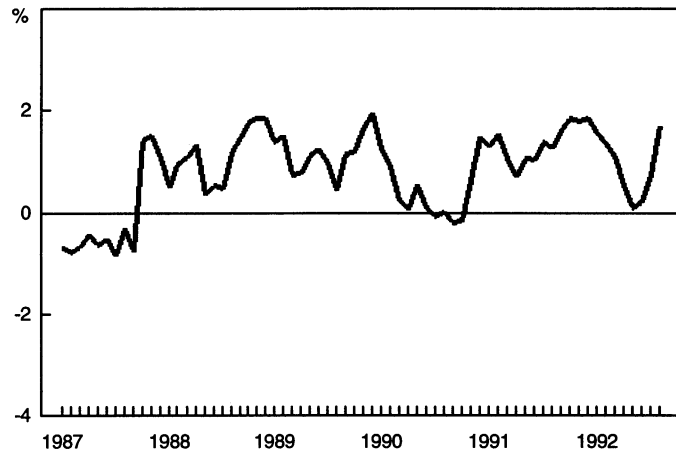

Figure 6.3d   **Great Britain, deviation of the current spot rate from the central parity**
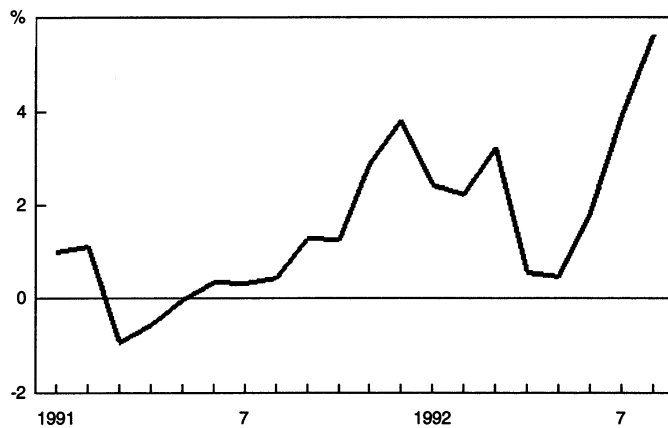
Figure 6.3e   **Italy, deviation of the current spot rate
                   from the central parity**

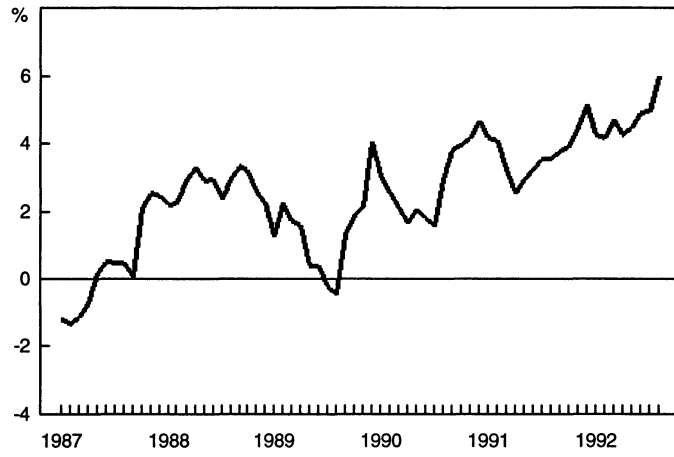Figure 6.3f   **Spain, deviation of the current spot rate
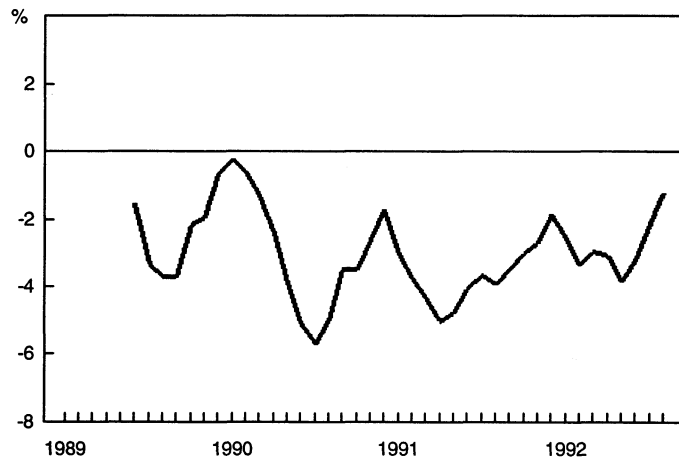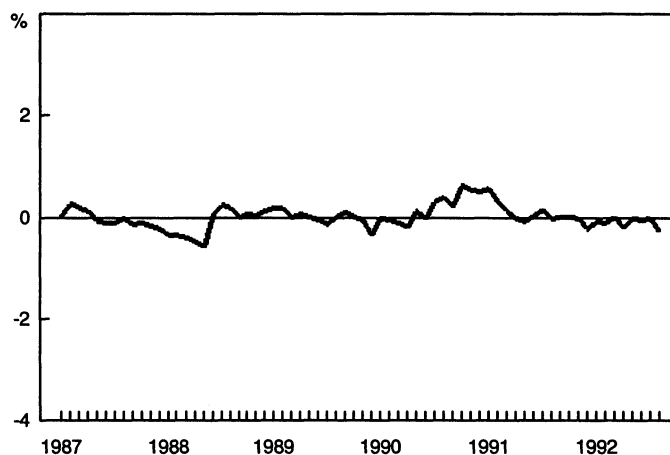   from the central parity**

Figure 6.3g   **The Netherlands, deviation of the current spot rate from the central parity**

6.4   Devaluation expectations measured by expected rates of devaluation

In order to estimate the expected rates of devaluation, interest rate differentials should be adjusted for the estimated expected rates of depreciation within the band as shown in equation (6.3) above. Hence, the results obtained from the estimation of the expected exchange rate change within the band are inserted in (6.3) to calculate the expected rate of devaluation, δ. Previous studies have shown that the exchange rate risk premium is minimal for ERM exchange rates, so we may assume an insignificant foreign exchange risk premium and, hence, set $\rho = 0$. Alternatively, if the underlying assumption of uncovered interest rate parity is rejected, what is measured is the sum of the expected rate of devaluation and the foreign exchange risk premium. The resulting time-series of estimated expected rates of devaluation are displayed in Figures 6.4a–g. Again, the scale is the same for all exchange rates and constructed so that the limits correspond to an annual expected devaluation rate of approximately 2 %.

Figure 6.4a   **Belgium, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is allowed**
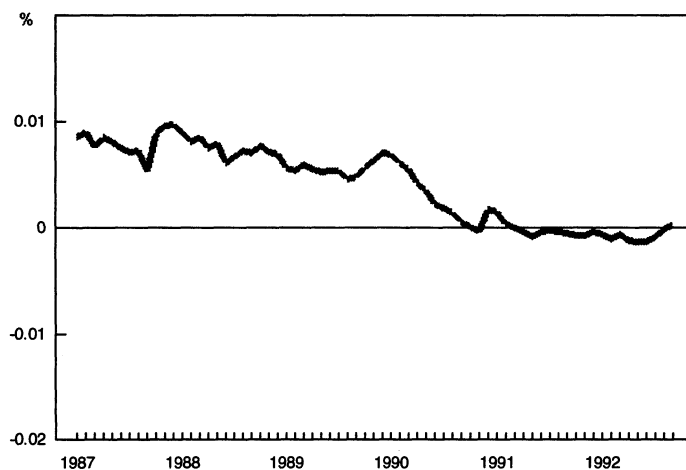

Figure 6.4b   **Denmark, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is allowed**

Figure 6.4c   **France, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is allowed**

Figure 6.4d   **Great Britain, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is allowed**

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Figure 6.4e   **Italy, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is allowed**

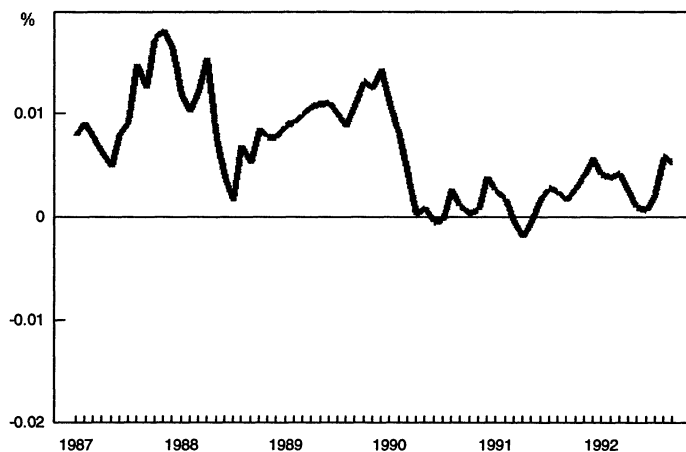Figure 6.4f   **Spain, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is allowed**

Figure 6.4g   **The Netherlands, estimated expected rate of**
                     devaluation calculated on basis of the expected
                     rate of depreciation within the band when the
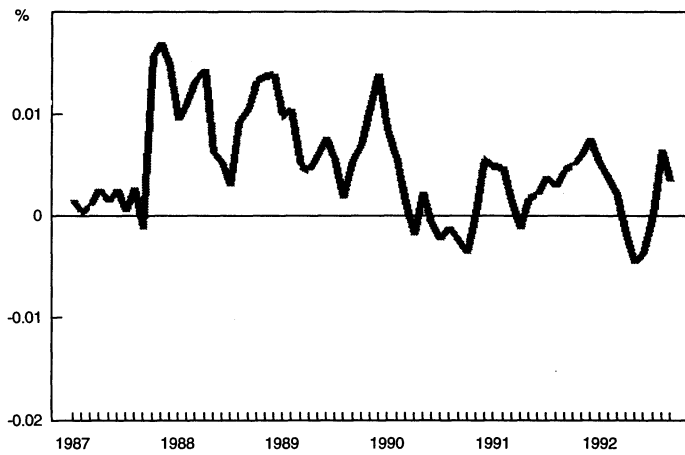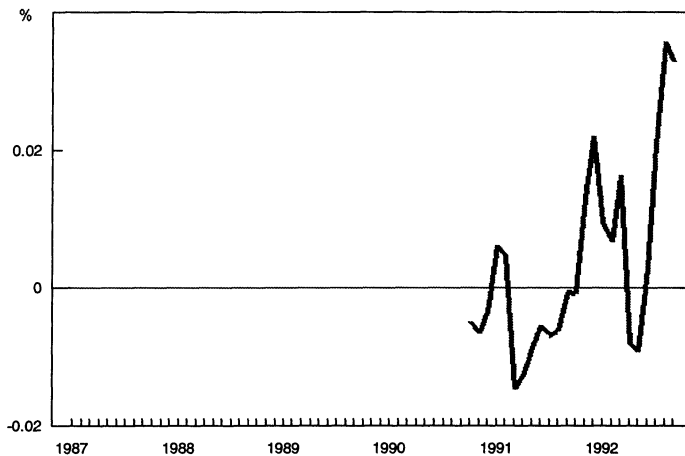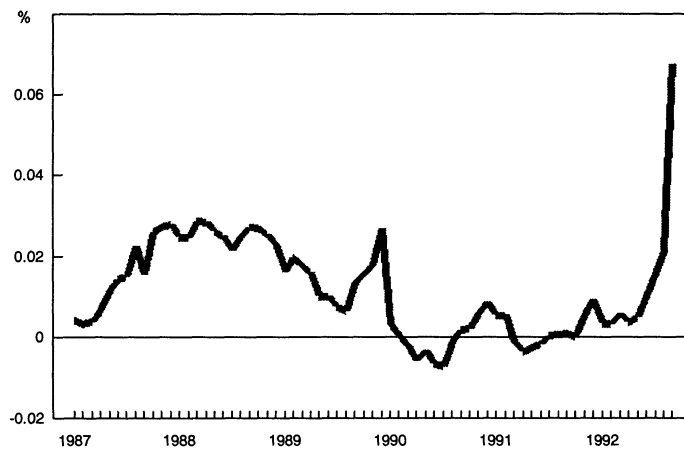   **constant is allowed**
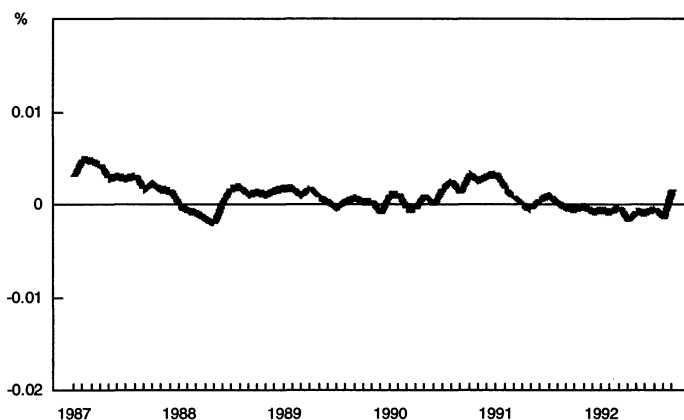
6.4.1 General overview

Figure 6.4 shows that the EMS exchange rates were not perfectly
credible in the period from 1987 to 1992. The positive values for
realignment expectations foreshadow a devaluation vis-à-vis the DEM. If
the expected rates of the devaluation are calculated using the fitted values
of the regression of equation (6.4), there are, allowing for the constant,
occasional signs of the expected rate of the devaluation of the DEM. The
results of these regressions are displayed in Figures 6.5a–g. Such
expectations, however, disappear if we do not allow for the constant.
Since expectations of a DEM devaluation seem to be unreasonable in
reality, this finding can be seen as supportive of the theoretical argument
that the model itself actually implies/assumes that there should not be any
continuous change in the exchange rate unless the spot rate diverges from
the central rate. Hence, the discussion that follows refers only to the
results that have been calculated on the basis of the fitted values for the
expected rates of depreciation within the band and *not* allowing for a
constant.

