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Abstract

The paper aims at evaluating the impact of the 1992-93 European Monetary System crisis on the member countries. The primary focus is on the macroeconomic performance of the former "narrow band countries" of the Exchange Rate Mechanism, in particular France and Belgium, whose interest rate differentials widened and exchange rates weakened with respect to the Deutsche Mark during the crisis, but came back close to the pre-crisis level in early 1994. The analysis is carried out using the GEM macroeconomic model of the National Institute for Economic Research. The results of the simulations seem to suggest that the macroeconomic costs of the crisis have been limited but not negligible: in the absence of the crisis, French and Belgian GDP would have been higher by about 0.25-0.40 percentage points each year from 1993 to 1996. These results have to be taken with caution. The paper discusses the limitations of the approach and possible extensions as a stimulus for further research in this field.

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1. Introduction[1]

If an astronaut had come back to earth early in 1994 after a two-year long flight in space (without a Reuters screen in his shuttle!) and as soon as he landed checked the situation of his diversified portfolio, he would probably not have been very surprised. He would have found the exchange rates of the DM and the other ERM currencies participating in the narrow band since the beginning practically unchanged and likewise for interest rate differentials at both the short and the long end of the market (although at a lower level of interest rates).

He would also undoubtedly have noticed that a group of currencies - the lira, the pound sterling, the peseta and the escudo - had substantially depreciated, something which had certainly not been expected before his departure in early 1992. On second thoughts, however, he would probably have concluded that he had been too optimistic two years earlier about the value of these currencies and the ability of the countries in question to adjust their imbalances. He would also have noticed that the interest rate differentials, both short and long, of these countries with respect to Germany were at levels close to those prevailing two years earlier. He might have reasonably imagined therefore that during his absence the EC monetary authorities had decided to realign these currencies in order to adjust previous imbalances and prepare for the "run to EMU" (if he had not yet read the news

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1 A preliminary version of the paper was presented at the Conference "European Currency Crisis and after"; Bordeaux, 11-12, July 1994. We wish to thank the participants, in particular Jean Pisani-Ferry, for their useful comments. We are also grateful to Rosanna Gattodoro for editorial assistance, Alessandra Liccardi for research assistance and John Smith for revising the English version. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Banca d'Italia.

about the fate of European integration!) and that markets had adjusted smoothly to this "last realignment".

Our astronaut would soon find out that, unfortunately, he was wrong. The early 1994 picture of broad stability in EC monetary relations came after two years of tension, at times crisis in the ERM, with repeated speculative attacks, devaluations and finally the widening of the fluctuation bands in August 1993, as those who remained on earth well know. One of the peculiarities that would have to be explained to the astronaut is that the crisis had affected not only countries with internal or external imbalances, where a realignment was more or less justified on the basis of fundamentals, but also countries whose fundamentals were highly convergent with respect to Germany.

After giving the astronaut a full account of events and attempting to provide a coherent explanation of the crisis one might wonder what the world would have been like if the scenario first imagined by the astronaut had been true, i.e. if the realignment of the diverging countries' currencies had taken place in an orderly fashion, thereby avoiding the speculative attacks and preserving the overall stability of the system within its narrow fluctuation bands. This paper seeks to assess what would have happened in such a scenario, by considering the assumption that in 1992-93 the exchange rates between the formerly narrow band currencies remained unchanged and that interest rate differentials converged further. The aim is to assess the macroeconomic costs of the crisis, without questioning whether and how the crisis could have been avoided. Unfortunately, the attainment of this objective is constrained by the analytical tools available to the researcher. Conducting a counterfactual experiment as the one suggested above, i.e. the absence of the 1992-93 ERM crisis, entails enormous difficulties which can only be

addressed by making a number of strong assumptions that will be made explicit later in the paper. The results have to be taken cautiously and considered mainly as a stimulus for further research in this field, which we think is of great importance for the understanding of the impact of monetary and exchange rate policies during the transition phase of EMU.

The paper is organised as follows. The next Section describes the main features of the macroeconometric model used in the analysis. In Section 3 the results of the simulation of a "no-crisis scenario" for some currencies are compared with the baseline. In Section 4 alternative exercises are conducted, for the purpose of sensitivity analysis. The final Section presents some concluding comments.

2. Methodology

The analysis is carried out using the framework provided by the Global Econometric Model (GEM) developed at the NIESR. GEM contains a description of the 7 major industrial countries, plus Spain, the Netherlands and Belgium, with detailed equations for the balance of payments, national income and employment, wages and prices, the financial sector and the public sector. For the other OECD countries, output, prices and international trade are aggregated into broad areas, such as the rest of the EC (including Denmark, Ireland, Greece and Portugal).[2]

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2 GEM is used by the NIESR to make quarterly forecasts for the world economy and to run simulation exercises. It has been used to examine possible regimes of international policy co-ordination (Currie and Wren-Lewis, 1989), to assess the implications of EMU (Barrell, 1990; Barrell, Surney and In T'veld, 1991) and of a wider use of a

The model is characterised by short-term nominal rigidities in the goods and labour markets; government bonds are considered net wealth (Ricardian equivalence does not hold). Expectations are formed rationally: in particular, long-run interest rates and wages are forward-looking. Terminal conditions are imposed to ensure that current account imbalances and stocks of government debt do not follow explosive paths in the long run.

In this analysis we use the February 1994 version of the model which has been estimated, on quarterly data, over the sample period from 1984-I to 1993-III. This period includes then the 1992-93 crisis, when interest rates increased in most countries, except Germany, to defend the ERM bands, in particular in France, by about 3 percentage points in the first quarter of 1993 and in Belgium by 2 points in the third quarter of 1993; the French and Belgian francs depreciated by 2.5 and 3.5 per cent, respectively, after the bands were widened in August 1993.

In early 1994 the French and Belgian currencies returned inside their previous ERM (narrow) bands with respect to the Deutsche-mark and exhibited relatively stable behaviour thereafter; their respective interest rate differentials dropped to levels close to those prevailing before the crisis. In the February 1994 baseline, French and Belgian interest rates are assumed to converge on the German levels (6.0 and 6.5 per cent in the short and long-term respectively) between 1994 and 1995.

European currency (Barrel, Britton and Mayes, 1990), and to assess the need for inflation convergence (Bini Smaghi and Del Giovane, 1995).

The basic exercise conducted in this paper consists of simulating a "no-crisis" scenario in which the French franc and the Belgian franc are not affected by the ERM crisis. The French interest rates fully converge to the level of German rates from the second half of 1992 (see Figure 1). For Belgium, the short-term interest rate differential with Germany is assumed to fall to zero in 1993; the long-term interest rate differential is maintained at 40 basis points until 1994, and at the equilibrium level (20 basis points) thereafter (see Figure 2). The exchange rates of the French franc and the Belgian franc with respect to the Deutsche Mark are assumed to remain unchanged at their pre-crisis levels.

The next section presents the main results of the simulation. It is important, however, to bear in mind the assumptions that were implicitly adopted in carrying out the exercise.

First, the model provides equations only for the major countries, as indicated above, and therefore the direct and indirect effects of the crisis on the smaller countries such as Ireland, Denmark and others cannot be examined. Furthermore, the analysis concentrates on the former ERM narrow-band countries, whose exchange rates and interest rates differentials returned to levels close to the pre-crisis ones in early 1994, implicitly assuming that it had no effect on exchange rate developments in the other countries inside or outside Europe. This is clearly a very restrictive assumption. Indeed, even in those countries which recorded major imbalances in 1992, exchange rates have been affected not only by domestic factors but also by the systemic development of the crisis. In particular, the tensions that developed in the Nordic countries were interrelated with those in the ERM and had a strong impact on these economies, which are the major trading partners of the EC. The

repercussions of these events on the EC cannot be examined with the available model.