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Figure 6.5a   **Belgium, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is not allowed**
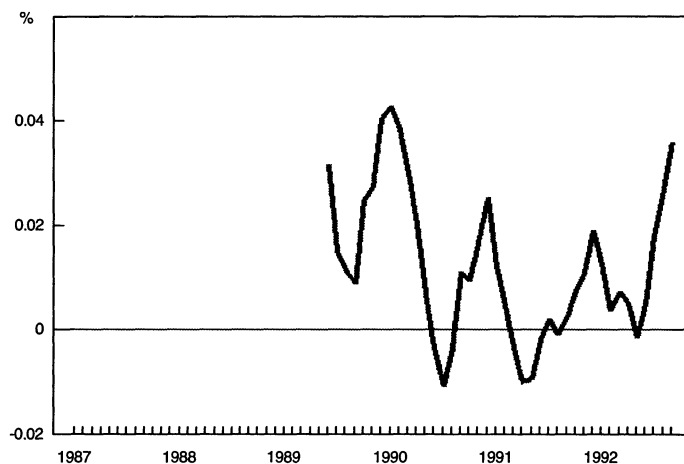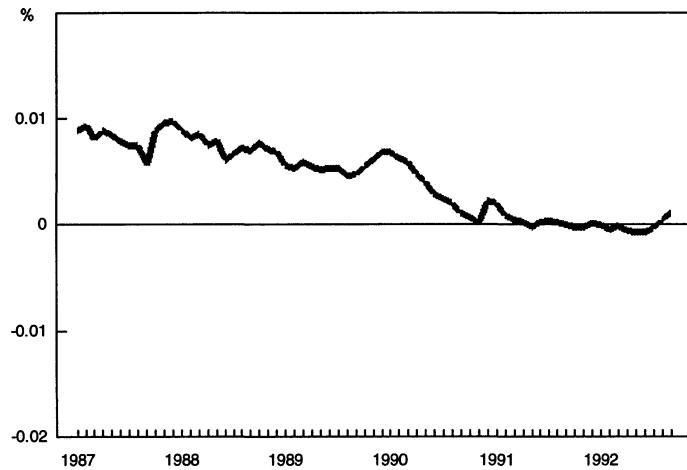

Figure 6.5b   **Denmark, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is not allowed**
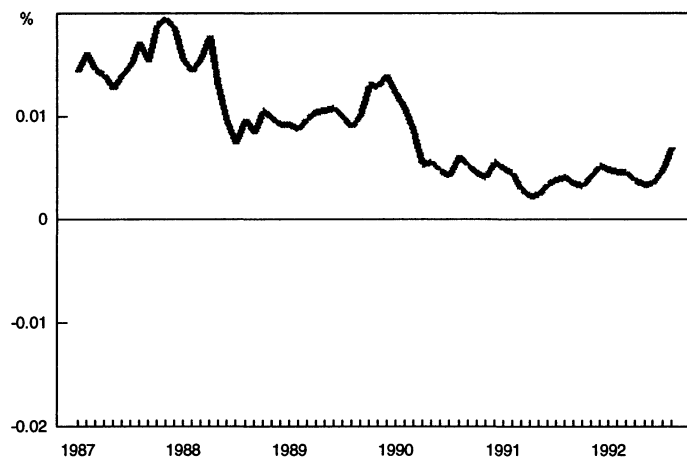
Figure 6.5c   **France, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is not allowed**
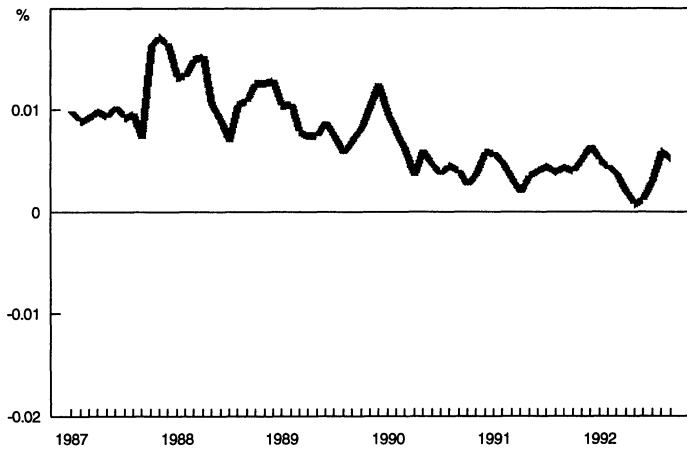
Figure 6.5d   **Great Britain, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is not allowed**

Figure 6.5e **Italy, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is not allowed**
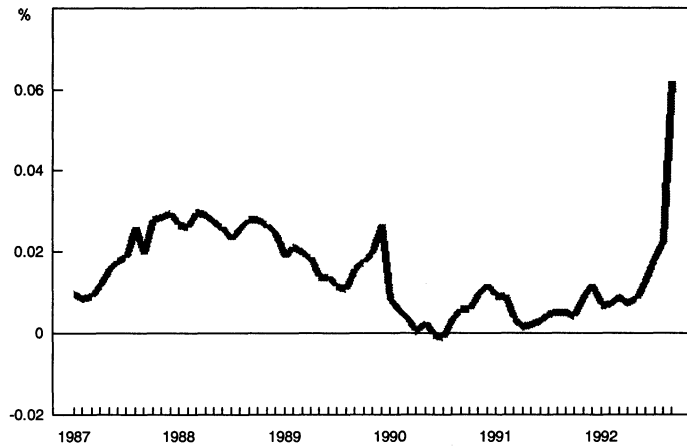
Figure 6.5f **Spain, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is not allowed**
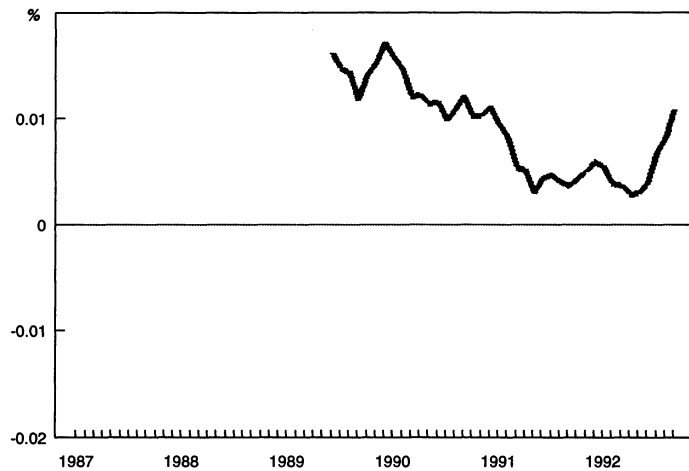
Figure 6.5g   **The Netherlands, estimated expected rate of devaluation calculated on basis of the expected rate of depreciation within the band when the constant is not allowed**

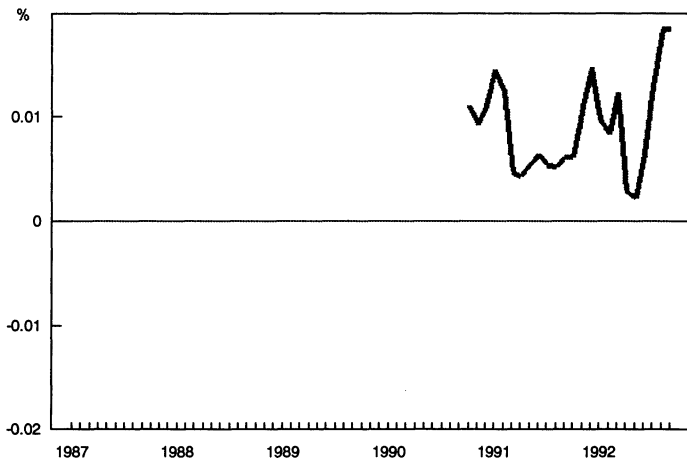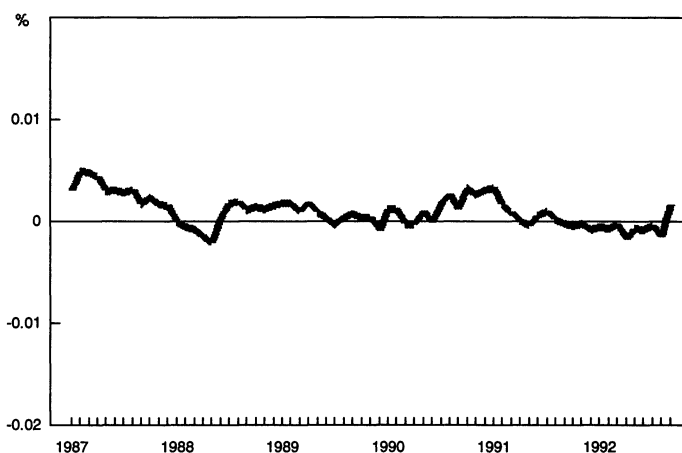
In general, currencies could be divided into three groups according to their degree of credibility. The BEF/DEM and NLG/DEM exchange rates have the smallest devaluation expectations, staying below 1 % at an annual basis throughout the period. In the case of the BEF/DEM exchange rate, the devaluation expectations also diminish throughout the period, and the effect of the regime change in 1990 can be clearly seen.

In the second group, we may place Denmark, France and Spain. DKK/DEM and FRF/DEM exchange rates improve in credibility throughout the period. The expected rate of devaluation decreases quite steadily from about 2 % annually to under 1 % on annually. In the case of the ESP, the ± 6 % width of the fluctuation band allowed a certain degree of flexibility in the exercise of the exchange rate policy. In fact, during most of the period studied, the monetary authorities managed to keep the ESP/DEM exchange rate within the lower half of the official fluctuation band. This exchange rate policy generated an effective – though not official – exchange rate regime which would have been somewhat credible, regardless of whether the official exchange rate regime was credible. Ayuso et al. (1993) note that because of this effective regime, the conventional reading of the target zone approach tends to provide a measure with a downward bias of the credibility of the exchange rate commitment. They suggest that the results of the traditional measure of the expected rate of devaluation should be applied as a measure of the effective fluctuation regime but not of the maintenance of the official central parity.

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The third group consists of Italy and Great Britain. These countries suffer from poor credibility throughout the period. Even though the expected rate of devaluation of the GBP/DEM exchange rate never exceeds an annual rate of 2 %, the great volatility can be interpreted as uncertainty about the rate of the GBP. In Italy's case, the expected rate of devaluation runs between two and three per cent annually. In mid-1990, the ITL/DEM exchange rate seems to reach full credibility. This can be explained, however, by the fact that in June 1990, the fluctuation band of the ITL was narrowed and, in that context, the ITL was effectively devalued. Since the change in the fluctuation band, the expected rate of devaluation of the ITL/DEM exchange rate has increased, indicating worse credibility than at the end of the 1980s. The fact that the credibility of the ITL/DEM exchange rate is clearly worse than that of the other exchange rates analyzed here might be affected by the applied method of measuring the expected rate of devaluation.[63] We know that the policy of the central bank of Italy is to make quite large intramarginal interventions and subsequently to raise interest rates to a significant degree. Such a policy yields a large interest rate differential relative to countries which do not use the interest rate tool to the same extent as the Italian authorities.

In general, the period seems to have been a period of increased convergence and diminishing devaluation expectations. In the first half of 1990, in fact, all exchange rates were closer to full credibility than at any time in EMS history[64]. Subsequently, the expected rates of devaluation seem to stabilize at a low and "acceptable" level. What is interesting here is that despite great expectations of a change in the value of the DEM as a result of GMU, the results do not show that the expected rate of devaluation of any of the currencies analyzed would have changed because of GMU. It is also remarkable that the crisis that occurred in September 1992 cannot be seen in the expected rates of devaluation. The results of this method do not reveal that the credibility of the EMS exchange rates would have worsened since 1990. Only in the very last months preceding the realignment of September 1992 do we note an increase in the expected rate of devaluation. This seems to indicate that the currency crisis of 1992 was not anticipated by financial markets. The description of the actual events is followed by a discussion on the target zone model as a measure for devaluation expectations.

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[63] The method is discussed in detail in section 6.3.3.

[64] From previous studies, eg Chen & Giovannini (1992) and Svensson (1991a), we know that the expected rates of devaluation have been the lowest in absolute terms during the five-year period from 1987 to 1992.

6.5 The crisis in the autumn of 1992 and the method of measuring devaluation expectations

Eichengreen (1993) notes that the striking feature of the 1992 EMS crisis is the absence of turbulence in the EC foreign exchange markets earlier that same year. In fact, divergencies between ERM exchange rates actually moderated. The BEF and the NLG moved closer to the central rate; the FRF moved up from the bottom of its band. The GBP, though relatively weak in 1992, remained comfortably within its fluctuation band. The Danish referendum of June 2 seems to be the turning point.

Tensions after Denmark's rejection of the Maastricht Treaty were further fuelled by uncertainty surrounding the outcome of the referendum on the same issue in France, scheduled for September 20. The prospects for monetary union, which in the past had played an important stabilizing role in the EMS, generated strong expectations of a realignment, which increased as the referendum date drew closer. Subsequent, parliamentary elections in other European countries provided new "critical" dates on which market expectations could focus. Further, there was an increase in the market's awareness of the conflict between the domestic needs of monetary policy and those connected with the defence of the exchange rate, especially in France.

Pressure on the exchange rate became notable first in Italy where the discount rate was raised over the summer of 1992 in several steps from 12 % to 15 %. In early August, the approval of an austere interim budget brought some relief. At the end of August, however, opinion polls showed an apparent majority of voters opposed to ratification of the Maastricht Treaty. This bolstered growing concerns about possible realignment. Meanwhile the ERM became increasingly polarised as the three currencies of the wide band, ie the ESP, the GBP and the PTE (not analyzed in this study) weakened noticeably. Pressure mounted in August and September with the approach of the French referendum. On August 26 the GBP fell to the floor of its fluctuation band despite official intervention. Other ERM member countries intervened in support of their currencies. The ITL was the most prominent target of the ERM currencies. The Bank of Italy allowed short-term rates to rise more than 30 per cent. At the same time, the German, Dutch and Belgian authorities intervened heavily. Ultimately, the rise in domestic interest rates did not save the ITL. On September 13, the central rate of the ITL was devalued 7 %.

On September 16 the Bank of England intervened massively on the foreign exchange market to prevent the GBP from falling below the

margin of its DEM band. It started the day by raising the base lending rate from 10 % to 12 %. Later in the day it announced a further rise to 15 % effective the following morning. These measures failed to relieve the pressure on the GBP. According to Del Giovane (1994), the distinctive feature of Britain's defence of the GBP was the virtual lack of interest rate policies. The size of the rise in the domestic interest rates was rather small, and the timing was late. Hence, on the evening of September 16, the British monetary authorities announced the temporary suspension of the GBP from the ERM. On the same evening, the Bank of Italy announced to the Monetary Committee that the inadequacy of its reserves in the face of speculative pressure had forced it to suspend foreign exchange market intervention and float the ITL. At the same meeting the Monetary Committee authorized a 5 per cent devaluation of the ESP.

It was stated in section 6.3.1 that the results of estimating the expected rates of devaluation do not indicate pressure on the foreign exchange markets prior to the crisis of 1992. When, however, we study the developments ex post, we know that there were speculative capital flows, and that central bank intervention or interest rate action was needed to guarantee exchange rate stability. This contradiction between the empirical results of the model and real-world events raises the question of the ability of the model to depict reality. Clearly, previous empirical tests of the model have proved that the model does show that devaluation expectations increase prior to a realignment of the central parities. Towards the 1990s, devaluation expectations diminish across the currencies. After 1990, the EMS seems to have achieved full credibility.[65] So how then should the crisis of 1992 be explained?

In this context an crucial characteristic of the model applied here for measuring devaluation expectations could be that it uses interest rate differentials as the only variable. Expected rates of depreciation within the band are estimated using the exchange rate itself as an explanatory variable. Other studies also show that it is difficult to find an equation that would give more information on the expected rate of depreciation within the band. Thus, while we use this simple method to measure exchange rate movements within the band, we know that other factors also affect the behaviour of the exchange rate within the band. Interventions are certainly very crucial in this respect[66]. Intra-marginal interventions have increased especially after the signing of the Basle-

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[65] See eg Svensson (1991a), Caramazza (1993), Chen & Giovannini (1993) and Thomas (1994).

[66] For reference, the exchange rate strategies of some EMS central banks during the period from 1987 to 1993 are described by DelGiovane (1994).

Nyborg Agreement in 1987, which should affect at least the ex post behaviour of the EMS exchange rates.

If interventions have become the most popular tool in exchange rate management, then other tools such as interest rate differential have evidently lost importance. As a consequence, we can observe diminishing interest rate differentials – which do *not* indicate increased credibility[67]. Instead, central banks have stabilized their exchange rates through interventions. Hence, if the model uses interest rate differentials only as a measure of credibility, the results can be misleading in the absence of an important piece of information. One should take the number of interventions as an additional indicator of credibility. There are, however, difficult problems with the inclusion of interventions in an empirical model. First, the published series on foreign exchange reserves are an imperfect measure of the magnitude of foreign exchange market intervention. Central banks may report only gross foreign assets, even though it is standard operating procedure to arrange for standby credits in foreign currency. When the authorities intervene, they draw on the credit lines without having to sell any of the reported foreign assets. Off-sheet operations such as swaps and forward contracts typically undertaken during periods of speculative pressure are also omitted even if data on other foreign liabilities is available. Moreover, as Eichengreen et al. (1994) note, intervention by foreign central banks can be hard to detect. This applies especially to the EMS, where compulsory interventions are undertaken simultaneously by two central banks. Moreover, it is not just the amount of intervention that affects devaluation expectations. As pointed out by DelGiovane (1994), the effectiveness of interventions increases when they are coordinated; the effectiveness of such interventions is further connected to the degree of symmetry with which they are carried out.

This discussion leaves us with the conclusion that the model, when applied empirically, does not capture all information that would be necessary to find an accurate measure for devaluation expectations. Hence, we cannot draw any conclusions that rely exclusively on devaluation expectation estimates. Complementary analysis is needed. In chapter 7, we try to find out more about the working of the EMS by using the method of regressing the estimated expected rates of devaluation against a set of fundamental macroeconomic variables.

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[67] DelGiovane (1994) also reports that the size of increases in interest rates depends on the timing of the operation. If interest rates are raised promptly to check emerging pressures, the increases necessary to overcome the tensions are smaller. On the contrary, if the action is delayed, a large increase is needed.

7 Devaluation expectations and macroeconomic variables

In the previous chapter we calculated devaluation expectations for selected EMS exchange rates. As a purely technical exercise, no explanations of the change in the devaluation expectations changed over time was provided. The aim of this chapter is to use standard exchange rate theories to find macroeconomic variables that we know do affect the actors' devaluation expectations. We will also run an empirical test to determine the extent to which each of the suggested variables affects the devaluation expectations.

7.1 Previous studies

In the target zone literature we find an increasing number of studies applying econometric tests for determining relationships among certain macroeconomic variables – other than interest rates – and the expected rate of devaluation. One of the earliest study of this type was made by Edin & Vredin (1993), who analyzed the behaviour of the Nordic currencies by constructing a simple exchange rate model for a small, open economy with a standard money demand equation, an equation for the real exchange rate and the uncovered interest rate parity. From this model they solve the "fundamental" that is determined by nominal money, foreign price level, real exchange rate, domestic output and foreign interest rate. They also include lagged central parity in their equation. Their results show that, for Nordic countries, the lagged central parity and industrial production enter with significant negative coefficients, while the money stock has a marginally significant positive coefficient. Foreign interest rates, foreign prices and the real exchange rate are not significantly different from zero.

Pesaran & Samiei (1992) also use a macroeconomic model to explain devaluation expectations. They estimate three well-known two-country specifications of the exchange rate model, adjusted to take account of the limits. The first model is based on the monetary model determining for exchange rates ie the exchange rate is determined by expectations, relative money supplies and relative outputs. If this model is used, the coefficient of exchange rate expectations is significantly different from zero, as is the coefficient of the lagged interest rate

differential. The second model is a portfolio balance model, where the variables included are the current interest rate differential and the relative current account surpluses. The empirical results are similar to those obtained for the monetary model. The third model is essentially a combined portfolio-balance model and a monetary model. Here, the empirical test shows that, in addition to the exchange rate expectations and the interest rate differential, the lagged money supplies also have a coefficient significantly different from zero.

Caramazza (1993) has studied the devaluation expectations associated with the FRF/DEM exchange rate. His explanatory variables for the observed devaluation expectations are the change in the foreign exchange reserves, the government financing requirement, inflation differentials, export price competitiveness, the unemployment rate, the deviation of the FRF/DEM exchange rate from the upper edge of the band, relative money growth rates and the trade balance. Of these, all but the last two turn out to be significant, explaining over 70 % of the variation in the expected rate of devaluation.

Chen & Giovannini (1993) have analyzed the FRF/DEM and the ITL/DEM exchange rates. In their model they include relative foreign exchange reserve position, percent change in budget surplus, the difference in the trade balance surpluses, relative industrial production indices, the position of the exchange rate within the band, time since the last realignment, an index of relative CPI's, an index of relative wages, relative liquidity and, finally, the DEM/USD exchange rate. Their results show that the variables with consistently high explanatory power are the length of time since last realignment and the deviation of exchange rates from central parity.

Vajanne (1993) also examined a Nordic currency applying a monetary model for a small, open economy with free capital movements. In her study the exchange rate is treated as an asset price dependent on expectations concerning exogenous real and monetary factors that will affect price levels in the future. Vajanne's model is constructed from the following variables: domestic money supply, domestic GDP, real exchange rate, domestic inflation rate, unemployment rate, government net borrowing requirement, foreign reserves of the central bank and, the current account balance. The results show that for the FIM the rate of unemployment, the growth rate of the domestic GDP and the foreign exchange reserves are highly significant explanations for the devaluation expectations, whereas the current account balance has only minor significance.

Eichengreen et al. (1994) have sought to establish stylized features concerning the behaviour of macroeconomic variables around the time of

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speculative attacks on fixed exchange rates. Attacks are defined as large movements in exchange rates, interest rates and international reserves. The theory is tested empirically using data for ERM and non-ERM currencies. They derive an index of speculative pressure which says that pressure increases as domestic reserves of foreign exchange decline, as interest rates rise and as the exchange rate depreciates. The theoretical underpinnings then suggest that speculative pressure should be a parametric function of fundamentals, such as the rate of growth of domestic credit, the level of income and the interest rate differential. In their empirical analysis, they use the following variables: exchange rate vis-à-vis the DEM, changes in interest rates and international reserves relative to those of Germany, short-term money market interest rates, the ratio of central government budget position to nominal GDP, the real effective exchange rate, the ratio of exports to imports, domestic credit and CPI inflation.

For first-generation crisis models the results show that key macroeconomic and financial variables do not behave as predicted. In the ERM countries money growth and inflation have an inverse effect compared with the predicted result. Alternatively, ERM crises could be interpreted as self-fulfilling speculative attacks and multiple equilibria in foreign exchange markets in which policy shifts in a more expansionary direction in response to the attack. The results, however, show little evidence of such a pattern. The final finding of the paper is that the behaviour of macroeconomic variables differs significantly around the time of speculative attacks on the one hand and realignments and changes in exchange rate regimes on the other: ERM countries underpinning realignments have significantly higher inflation rates, interest rates, rates of money and credit growth and budget deficits, and their trade balances are significantly weaker. The authors conclude that although they fail to turn up strong evidence favouring second-generation models (ie they detect no significant shifts in macroeconomic variables in the wake of speculative attacks), their results tend to shift the burden of proof toward the proponents of first-generation models.

Mundaca & Vik (1994) concentrate on calculating the probability of a realignment of Nordic and several other EMS exchange rates by projecting the interest rate differential on a set of variables that are included in the information set of the actors when these are forming expectations about the future exchange rate. Using the ARCH method, they first try to capture expectations of future exchange rates by looking at the difference in spot exchange rates from central parity. Next, they take the time elapsed since the last realignment to see whether the time since the last realignment has been conferred increased credibility of the

band or awakened expectations of realignment. Third, they use the DEM/ECU exchange rate to establish the strength of the DEM in the EMS[68]. The authors argue that the explanatory variables, the expected rate of depreciation within the band and the expected rate of realignment, cannot be regarded as independent from each other since the market's expectations of both are conditional upon a single information set. Hence, they define a credible currency band as one where an exchange rate deviation from parity gives rise to expectations that the exchange rate is most likely to revert towards its central parity, rather than deviate from parity, which causes realignment expectations. The results show that all exchange rates except the ITL have followed the mean reversion process in the sense that a weak exchange rate has caused a decrease in the interest rate differential and, therefore, expectations of appreciations within the band. They also find, however, that simultaneously there were strong positive relationships between the exchange rate deviation from parity and the expected rate of realignment. In the case of the ITL any positive deviation from parity only increased the interest rate differential because of the lack of mean reversion in the exchange rate and its large positive effects on realignment expectations.