Second, the exercise is based on the assumption that the crisis produced its effects only during the 1992-93 period. Since early 1994, as exchange rates and interest rate differentials of former ERM narrow band countries reached levels close to the pre-crisis ones, it is assumed that the world has returned to a situation similar to the one prevailing before 1992. This is a restrictive assumption, since the 1992-93 crisis may have produced more lasting effects, in particular concerning the prospects for EMU and presumably the process of convergence in Europe with repercussions on the goods and financial markets. These factors cannot be easily accounted for in a macroeconomic model.

Third, it is assumed that the effects of the EMS crisis were produced only by the developments in interest and exchange rates. Other potentially important transmission mechanisms are not considered. In particular, uncertainty in the foreign exchange markets of 1992-93 may have generated a change in agents' expectations, eventually leading to a crisis of confidence with strong repercussions on households' and firms' behaviour. There is some evidence that this factor played an important role in France, but it can hardly be captured by an analysis based on a relatively simple macroeconometric model.

Finally, the exercise is based on the assumption, common to any macromodel, that the crisis did not affect the behavioural relationships specified in the model, and would therefore be subject to the Lucas critique if a regime change had occurred. There is some evidence that the performance of certain equations of the GEM model deteriorated markedly in

the 1992-93 period. In particular, for France the model makes a large over-prediction of private consumption in the first quarter of 1993 and of investment in the first two quarters of 1993. Constant negative add-factors have been included in these equations, which suggests that the behavioural equations may have been subject to structural changes.

Section 4 tries to address some of these issues.

3. Main results

The first exercise consists of simulating a "no crisis" scenario. The main hypothesis concerning exchange rates and interest rate differentials are illustrated in Figures 1 and 2. They imply : i) an average annual short-term interest rate which is lower than the baseline level by 77, 118 and 23 basis points respectively in 1992, 1993 and 1994 in France (105, 132 and 52 basis points in Belgium); ii) a lower long-term rate, by 55 and 49 basis points in 1992 and 1993 in France (41 and 65 basis pints in Belgium); iii) an average appreciation of the effective exchange rate in 1993 by 0.87 per cent for the French franc and by 1.08 per cent for the Belgian franc, and a depreciation of the DM and guilder by 0.25 and 0.3 per cent.

The results of the simulation are presented in Table 1, expressed in terms of differences between the "no-crisis scenario" and the GEM February 1994 baseline, which instead incorporates the "crisis scenario".

In the no-crisis scenario French GDP is higher in 1993-96, by about 1 per cent cumulatively. The lower level of interest rates raises real net wealth, and hence private consumption, and stimulates investment. Domestic demand rises

by over 1.6 per cent cumulatively over the four-year period. The appreciation of the exchange rate partly offsets this effect: the current account balance deteriorates by about 0.3 per cent of GDP in the 1993-96 period. Import volumes rise, by about 2.5 percent over 1993-96, while export volumes initially fall, with respect to the baseline "crisis scenario", recovering only in 1995. French employment increases by 8 thousand units in 1993 and by an annual average of approximately 25 thousand over the period 1994-96. Inflation is virtually unchanged. Public sector saving improves with respect to GDP by around 0.30 per cent.

Similar results are obtained for Belgium. GDP and employment increase slightly, while the current balance deteriorates. The model for this country is however much more simplistic and thus the results are only provided for a few variables. An important effect is the improvement in public sector saving following the impact of lower short and long-term interest rates on debt service.

The higher growth in France and Belgium contributes marginally to an improvement in the growth and employment performances of Germany and the Netherlands. Their current account balances also improve.

In summary, the results of the simulation conducted with the GEM model suggest that the crisis of 1992-93 and the policies aimed at counteracting it led to an annual average reduction in French and Belgian GDP of about 0.25 per cent, over the period 1993-96.