Thomas (1994) challenges the notion that interest rate differentials are appropriate measures of the risk of devaluation and that they reflect the movements of internal and external balance variables. The derivation of the measure for the devaluation risk follows the standard model derived in Svensson (1991a). The determinants of the expected rate of devaluation are then examined in light of the perceived macroeconomic objectives of the government. Internal balance is defined as the difference between the current unemployment rate and the level that is consistent with a non-accelerating rate of inflation. External balance, in turn, is defined as the value of the current account that is consistent with the investment and demographic needs of the country in question. External balance is influenced by the level of competitiveness given as a ratio of unit labour costs. In addition to these potential determinants of devaluation expectations, the author includes other explanatory variables: the inflation rate differential, the difference between domestic and foreign government debt/GDP ratios, the deviation of the spot exchange rate from the central rate and the rate of change in the stock of foreign exchange reserves. The results of the empirical analysis suggest that the dominant explanatory variable is the position of each currency in its target band. In other words, as the author notes, a considerable share of the variability in devaluation expectations seem to be explained by a variable that is only

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[68] For the Nordic currencies, they use the USD/ECU exchange rate.

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weakly related to standard macroeconomic fundamentals. When this variable is excluded from the analysis, official holdings of foreign exchange reserves become a significant determinant. The effect of the standard macroeconomic variables is, however, weak.

Ötker & Pazarbasioglu (1994) propose a speculative attack model of currency crises. Their main attempt is to identify the roles of macroeconomic fundamentals and speculative market pressures in an adjustable fixed exchange rate system such as the EMS. Using a stochastic version of monetary approach to exchange rate determination, they derive the macroeconomic fundamentals that give an equilibrium shadow exchange rate. The model describes a small, open economy whose government and monetary authorities are committed to maintaining their exchange rate within an adjustable peg system. It consists of equations for the demand for money, money supply, uncovered interest rate parity, real exchange rate and, the money market equilibrium. When foreign exchange reserves used to maintain money market equilibrium become exhausted, the central bank must abandon its announced fixed exchange rate. The rate which would clear the market when the central bank stops defending its fixed parity can then be obtained from the model. This shadow exchange rate is never observed unless the central bank changes its policy to preserve the announced fixed exchange rate. In their study the authors relate a speculative attack and the probability of a regime change to the condition that the shadow exchange rate exceeds the announced exchange rate by a certain margin. This approach lets the authors first calculate the probability of a regime change as a function of speculative factors only. Such factors are the interest rate differential, the deviation of the exchange rate from central parity and the level of foreign exchange reserves. The analysis is then extended by adding the fundamentals as explanatory variables into the equation. The authors use a probit model and estimate the explanatory power of the following macroeconomic fundamentals. An increase in the current level of domestic credit is expected to increase the probability of a devaluation. An increase in the real effective exchange rate is expected to induce expectations of an exchange rate adjustment and result in a higher probability of a regime change. A low level of foreign exchange reserves is expected to increase the probability of a regime change. Higher foreign interest rates exert pressure on the domestic currency. A high level of unemployment is expected to pressure the central bank to reconsider its exchange rate policy and thus increases the probability of a regime change. Higher prices in the anchor country reduce inflation differentials and thus the probability of a devaluation. Finally, the authors include the central rate in the equation with the expectation that an increase in the

existing fixed rate implies an adjustment of the exchange rate with respect to economic fundamentals and thus decreases the probability of a further devaluation. The probability of a regime change is expected to rise with an increase in interest differentials and deviations in the exchange rate from the central parity, and to fall with an increase in the level of foreign exchange reserves available to the central bank to defend its currency. The empirical results show, according to the authors, that both speculative and fundamental factors were important in generating the recent crises in the EMS. In particular, the worsening of the trade balances of the countries, increases in German prices, the rise in the rate of unemployment, the level of domestic credit and the loss of foreign exchange reserves as well as the loss of external competitiveness increased the probability of a regime change.

Rose & Svensson (1995) measure realignment expectations by using the standard method of subtracting the estimated change of the spot exchange rate from the interest rate differential. They then choose five macroeconomic variables to explain the observed realignment expectations. They derive money and output as potential explanatory variables from traditional monetary models of exchange rate determination with flexible prices. Monetary models with sticky prices, on the contrary, give inflation as a determinant for the exchange rate. Various models of balance-of-payments crises assign key roles to actual or expected levels of international reserves, trade balances, and the real exchange rate. In addition, the authors investigate the link between implicit bandwidth, monetary independence, and realignment expectations. They argue that not exploiting potential monetary independence improves credibility. Therefore, they measure the amount of monetary independence by the standard deviation of expected future exchange rate drift within the band and investigate possible linkages between that variable and realignment expectations.

The results of the regression run by Rose & Svensson (1995) show that inflation has a large and precisely estimated impact on credibility. Similarly, decreases in international reserves are correlated with increased realignment expectations. Increases in exchange rate variability and therefore the degree of exploited monetary independence are also associated with significant increases in realignment expectations. In order to find out whether permanent changes in the macroeconomic variables are associated with permanent changes in the level of realignment expectations, the authors also run a VAR regression for these explanatory variables. However, with the exception of a strong link from inflation differentials, there are few clearly significant channels of macroeconomic influence on realignment expectations.

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The main conclusion in Rose & Svensson (1995) is that the currency crisis of 1992 was not preceded by a gradual deterioration in ERM credibility. Indeed, realignment expectations were essentially constant through the period after German unification. The authors conclude that the data appear to indicate that financial markets were surprised by the events of September 1992: indications of a pending crisis did not emerge until late August.

Table 7.1 summarizes the empirical findings of previous studies. The left-hand column lists all macroeconomic variables used to test determinants of the expected rate of devaluation. In the following columns, the left-hand symbol shows which variables have been used in the actual study and the right-hand symbol shows the variables that turned out to be significant. Armed with this knowledge we can now attempt to construct a useful model. The set of macroeconomic variables we will investigate is relatively broad, although they are deliberately limited for the sake of usefulness. The set includes all of the most plausible candidates either implied by theoretical work, or, following Rose & Svensson (1993), that have been mentioned in the popular press.

7.2 Variables used in exchange rate modelling

The hypothesis has been that a devaluation involves a change from one target zone to another, ie a change in the central rate parity, and is related to fundamentals other than interest rates differentials.

The breakdown of the log of the exchange rate s into the log of the central parity c and the log of the percentage deviation from the central parity yields

$$s_t = c_t + x_t \tag{7.1}$$

Following Chen & Giovannini (1993), the one-period expected change in the exchange rate can be broken down into expected change in central parity and expected change in the percentage deviation from central parity:

$$E(\Delta s | I_t) = E(\Delta c | I_t) + E(\Delta x_t | I_t) \tag{7.2}$$

Table 7.1

Study	Pesaran & Samiei (1992)	Caramazza (1993)	Chen & Giovannini (1993)	Edin & Vredin (1993)	Vajanne (1993)	Eichengreen et al. (1994)	Mundaca & Vik (1994)	Thomas (1994)	Ötker & Pazarbasioglu (1994)	Rose & Svensson (1995)
Dependent variable / Explanatory variables	Exchange rate Expectations	Expected rate of devaluation	Expected rate of devaluation	Expected rate of devaluation	Expected rate of devaluation	Speculative pressure	Expected rate of devaluation	Expected rate of devaluation	Probability of devaluation	Expected rate of devaluation
Deviation of spot rate from central parity	o*	o*	o*	o			o*	o*	o	o*
Domestic credit	o*	o	o*	o*	o	o			o*	o
Real exchange rate		o*		o	o	o			o*	o
Trade balance	o	o	o		o*	o		o	o*	o
Unemployment		o*			o*			o	o*	
Interest rate differential	o*			o		o*			o	
Production	o		o*	o*	o*			o	o	o
Foreign exchange reserve		o*	o*		o*	o*		o	o*	o*
Government expenditure		o*	o		o	o		o*	o	
Inflation rate differential		o*	o		o	o		o*		o*
Time elapsed since last realignment							o*		o	
Foreign interest rate			o*	o*						
Foreign inflation rate			o*	o*					o*	
Third DEM exchange rate		o	o				o			

o = variable used in regression   * = variable significant

As is apparent, all expectations depend on the information set (I) available at time t. If the interest rate parity holds as assumed, the left-hand side of equation (7.2) can be replaced by the interest rate differential $(r-r^*)$. Hence, the expected rate of devaluation can be written as:

$$E(C_{t+i} - C_t | I_t) = (r - r^*) - E((X_{t+i} - X_t) | I_t) \qquad (7.3)$$

Since the interest rate differential is known, the equation yields that the expected rate of devaluation can be calculated by measuring the expected change in X. Using these data, we can easily calculate the ex post measure of the expected realignment devaluation as

$$C_{t+i} - C_t = (r - r^*)_{t+i} - (X_{t+i} - X_t) \qquad (7.4)$$

To determine the variables to choose for the information set, it would, naturally, be ideal to have a theoretical model that formally links the fundamental variables to the expected rate of devaluation. As stated by Chen & Giovannini (1993), however, existing theoretical models have not succeeded in clearly identifying the impact of fundamentals, rather they suggest potential impact. An important aspect here is that factors that have the most influence on exchange rates over the short term are not necessarily the same ones that exercise the most influence over the longer term. Further, as found by Taylor & Allen (1992), non-fundamentalist advice may be an important influence in foreign exchange markets. It is assumed rather that in forming expectations of a currency's possible realignment, agents consider a number of factors, both at home and abroad, that may induce a change in the central parity. We will discuss, therefore, a set of variables important for the determination of an exchange rate without trying to construct a technical model for them. In sections 7.2.1 to 7.2.8 factors considered to be relevant for the current study are presented. In sections 7.2.1 to 7.2.3 variables reflecting the external competitiveness of the country are discussed. Sections 7.2.4 to 7.2.6 include factors that reflect the general state of the economies. Finally, in sections 7.2.7 and 7.2.8 more speculative variables affecting devaluation expectations are discussed.

7.2.1 Competitiveness

External competitiveness is chosen as an explanatory variable because if there is a gain or loss in competitiveness relative to a period in which the external position was regarded to be in equilibrium, there is a presumption that the exchange rate is no longer consistent with the underlying external position of the country. If the purchasing power of a currency is weaker or stronger than the purchasing power of other currencies for long periods, exporting or importing goods respectively goods of goods becomes more attractive. A continuous current account surplus or deficit affects the demand for the currency in question, and this must finally show in the price of the currency, ie in its exchange rate.

In previous studies, the competitiveness of a country in international markets has been measured either by the trade balance or the real effective exchange rate[69]. Current account factors have generally been introduced into exchange rate modelling through the portfolio balance approach. In these models the financing of current account deficits affects the supply and holdings of domestic and foreign assets. Balance of payments and monetary equilibrium occur when wealth holders are satisfied with the relative proportions in which different financial assets are held in their portfolios. A surplus in the current account implies that domestic residents are accumulating foreign assets. The accumulation of foreign assets creates an excess supply of them and a corresponding excess demand for domestic assets. *The excess supply of foreign assets causes their price to drop so the price of foreign exchange declines.* The appreciation of the local currency then gradually eliminates the current account surplus. Since large and persistent current account imbalances can cause pressures within the EMS, this variable is included in the current regression.

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[69] An alternative, more direct method for measuring competitiveness would be to use production costs, which could be compared by using unit labour costs. In order, however, to obtain results that can be compared with the results of the other studies, we have chosen to use the current account as a measure of competitiveness.

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7.2.2 Inflation rate differential

An important conclusion of the monetary model is that a country cannot follow an independent monetary policy under fixed exchange rates – nor, as a consequence, can it choose price levels or an inflation rate different from that of the rest of the world. Under fixed exchange rates in the monetary model, starting from a position of equilibrium, the result of a rise in domestic prices will cause a decrease in reserves stemming from a temporary balance of payments deficit, other things equal. In the long run, a persistent balance of payments deficit cannot be sustainable; the country will have to adjust its monetary policy to the inflation rate of the surrounding countries. Alternatively, the adjustment has to come through the exchange rate. The effect of a devaluation is to move the economy to a point where the home country has regained its loss of competitiveness. Hence, *a higher domestic inflation rate should be expected to strengthen devaluation expectations*. Higher prices in the anchor country reduce inflation differentials and thus the probability of a devaluation.

7.2.3 Relative money supplies

Since an exchange rate is, by definition, the price of a country's currency in terms of another currency, it makes sense to analyze the determinants of that price in terms of the outstanding stocks of and demand for the two currencies. This is the basic rationale of a monetary approach to the exchange rate. *Within a target zone model, an increase in the level of domestic credit is expected to increase the probability of a devaluation.* An increase in the current level of domestic credit either adds to the money supply or results in lower interest rates, and so increases future inflationary pressures. On the other hand, as noted by Ötker & Pazarbasioglu (1994), if the central bank sterilizes the effect of the increase in the money supply, the decline in foreign exchange reserves will reduce the ability of the central bank to defend the fixed parity and hence, arouse devaluation expectations.

7.2.4 Relative government budget deficits

The role of fiscal variables as potential determinants of an expected devaluation is debatable. They are generally included in this kind of analysis mainly because high-debt countries may be induced to inflate away the portion of debt denominated in the domestic currency. The

inflation rate is then the channel of effect from changes in fiscal stance to changes in expected devaluation. If the inflation rate is already included in the analysis, the inclusion of fiscal variables is justified on the grounds that they are better predictors of future inflation than the current rate.

Frenkel & Razin (1987a) and Masson & Knight (1990) find that large autonomous changes in national saving and investment balances – in particular, those induced by shifts in public sector fiscal positions – exert a very strong influence on current account positions, real interest rates and, hence, exchange rates. In the context of target zones, the credibility of a regime may change from period to period if the signal of a reputation for toughness in one period through contractionary government policy leads to excessive costs from not adjusting in a later period. High-debt countries may be induced to inflate away the portion of debt denominated in the domestic currency. As also Drazen & Masson (1993) also note, the influence of fundamentals on the expected change in central parity depends on the credibility of the government and the cost of maintaining credibility in each period. Hence, we include the government net borrowing requirement in the regression equation. We use the flow variable and not the levels, because *the flow variable reflects the theoretical prediction of a positive relationship between the risk of devaluation and the rise in government debt.*

7.2.5 Industrial production

Industrial production is included in the equation because in one approach the exchange rate is determined by relative outputs. According to the monetary model, *a country with faster economic growth should have an appreciating exchange rate.* For a given level of aggregate demand, an increase in production is absorbed in the long run either at home or abroad. If the excess supply is to be consumed at home, prices have to decrease, which will improve the competitiveness of domestic products on international markets. The exports of the country grow as a result of the decrease in prices. The current account is then brought back into equilibrium through an appreciation of the exchange rate.

The opposite effect is obtained in the macroeconomic balance approach to the determination of an exchange rate. According to this approach, if output is above its potential, higher domestic demand is satisfied either by domestic output or imports. If it is satisfied by domestic output, inflationary pressure is created. A higher expected inflation rate is then discounted in the exchange rate as depreciation. On the other hand, if the domestic production tends to exceed its potential

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level and demand is satisfied through imports, the current account will deteriorate. This imbalance can be brought into equilibrium through *a depreciation of the exchange rate*, so that the competitiveness of the country's exports improves.

7.2.6 Foreign exchange reserves

It seems quite natural to include the foreign exchange reserves of the central bank in an analysis of the determinants of an expected devaluation. Various models of balance of payments crises assign key roles to actual or expected levels of international reserves. In a fixed exchange rate regime, central banks intervene to keep the exchange rate within the announced fluctuation band. Therefore, market agents observe the development of the foreign reserve position of the central bank. If the reserve is low, the possibilities for the central bank to maintain the fixed exchange rate are smaller than if the central bank has a large reserve. Further, free capital movement means that the threat of a speculative attack that will empty the reserves of the central bank is constant. Hence, *if the reserves of the central bank decline, agents begin to suspect a forthcoming devaluation of the currency.*

The foreign exchange reserves are included as a change in the level of the reserves of the domestic central banks. Alternatively, we could use the difference between domestic and German levels. As Eichengreen et al. (1994) point out, analyzing changes in the reserves of each country relative to changes in German reserves would yield results that take into account compulsory simultaneous interventions. Because Germany has been the strong-currency country in the EMS, the Bundesbank is almost always the other actor in such interventions. Voluntary (intra-marginal) intervention by third central banks, however, is not included in the bilateral differential. Because there is also the problem of attributing the interventions of the Bundesbank to a particular country, we have chosen to apply the change in the domestic foreign exchange reserves as the explanatory variable.

7.3 Results

The data was regressed for each country separately, and as a panel for all countries, using ordinary leased squares (OLS) corrected for heteroscedasticity and autocorrelation by the Newey-West method. A description of the data is provided in the Appendix. The results are reported in Tables 7.2a–b. Table 7.2a presents the results of the initial regressions including all data. Table 7.2b gives the results for the set of regressions where the insignificant variables have been dropped. Plots of these fitted estimates are presented in Figures 7.1a–h.

7.3.1 Panel data

Panel estimations were made by using fixed country effects. In panel data the inflation rate, industrial production and foreign exchange reserves appear with a significant coefficient. A positive inflation rate differential tends to increase devaluation expectations, just as was expected. In addition, the level of foreign exchange reserves has a coefficient with the expected sign: an increase in reserves improves the credibility of the fixed exchange rate regime and, as a consequence, the expected rate of devaluation decreases. The coefficient of industrial production is, on the contrary, positive. If there is stronger growth in production compared with Germany, devaluation expectations concerning the domestic currency increase. This indicates that an increase (decrease) in domestic industrial production relative to Germany is regarded as inflationary (deflationary), and these expectations are then discounted in the exchange rate. It could also be that more rapid growth at home affects imports more easily than exports.

  The remaining explanatory variables have insignificant coefficients, and after they are dropped over 72 % of the variation in the expected rate of devaluation is explained by the inflation rate differential, domestic credit, industrial production and the level of foreign exchange reserves. The inflation rate differential has a positive coefficient, indicating correctly that an increase in the domestic inflation rate relative to the inflation rate in Germany increases devaluation expectations of the domestic currency. Domestic credit becomes significant when the current account is dropped from the set of explanatory variables. An increase in the domestic money supply, or domestic credit, relative to Germany, increases devaluation expectations. An increase in the level of foreign exchange reserves, on the contrary, diminishes the devaluation expectations of the domestic currency, which is in accordance with the

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Table 7.2a   Results of the Regressions of Expected Rates of Devaluation on Selected Macroeconomic Variables

All variables	Panel	Belgium	Denmark	Spain	France	Great Britain	Italy	The Netherlands
Constant	Country Specific	0.07519** (5.26)	0.04133** (2.12)	0.07516 (1.44)	0.09404* (1.79)	-0.26967 (0.93)	0.24240** (8.03)	0.09693** (4.01)
Current Account	0.00145 (0.45)	-0.00227 (0.84)	-0.00335 (0.77)	0.00287 (1.18)	0.01175 (1.13)	-0.02215* (1.35)	-0.00247 (0.40)	0.00415 (0.99)
Inflation Differential	0.00070* (1.52)	0.00020 (0.85)	0.00170** (7.91)	-0.00002 (0.02)	0.00113** (2.27)	0.00021 (0.44)	0.00156* (1.65)	0.00094* (1.63)
Relative Money Supply	0.01671 (0.98)	-0.00898 (0.56)	0.00089 (0.12)	0.00620 (0.92)	0.02789 (0.15)	-0.05064 (0.48)	0.07652* (1.58)	-0.0194 (0.76)
Relative Government Deficit	0.01765 (1.03)	-0.8661** (3.04)	-0.01282 (0.67)	-0.18605** (3.40)	0.05145* (1.76)	0.00805 (0.10)	0.22083*** (4.08)	-0.02385*** (2.61)
Industrial Production Differential	0.04957** (6.76)	0.02855** (4.13)	0.02114** (2.30)	0.00342 (0.89)	0.04797** (2.51)	0.16255** (2.74)	0.09492** (4.77)	0.00750* (1.70)
Level of Foreign Exchange Reserves	-0.010119** (5.98)	-0.00805** (5.27)	-0.00379* (1.73)	-0.00609* (1.33)	-0.00844** (1.65)	0.02701 (0.99)	-0.02041** (7.37)	-0.00994*** (3.98)
R^2	0.74	0.80	0.77	0.89	0.56	0.43	0.76	0.35
Standard error	0.0035	0.0017	0.0024	0.0016	0.0028	0.0038	0.0048	0.0013

* significant at 5 % level, ** significant at 1 % level

Table 7.2b   Results of the Regressions of Expected Rates of Devaluation on Selected Macroeconomic Variables

All variables	Panel Country Specific	Belgium	Denmark	Spain	France	Great Britain	Italy	The Netherlands
Constant		0.07279** (5.30)	0.04551** (2.39)	0.07981** (2.10)	0.09043* (1.71)	0.01694** (5.54)	0.24097** (7.92)	0.09798** (4.08)
Current Account						-0.02074* (1.44)		
Inflation Differential	0.00075** (4.00)		-0.00171** (7.66)		0.00105** (2.71)		0.00155* (1.68)	0.00039 (1.37)
Relative Money Supply	0.01371* (1.41)						0.07189 (1.65)	
Relative Government Deficit		-0.08679** (3.71)		-0.19529** (4.70)	0.05555* (1.87)		0.22021** (4.07)	-0.01701** (2.00)
Industrial Production Differential	0.04818*** (6.80)	0.02785*** (4.24)	0.02026*** (2.64)		0.05278** (2.67)	0.15614** (3.11)	0.09561** (4.93)	0.00604 (1.42)
Level of Foreign Exchange Reserves	-0.010119*** (5.97)	-0.00816*** (5.94)	-0.00452*** (2.04)	-0.00667* (1.92)	-0.00816 (1.57)		-0.02026** (7.29)	-0.01002** (4.04)
R²	0.73	0.79	0.77	0.89	0.54	0.35	0.76	0.31
Standard error	0.0035	0.0016	0.0024	0.0015	0.0028	0.0037	0.0048	0.0013

* significant at 5 % level, ** significant at 1 % level

theory. Industrial production still enters the equation with a positive sign, indicating that stronger economic growth at home than in Germany increases devaluation expectations of the domestic currency.

7.3.2 Belgium

In the regression of devaluation on macroeconomic variables expectations of the BEF/DEM exchange rate, the government deficit and level of foreign exchange reserves are highly significant and have the correct sign. An increase in domestic credit strengthens devaluation expectations, while an increase in the foreign exchange reserves diminishes devaluation expectations. The coefficient of the last variable, industrial production, is also significant, and it is positive. The result indicates that growing industrial production creates expectations of a devaluation of the currency.

After the insignificant variables have been left out, almost 79 % of the variation in the devaluation expectations of the BEF/DEM exchange rate are explained by the government deficit, industrial production and the level of foreign exchange reserves. A worsening fiscal position increases devaluation expectations, whereas an increase in the foreign exchange reserves diminishes them. A growing differential vis-à-vis Germany in industrial production tends to increase devaluation expectations.

Figure 7.1a   **Belgium**

1 fit
2 devex
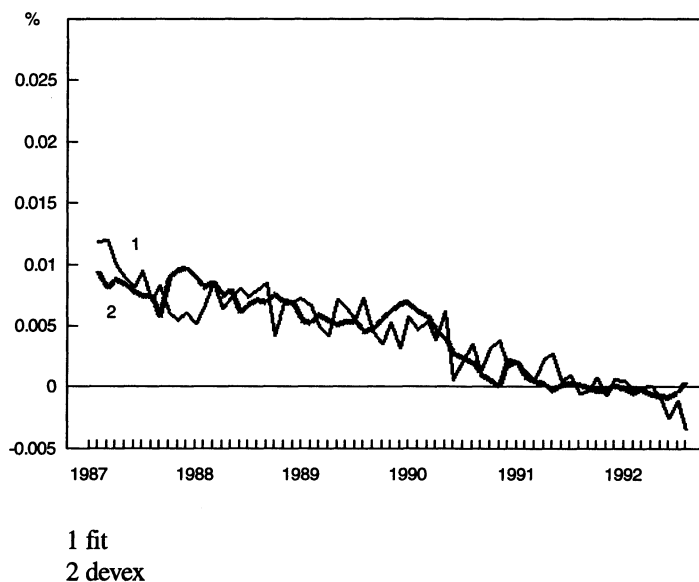
7.3.3 Denmark

For the DKK/DEM exchange rate the inflation rate differential has, as anticipated, an increasing effect on devaluation expectations. The coefficient is also highly significant. Industrial production is significant and, again, positive. The level of foreign reserves has a negative as well as a significant coefficient.

The results after the exclusion of the insignificant variables are as follows. A positive inflation rate differential vis-à-vis Germany increases devaluation expectations, and an increase in the foreign exchange reserves has the opposite effect. A positive differential in industrial production vis-à-vis Germany increases devaluation expectations. These variables explain almost 77 % of the variation of the expected rate in devaluation of the DKK/DEM exchange rate.

Figure 7.1b   **Denmark**

1 fit
2 devex

132
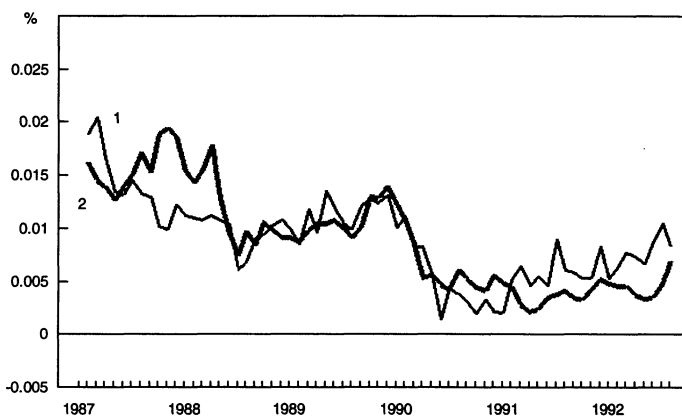
7.3.4 Spain

In the regression equation for the expected rate of devaluation of the ESP/DEM exchange rate, four of the six variables have an insignificant coefficient. The two significant variables, the government deficit and level of foreign exchange reserves, have the correct sign. An increase in the government deficit weakens the domestic currency and induces devaluation expectations, whereas an increase in foreign reserves has the opposite effect. These two variables explain almost 89 % of the variation in the devaluation expectations.