4. Extensions

As previously discussed, the exercise conducted in

Section 3 is subject to a number of limitations. In the remaining part of the paper, we attempt to assess the effects of these limitations on our results.

4.1 "No crisis" for other ERM currencies

The exercise conducted in Section 3 is based on the hypothesis that in the "no-crisis scenario" the exchange rate and interest rate differentials of the former narrow-band countries that did not devalue between 1992 and 1993 remain unchanged, but those of the other ERM countries behave exactly as historically experienced. However, the exchange rate developments of the lira and the pound sterling, even though they had been floating since 17 September 1992, were affected by the ERM turbulence from October 1992 to end 1993.

It is difficult to make an assumption regarding the behaviour of these currencies based on the hypothesis that after their devaluation the ERM would have become calm again. As a benchmark hypothesis we consider the case of the lira and assume that after the devaluation the exchange rate remains, until the end-1993, at the level corresponding to the lower margin of the narrow band adopted after the September 12 devaluation, i.e. 900 lire per DM, the level reached approximately at the end of September 1992. This implies an appreciation of the lira in effective terms, with respect to historical levels, by 5.5 per cent in 1993 and by 0.6 per cent in 1994. Short and long-term interest rate differentials with respect to the DM are assumed to remain unchanged at the level prevailing before the crisis (Figure 3). Therefore, with respect to the baseline, Italian short-term interest rates are lower by 184 basis points in 1992 and 43 basis points in 1993, on an annual average (long term rates by 1.34 and 0.58 points, respectively). In early 1994,

when the immediate effects of the ERM crisis are assumed to end, the exchange rate of the lira and the interest rate differential return to the baseline level, on the assumption that thereafter they are only affected by non-EMS-related (mainly domestic) factors.

In this scenario Italian income falls slightly in 1993-94 and partly recovers in 1995-96 (Table 2). Domestic demand increases cumulatively by over 1 percentage point over the 1993-95 period, mainly as a result of the lower interest rate, but exports fall by about 1 per cent and imports rise by almost 4 over the same period, following the real exchange rate appreciation. Up until 1995, the current balance deteriorates with respect to the baseline.

These changes in the Italian economy also affect France and Germany, which experience a marginal improvement in growth performances, between 0.1 and 0.2 per cent cumulatively, over 1993-95. Net exports increase in both countries as a result of the gain in competitiveness obtained from the stronger exchange rate of the lira.

In sum, the results seem to suggest that the Italian economy was not directly hurt by the crisis, as the devaluation of the lira more than compensated the effects of the higher interest rates. However, these results have to be taken with caution, because the effects of the crisis may be underestimated. On the one hand, the trade effects appear to be quite small, especially in view of the huge turnaround of the Italian trade balance that took place after the devaluation (of approximately 16 per cent in effective terms between 1992 and 1993) and contributed by more than 3 per cent to GDP growth in 1993 (with an 8.5 per cent increase in exports and a 10 per cent decrease in imports). A plausible explanation for the small effects on trade flows is that the

model underestimates their response to sharp exchange rate changes.[3] Indeed, the examination of the in-sample performance of the February 1994 version of the GEM model suggests that it strongly underpredicts Italian export volumes in 1993. On the other hand, as mentioned in Section 2, the model does not take into account the effects of the EMS crisis on the level of confidence of households and firms which, as the evidence shows, sharply deteriorated causing a marked reduction in private consumption and investment.

4.2 "No crisis" for the ERM-dollar exchange rate

In the exercise conducted in Section 3 it was assumed that the crisis affecting the ERM did not influence the exchange rate of ERM currencies with respect to the rest of the world and in particular the US dollar. It is difficult to establish a clear-cut relationship between the DM-dollar exchange rate and the exchange rate of the DM with the other European currencies. During the EMS period the correlation seems to have gone both ways, a strong dollar at times contributing to exchange rate stability in the ERM, at times putting pressure on the weaker currencies. During the 1992 summer crisis the tensions in the ERM might have contributed to a weakening of the dollar if agents opened short dollar positions to speculate against the weaker ERM currencies or, on the contrary, to a strengthening of the dollar if the closing of the convergence plays previously opened in favour of the latter currencies was accompanied by a reduction of short dollar positions.