Figure 7.1c   **Spain**

1 fit
2 devex

133
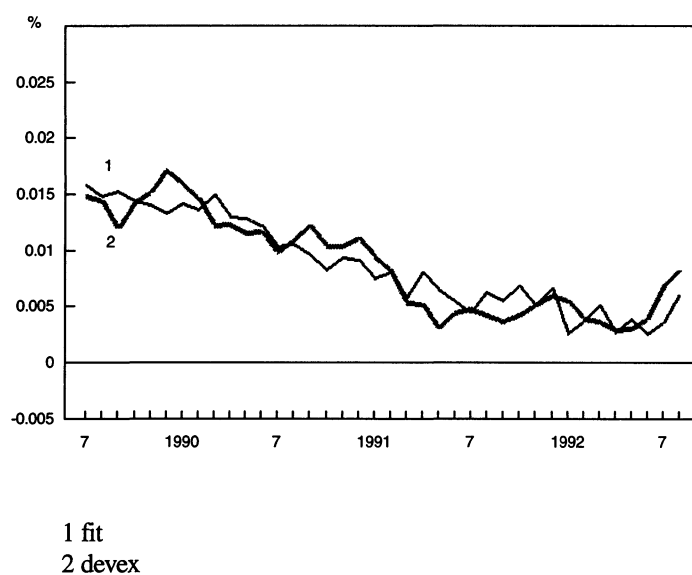
7.3.5 France

For the FRF/DEM exchange rate four variables have insignificant parameters/coefficients. The inflation rate differential has a positive coefficient indicating that, as expected, a faster domestic rate of inflation weakens the domestic currency. A decrease in industrial production diminishes devaluation expectations. The negative coefficient for the level of foreign exchange reserves indicates correctly that an increase in reserves diminishes devaluation expectations. The remaining significant variable, on the other hand, displays the wrong sign. The result shows that a worsening of the government deficit diminishes devaluation expectations.

The dropping of the variables with insignificant coefficients did not change the wrong sign of the government deficit. Hence, devaluation expectations of the FRF/DEM exchange rate decrease when the budgetary position in France worsens. The other variables obtain coefficients with correct signs, indicating increasing devaluation expectations with an increasing positive inflation rate differential vis-à-vis Germany, with growing industrial production in relation to Germany, or with decreasing foreign exchange reserves. These variables explain 54 % of the variation in the expected rate of devaluation of the FRF/DEM exchange rate.

Figure 7.1d   **France**

1 fit
2 devex
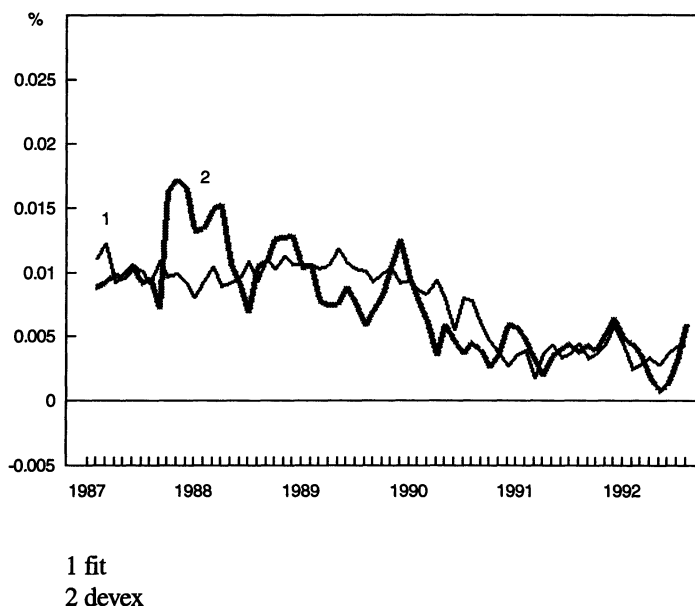
7.3.6 Great Britain

The devaluation expectations of the GBP/DEM exchange rate seem to be affected mainly by two variables, the current account and industrial production. The current account shows a negative sign, which means that an improvement in competitiveness strengthens the currency. Industrial production, on the other hand, enters into the equation again with a positive coefficient, indicating that greater economic activity would weaken the domestic currency. Of the remaining four variables, only one, namely the inflation rate differential, shows a coefficient with the correct sign. Domestic credit, the government deficit and level of foreign exchange reserves show wrong signs but are, as is the inflation rate differential, insignificant. The significant variables, the current account and industrial production explain only 35 % of the variation in the expected rate of devaluation of the GBP/DEM exchange rate.

Figure 7.1e   **Great-Britain**

1 fit
2 devex
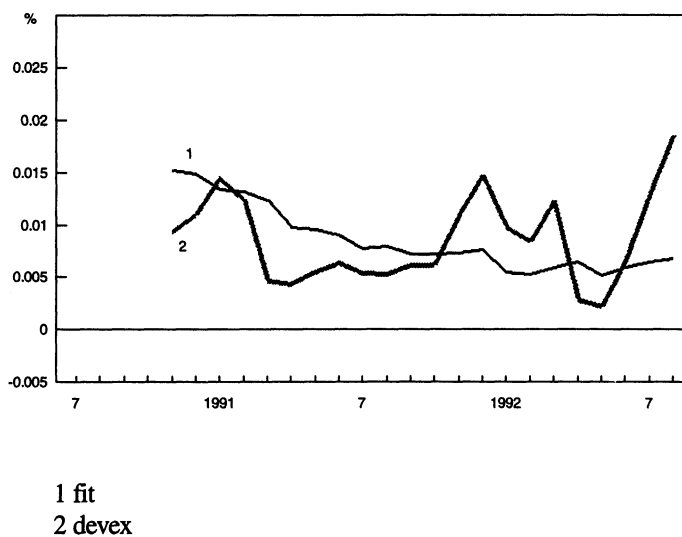
7.3.7 Italy

The Italian case yields interesting results. Excluding current account, the remaining explanatory variables explain over 76 % of the variation in the devaluation expectations of the ITL/DEM exchange rate. Of these variables, the inflation rate differential and domestic credit have the correct positive coefficient but are of only slight significance. They indicate that monetary expansion and a faster inflation rate in the home country have an increasing effect on devaluation expectations. Industrial production enters the equation with a highly significant positive coefficient. A decrease in industrial production should, hence, have a diminishing effect on devaluation expectations. Similarly, an increase in the level of foreign exchange reserves has a significant negative sign, indicating, correctly, that larger reserves diminish devaluation expectations. The government deficit enters the equation with a highly significant coefficient that has the wrong sign. A worsening of the government's financial position and a decrease in industrial production should have a diminishing effect on devaluation expectations.

Figure 7.1f   **Italy**
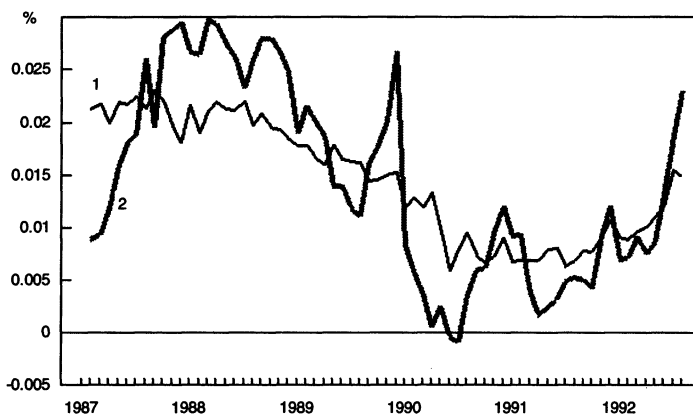
1 fit
2 devex

7.3.8 The Netherlands

In the regression equation for the devaluation expectations of the NLG/DEM exchange rate the coefficients for inflation rate differential and industrial production are of modest significance. A positive inflation rate differential vis-à-vis Germany tends to increase devaluation expectations. The coefficient for industrial production is, even in this case, positive. The coefficients for the government deficit and the level of foreign exchange reserves enter the equation significantly and with correct signs. A worsening of the fiscal situation increases devaluation expectations, whereas an increase in the level of foreign exchange reserves diminishes devaluation expectations. The reduced set of explanatory variables explains only 32 % of the variation in the expected rate of devaluation of the NLG/DEM exchange rate.

Figure 7.1g   **The Netherlands**

1 fit
2 devex

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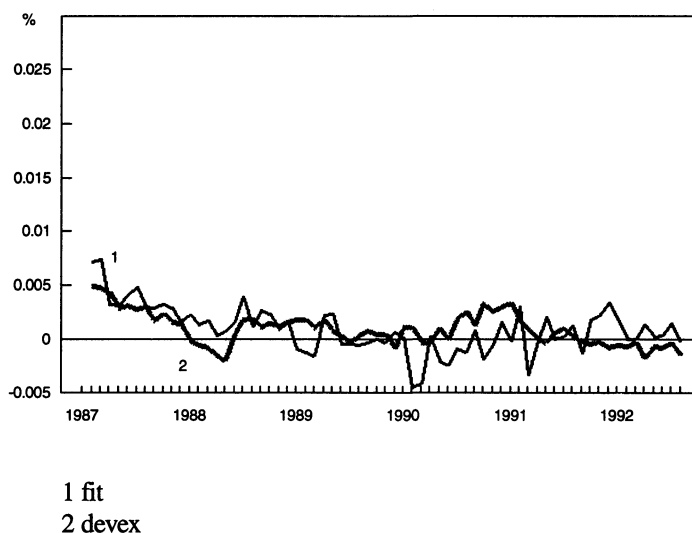
7.3.9 Summarizing the results

Summarizing the results from the panel for individual countries shows that there are some patterns in the behaviour of devaluation expectations. The inflation rate differential and domestic credit relative to German domestic credit seem to be quite neutral explanatory variables. They both appear significantly and correctly with positive signs in the panel, indicating that within the ERM monetary expansion in the home country tends to increase devaluation expectations of the domestic currency. For individual countries these variables always enter with the correct sign, but their degree of significance varies.

In reality it always seems, as stated by Cooper (1988), that there is a weak link between a deterioration in the current account and a depreciation of the nominal exchange rate. This relationship, however, is neither strong nor systematic and does not account for a large portion of actual exchange rate movements. In the regressions in this study the current account appears significant only for the GBP. In this case the current account might reflect the effect of external stability because the GBP/DEM exchange rate is the only case where the level of foreign exchange reserves has no effect on devaluation expectations.

The government deficit does not obtain a significant coefficient in the panel. For the BEF/DEM, ESP/DEM and NLG/DEM exchange rates it appears with a negative sign, indicating that a worsening fiscal position tends to increase devaluation expectations. It is quite puzzling, however, that for the FRF/DEM and ITL/DEM exchange rates, the coefficient has the wrong sign and is significant. This inverse result could reflect the difference in what kind of expectations a change in the fiscal position induces. If an increase in the deficit is expected to be followed by a contractionary monetary policy, and this expectation is discounted in the exchange rate, the increase in the deficit arouses expectations of an appreciation of the currency. For example, countries such as Belgium and the Netherlands, which have maintained close links with the DEM, have been successful in convincing markets that their commitment to the exchange rate parity is the most important of their monetary policy objectives. Even though there are some elements of vulnerability to high interest rates, the markets are presumably convinced that those costs would be absorbed to protect the longer-term benefits of exchange rate stability. On the other hand, in a country with low credibility and a weak fiscal position, a deterioration in the deficit can be easily seen as an incentive for the government to inflate away part of its debt. Such expectations then add to devaluation expectations. Defending the domestic currency with higher interest rates may worsen the situation rather than increase the credibility of the exchange rate commitment.

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A large increase in interest rates can feed back quickly and powerfully to increase the government's fiscal deficit. At some point, increases in interest rates may actually weaken the attractiveness of the domestic currency if market participants believe that they can increase debt-servicing problems. Moreover, high interest rates – maintained for the purpose of defending the fixed exchange rate parity – will often be viewed as having a high opportunity cost in terms of domestic economic activity, particularly in cases where the economy has been in recession, where unemployment rates are high, where inflationary pressures are moderate and receding, and where the consensus forecast is for slow growth. The greater the differences between the domestic and external requirements for monetary policy in a weak-currency country, the more likely it is that questions will be raised about the meaningfulness of "tying one's hands" on monetary policy. In such a situation, increases in interest rates will be politically unpopular. In the current study, the result – the negative and significant coefficient for the government deficit – for Spain might reflect such arguments. The coefficient for Spain is also larger than the coefficients for Belgium and the Netherlands.

Of the remaining explanatory variables, the level of foreign exchange reserves and industrial production seem to be most crucial. The level of foreign exchange reserves correctly obtain a negative and significant sign in all cases except for Great Britain. As was stated above, in the British case, the current account may, instead, reflect the external position of the home country. Industrial production also behaves very consistently in all regressions. The coefficient is significant in all cases except Spain. The coefficient is also positive, indicating that slower economic growth at home than in Germany tends to strengthen the domestic currency. In other words, among the EMS countries either the significance of a rise in the exchange rate seems to be strongly affected by expectations, or the sensitivity of imports to changes in industrial production is considerably larger than that of exports. The business cycle of the anchor currency country also seems to play an important role. A boom in the country providing the anchor currency is expected to have positive spill-over effects on the other countries and, vice versa, a recession in the anchor currency country is expected to have negative spill-over effects on the partner countries. This result leads us to the conclusion of this study, namely: what were the effects of GMU on the credibility of the exchange rates in the EMS?

8 German Monetary Unification and the EMS

8.1 Summary of the study

The purpose of this study was to analyze the credibility of the EMS in the five-year period during which no realignments occurred. If the exchange rates remained unchanged for five years because of a stronger political commitment to the EMS, stability may be attributed to an administrative decision to keep the parities unchanged independent of the development of the economies of member states, and one would expect to observe greater interest rate gaps as a result of increasing devaluation expectations[70]. Conversely, if the reason was increasing convergence and stability in the underlying economic factors, one must wonder what actually caused the turbulence in the European foreign exchange markets in autumn 1992 and autumn 1993.

Assuming that the member states experienced economic convergence, and that the EMS exchange rates remained stable because of such a favourable development, something must have occurred that justified the exchange rate crisis after so many years of relative calm. In this study, we have focused especially on the role of German Monetary Unification (GMU).

The analysis began by calculating, on the basis of the uncovered interest rate parity theorem, a credibility corridor for the domestic interest rate. If a target zone is credible, then the exchange rate can never exceed the upper bound or fall below the lower bound of the fluctuation band. Using this information, we can calculate bounds for the domestic interest rate, within which the interest rate differential indicates full credibility of the announced target zone. The results indicate that the credibility of the EMS exchange rates would have increased during the period 1987–1992. In other words, this simple method indicates nothing that would have triggered the autumn 1992 crisis on Europe's foreign exchange markets.

Thus, this very simple method was developed further. Using a model that breaks the interest rate differential in two components, the expected rate of depreciation within the allowed fluctuation band and the expected rate of depreciation of the central parity rate, we get a measure for the

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[70] Assuming of course that the markets had to be convinced by experience of the increased reluctance to realign.

credibility of the exchange rate. We then estimate the expected rate of depreciation of the exchange rate within the band, subtract the results from the interest rate differential, and obtain values for the expected rate of devaluation.

Finally, the estimated values for the expected rate of devaluation are regressed on selected macroeconomic variables to identify the extent to which the expected rate of devaluation depends on various economic fundamentals. As no exchange rate model yet devised performs perfectly, this model was built by including commonly recognized important factors for exchange rate determination. Selection and interpretation were based on previous theoretical and empirical work within exchange rate economics.

The estimation results suggest that GMU, which took place in July 1990, caused no acute short-term nominal tension within the EMS, as was feared. On the contrary, we observe increased exchange rate credibility in the form of decreasing devaluation expectations. The explanation for the increase in the stability of the EMS exchange rates is that German variables, ie interest rates and inflation, move upwards and hence, approach the corresponding variables of the other EMS countries. It was the convergence of these variables that apparently eased pressure on nominal exchange rates. The model foreshadows no signs of impending crisis. Expectations of possible realignments as a tool of adjustment become relevant only after it is apparent that there is a discrepancy between the cyclical needs of the economies in the other EMS countries and the high interest rates imposed on the ERM by Germany. These discrepancies emerged first in Italy, Great Britain and Spain.

The traditional weak-currency countries Italy and Spain faced the most difficult domestic economic situation. The government deficit of these countries, relative to Germany, affected devaluation expectations. In Italy the divergence of the business cycles amplified this effect. In both countries, the falling level of foreign exchange reserves of the central bank were noted by the markets, which put these currencies under speculative attack. Great Britain, in turn, had to fight against the public perception that the GBP rate was fixed at an inappropriately high level in the ERM. As the German locomotive lost steam pessimism worn out and a British recession could no longer be avoided.

In hard-currency countries such as the Netherlands and Belgium, devaluation expectations could not be seen even on the very eve of the crisis. For both countries, we obtained the inverse result that a growing government domestic deficit as compared to Germany tends to strengthen the currency of the home country. Also France and Denmark were

strongly affected by the turn in the business cycle in Germany. Markets also seem to observe the inflation rate differential in these countries. For the crisis, however, this factor could not play a crucial role because the inflation rates of these countries practically matched the German inflation rate level. All in all, the results of this study suggest that the crisis was due to the reverse in the German business cycle in a situation where the anchor country conducted a strict monetary policy to fight domestic inflation pressures. We now turn to an economic interpretation of these results.

8.2   Increased convergence

GMU had positive spill-over effects on EMS countries in several respects. First, inflation expectations in Germany were adjusted upwards. This had an effect on the interest rates. Long-term rates rose because of the change in expectations, and short-term rates were raised by the Bundesbank as it tried to fight inflationary pressure. In the other EMS countries, there were no new immediate inflationary pressures and, hence, no need for corresponding interest rate increases. This implies that *interest rates converged*, as can be seen in Figures 8.1a–b. This per se diminishes devaluation expectations of the exchange rate parities.

The same pattern can be seen to have happened with actual inflation rates. As a consequence of GMU, German money supply grew faster than expected, and the monetary aggregate target of the Bundesbank was exceeded in several periods. Wages and prices rose more than what was warranted by growth in productivity. As a result, German inflation rate increased. At the same time, domestic demand in other EMS countries was declining. This boosted the effects of the anti-inflationary policy conducted by the monetary authorities since the end of the 1980s, causing inflation rates in these countries to fall. As Figure 8.2 shows, even here the German rate rose at the same time as the rates of the other countries were stable or even declining. In other words, even the *inflation rates were converging* as a result of GMU. This development also contributed to increased stability of the EMS exchange rates.

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Figure 8.1a   **Short-term interest rates**
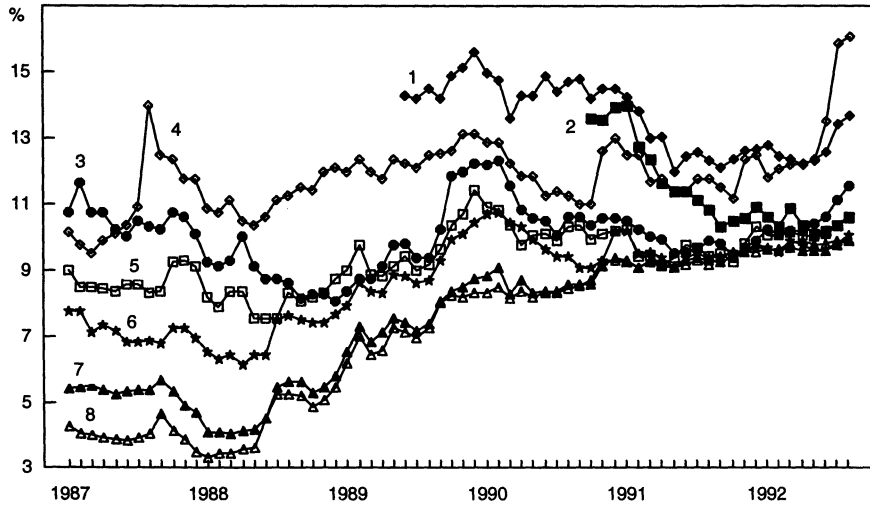
1 Spain   5 France
2 Great Britain   6 Belgium
3 Denmark   7 The Netherlands
4 Italy   8 Germany

Figure 8.1b   **Long-term interest rates**

1 Spain   5 France
2 Great Britain   6 Belgium
3 Denmark   7 The Netherlands
4 Italy   8 Germany

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Figure 8.2   **Annual inflation rates in**
              selected EMS countries
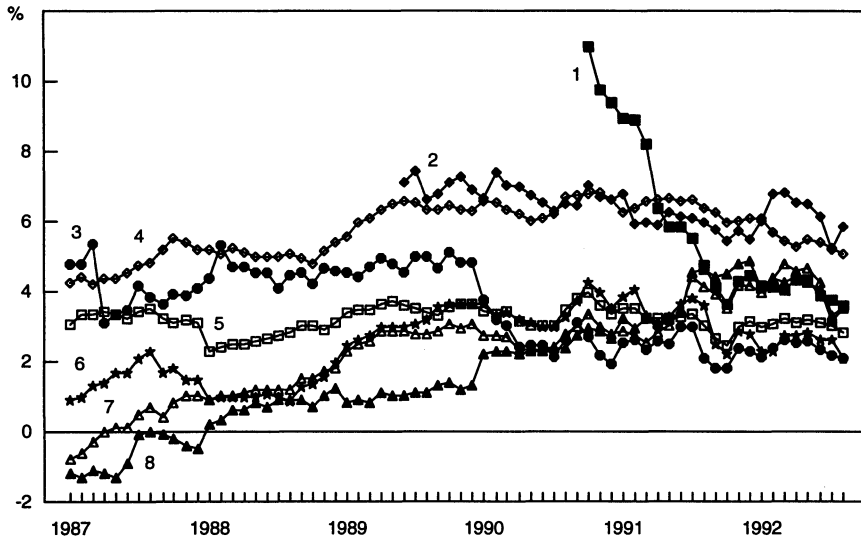
1 Great Britain   5 France
2 Spain   6 Belgium
3 Denmark   7 Germany
4 Italy   8 The Netherlands

Figure 8.3   **German trade balance**

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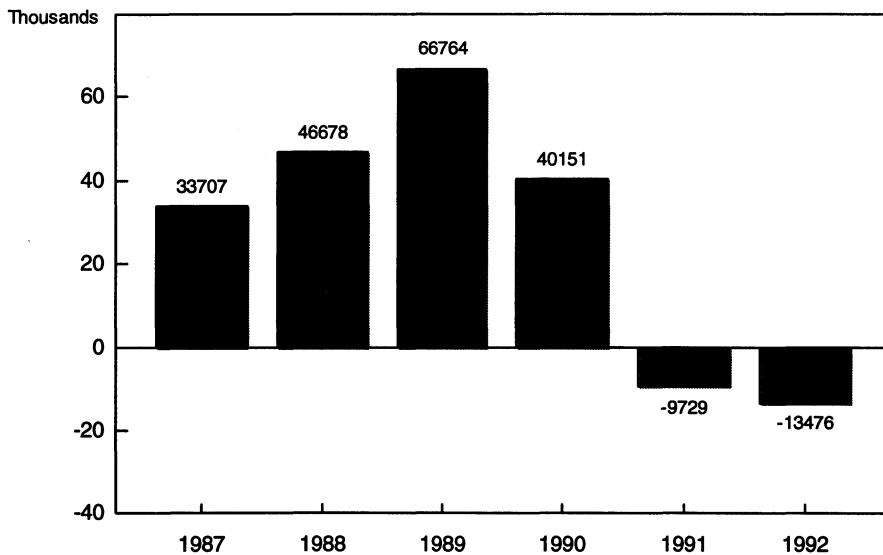
On the real economy side, convergence may be seen in the reversing trade balances. Traditionally, EMS partner countries suffer from persisting trade deficits with Germany. However, as the additional demand from rebuilding former East Germany has to be satisfied both through domestic production and imports, the trade balance was reversed. Trade partners were given the opportunity to remarkably diminish their deficits vis-à-vis Germany, and in some cases even turn them into surpluses. Accordingly, Germany became a net importer, as can be seen from Figure 8.3. Hence, even this effect of GMU added to convergence, diminishing devaluation expectations of the DEM exchange rate and other EMS currencies.

8.3   Divergence

Signs of recession in Europe could be seen at the end of the 1980s. In this respect, the German boom from GMU was extremely well timed. The spill-over effects of GMU kept the recession at bay for German's partners. However, this injection to the export sectors of these economies could not fully prevent recession, only delay it. After the stimulus was over, economic divergence became evident.

In Germany, the GMU boom started to fade within 18 months. By early 1992, growth in Germany starts to faulter. In its December 1991 Economic Outlook, the OECD forecasts for Germany that (p. 80): "Slowing private consumption and low public consumption growth complete the picture of declining final demand growth in 1991 and 1992. Import growth can therefore be expected to fall considerably from its recent high rates, and GNP to grow at rates below potential throughout the projection period." Despite of such projections, the Bundesbank was unwilling to cut interest rates. Instead, it announced that it would continue to fight inflation that was, according to the view of the Bundesbank, too high. A disappointment for market agents was that the Bundesbank refused to ease its tight monetary policy. In its Economic Outlook in June 1992, the OECD wrote (p. 66): "All-German real GNP may therefore (slow growth of domestic demand in 1992 and only a small pick up thereafter) increase by some 1 3/4 per cent in 1992 and by between 2 1/2 and 3 per cent in 1993." And the following issue of Economic Outlook (December 1992) was even upbeat about the performance of the German economy (p. 70): ".. in the year to mid-1992, western German investment was on average flat, after several years of strong growth, reflecting deteriorating business expectations and falling exports." Table 8.3 summarizes the projections of the OECD for the German economy in its

outlooks in December 1991 and June 1992 (bold numbers). As can be seen, in June 1992 the projections are revised downwards from the numbers given in its December 1991 Economic Outlook.

Table 8.3   **OECD forecasts for Germany**

		GNP	Industrial production	Change in foreign balance	CPI
1991	I	5.2	4.0	0.2	2.1
		4.4	**4.0**	**-1.1**	**2.4**
	II	-2.0	0	-1.0	5.5
		-1.4	**-2.5**	**0.2**	**6.2**
1992	I	3.3	2.0	0.7	3.5
		2.2	**4.0**	**0.2**	**3.5**
	II	2.6	2.0	0	3.8
		2.1	**2.3**	**-0.7**	**3.4**
1993	I	2.5	2.7	0.1	4.8
		2.5	**2.7**	**0.5**	**4.0**
	II	2.5	3.6	0.1	2.6
		2.3	**3.1**	**0.2**	**2.7**

Source: Economic Outlook

Recalling the results from our regressions of macroeconomic variables on devaluation expectations, we conclude the above discussion with the following argument. The short-run effects of GMU contributed to the convergence of the EMS economies. On the monetary side, interest rates and inflation rates converged; on the real side, trade imbalances vanished, and the boom had positive spill-over effects on neighbouring EMS countries. However, these positive effects were only *temporary*. In the longer term, as the immediate effects of GMU started to fade, the divergence of the business cycles in the EMS economies became more clearly visible. This difference in the business cycle can be seen in Figure 8.4a-b. In other countries, where domestic activity had been weak for some time, their economies were primed through increased activity in Germany. As the slowdown hit Germany, other countries experienced a decrease in aggregate demand, what was seen by the markets as a strong need for expansionary policies. This was impossible, however, given that fixed exchange rates in the EMS were linked to the monetary policies of the individual EMS countries. The interest rates of other EMS countries were tied to the interest rates of the anchor country, ie their monetary policy was dictated to a large extent by the monetary policy conducted by

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the Bundesbank. The German policy mix was, however, unsustainable by other EMS countries, eventually forming them to publicly challenge the value of thin commitment to the EMS. Expansionary fiscal policy combined with a tight monetary policy resulted in high interest rates, which was not considered as appropriate for the domestic needs of Germany's partners. The level of interest rates that many other EMS countries saw as appropriate for dealing with their domestic economic situation was lower than the level of rates that the anchor country in the EMS saw as appropriate for its own domestic economic conditions and responsibilities. Under a fixed exchange rate regime, the costs associated with weak-currency countries adopting large increases in interest rates are normally diminished by having the strong-currency country share the adjustment burden by reducing its own interest rates. However, this course of action was severely constrained by the Bundesbank's assessment that it would be incompatible with controlling inflationary pressures in Germany. As the GMU locomotive slowed further, the contradiction between the policy preferences of Germany versus other EMS countries became more pronounced.

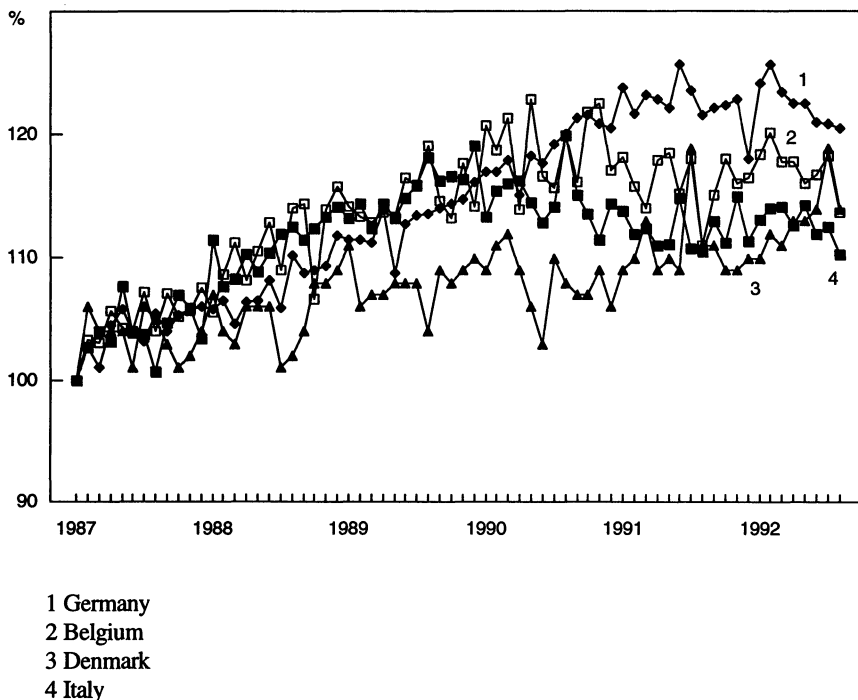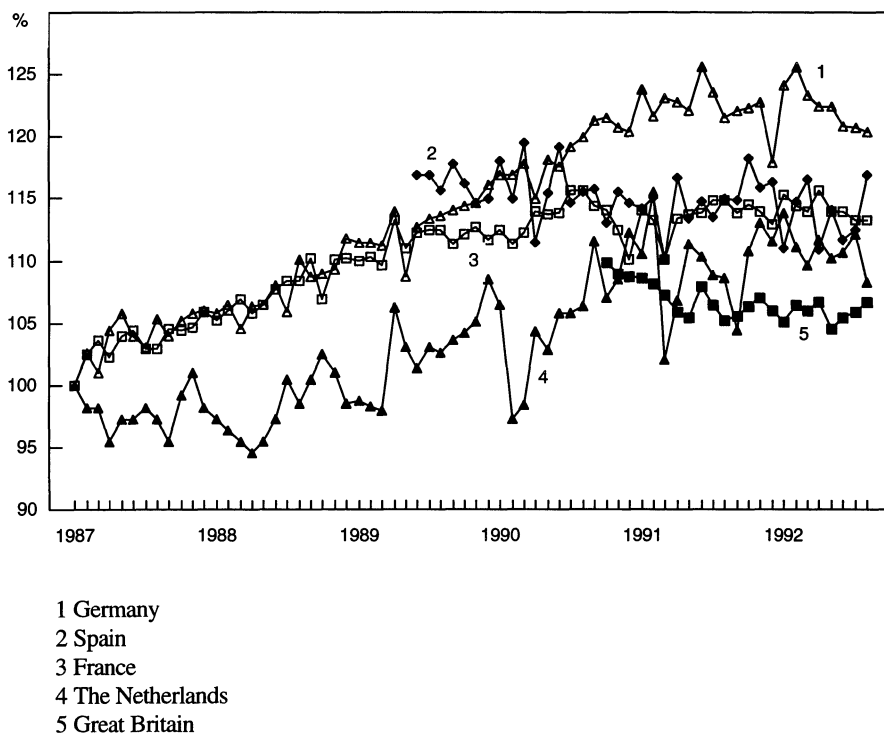Figure 8.4a **Industrial production in selected EMS countries**

1 Germany
2 Belgium
3 Denmark
4 Italy

Figure 8.4b   **Industrial production in**
                     selected EMS countries

1 Germany
2 Spain
3 France
4 The Netherlands
5 Great Britain

8.4   Conclusions

How can above results be generalized? As the target zone literature
suggests, there are two components that determine the interest rate
differential: the expected change of the spot exchange rate and the
expected rate of devaluation. Moreover, the expected rate of devaluation
is the product of the probability of a devaluation and the expected size of
the devaluation. The expected spot exchange rate can remain stable quite
independent of devaluation expectations. Devaluation expectations,
meanwhile, are not observed as long as certain underlying
macroeconomic variables converge.

Within the EMS, in the years from 1987 to 1992, crucial
determinants of the credibility of the exchange rates turned out to be the
inflation rate differential, relative money supplies, industrial production
and foreign exchange reserves of the central bank. Yet none of these
variables signalled the impending crisis. This suggests that the rise in the

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German interest rate was not decisive for the crisis. It resulted in interest rate convergence. It could be accepted by the partner countries because the interest rate effect of the GMU was accompanied by a positive spill-over effect. The excess German demand dampened the slow-down in the business cycles of the partner countries. Therefore, the contradiction between the policy mix of the anchor country and the other EMS countries was not experienced as urgent. However, as soon as the positive spill-over effect faded, the consequences of the high interest rate level became pronounced.

If any generalization can be drawn here, it is that devaluation expectations seem to become visible first when there are obvious policy conflicts, which are considered unsustainable over the longer term. Moreover, it is natural to think that devaluation expectations are connected with the credibility of the system as a whole rather than to a single exchange rate. There could to be a threshold after which participation in the system is considered or expected to bring more costs than gains. Further, in a situation where changes in variables are immediately and correspondingly transmitted through the financial markets, the monetary autonomy of the participating countries in the system is considerably reduced. This implies that the system must be experienced as meaningful before domestic monetary authorities are ready to give up their autonomy. If the system does not work so that it contributes to the goals of the domestic authorities, then the willingness of the authorities to commit to the system obviously decreases. When the market agents think that that threshold has been exceeded, devaluation expectations are aroused.

The above conjecture brings into question the ability of the target zone methodology to measure the credibility of a fixed, but adjustable, exchange rate system such as the EMS in a reliable way. If the cooperative nature of such a system makes the commitment of the authorities to the respective fixed parities more important than the development of single variables that are traditionally used as determinants in exchange rate models, then it should be of interest to try to pinpoint and model the elements that diminish the political willingness to participate in such a system. Anyway, it is clear that target zone models alone cannot be used to test such an assumption. While the literature in the field of speculative attacks might provide some help in this respect, work on this question shall be left as a task for further studies.

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Appendix

Description of the data

This appendix provides the description of the data used in the empirical analysis.

Inflation

Yearly inflation rate less German yearly inflation rate. Yearly inflation rates calculated from the Consumer Price Index. Source: OECD Main Economic Indicators, monthly data.

Domestic credit

The monthly change in a country's national currency log domestic credit less the log of German domestic credit. Sources: International Financial Statistics (IFS) monthly data, except for France and Belgium. The French data is disaggregated from IFS quarterly data. The Belgian data is disaggregated from IFS quarterly data until 1991. From 1991 onwards the Belgian data is composed by adding together "Portefeuille-effets" and "Debiteurs divers" in Bulletin de la Banque Nationale Belgique, table "XIV–3 Situation Globale des Banques".

Industrial production

Log of the country's seasonally adjusted industrial production index less the log of the respective German index. Source: IFS, monthly data.

Foreign exchange reserves

Log of central bank total reserves minus gold in domestic currency converted at the end-of-period spot exchange rate. Source: IFS, monthly data.

Trade balance

Log of exports less log of imports (CIF) in domestic currency. Source: IFS, monthly data, except for Belgium. Source for Belgium: OECD, Main Econmic Indicators.

Gross domestic production

Source: IFS quarterly data as annual rates, except for Denmark and Belgium. Quarterly data disaggregated and converted to monthly rates. Source for Denmark: IFS quarterly data as monthly rates. Quarterly data disaggregated. Source for Belgium: IFS yearly data. Yearly data disaggregated.

Government finance

Overall deficit (−) or surplus. Source: Government Finance Statistics Yearbook (GFSY), except for Spain, Germany and Denmark. Yearly data disaggregated. Source for Spain: IFS, monthly data. Monthly data added to yearly data, and disaggregated to reduce monthly variation. Source for Germany: Table "Balance of Receipts and Expenditure" in Deutsche Bank, Monthly Report, April 1995. Yearly data disaggregated. Source for Denmark: IFS, yearly data. Yearly data disaggregated.

Government finance is the ratio of the overall deficit/surplus and the gross domestic product less the respective German ratio.

Dummies in the panel

D1–D7: Country dummies for Great Britain, Spain, The Netherlands, France, Italy, Germany, Denmark and Belgium, respectively.
D8: Dummy for Belgian Domestic Credit for January, 1991.
D9: Dummy for Dutch Domestic Credit for December, 1988.
D10: Dummy for German Domestic Credit for June, 1990.

Dummies in the models for individual countries

D1: Dummy for German Domestic Credit for June, 1990.
D2 for The Netherlands: Dummy for Dutch Domestic Credit for December, 1988.
D2 for Belgium: Dummy for Belgian Domestic Credit for January, 1991.

Method of disaggregation

The disaggregation of the time series is done by "Ekta", using a method created by Denton. For more information, see Frank T. Denton: Adjustment of Monthly or Quarterly Series to Annual Totals, JASA March 1971.

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