For the purpose of the analysis we consider two opposite benchmark assumptions, i.e. that in the absence of

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[3] A similar assessment is made by Whitley (1991).

the EMS crisis the DM-dollar exchange rate would have: A) remained at the rate of 1.68, prevailing in early 1992, until the end of 1993, when it again reached this level; B) stayed close to the level of 1.55 reached in mid-1992 (Figure 3). From early 1994, the DM-dollar exchange rate is assumed to return to the baseline level. Assuming that other intra-ERM exchange rates remained unchanged, this implies, in case A an average annual depreciation of the DM in effective terms by 2.7 per cent in 1992, and by 0.65 per cent in 1993 (1.64 and 0.39 per cent for the French franc); in case B, an appreciation of the DM by 3.59 per cent in 1993 and 1.34 in 1994 (2.12 and 0.79 for the French franc).

The results of the two exercises are shown in Table 3. In case A, GDP is higher in France and Germany in 1992-93, by about 0.5 and 1 percentage points, respectively, largely as a result of higher exports. This improvement is however partly reversed in the following years. Inflation is higher in Germany by 0.1 percentage points in 1992 and by 0.4 points in 1993.

In case B, where the dollar is more depreciated, GDP worsens in 1993-94 by 0.8 per cent in France and 1.5 in Germany. Inflation falls in Germany by 0.2 per cent in 1993 and 0.5 in 1994 and in France by 0.3 in both years.

In both scenarios the interest rate policy of the Bundesbank is assumed unchanged. It is interesting to note that a different dollar exchange rate produces a larger effect on German GDP than on French GDP. A more appreciated dollar would have widened the divergence in cyclical positions in favour of Germany and increased inflationary pressures in the same country. Paradoxically, this could have led to a more restrictive policy stance in Germany than historically experienced. Such a policy would have been less

sustainable from the point of view of France and might have led to an even more critical situation in the ERM. A weaker dollar, on the other hand, would have reduced the growth differentials between France and Germany, reduced inflationary pressures and possibly led to a more relaxed interest rate policy in the latter country with possibly beneficial effects on exchange rate stability in the ERM. To summarise, if the ERM crisis was associated with a relative strengthening of the dollar, its macroeconomic costs for the European economies would, ceteris paribus, have been larger, although such an appreciation would probably have been accompanied by a policy of lower interest rates in Germany, which in part materialised from the autumn of 1992.

4.3 Using the ex-ante GEM model

The exercise conducted in Section 3 is based on the February 1994 version of the GEM model, which was estimated on the basis of data collected up until the second half of 1993. The sample period used for the estimation thus encompasses the 1992-93 crisis period. Simulating a no-crisis scenario with a model estimated over a period in which the crisis occurred might lead to biased results. This bias could be particularly important if the crisis produced substantial changes in the behavioural equations and in the structural parameters.

To partly account for this problem, we carried out a simulation using the May 1992 version of the GEM model, estimated on the basis of the information available up until early 1991. It is interesting to note that the baseline scenario of the May 1992 version is very similar to the "no-crisis scenario": it forecasts stable exchange rates within the ERM and further convergence of interest rates; in

early 1992 the NIESR, like financial markets, was not expecting the foreign exchange crisis of 1992-93.

This exercise is symmetric to the one conducted in the previous section, given that in the May 1992 version the baseline is equivalent to the "no-crisis scenario", while in the February 1994 version the baseline corresponds to the "crisis scenario". In sum, the exercise now consists of simulating the effects of the crisis within a model that did not forecast it.

In Table 4 we present the differences between the "crisis scenario" and the "no-crisis scenario". The results are very similar to those of Table 1 but with opposite sign. In France, the impact of the crisis on GDP appears to be slightly smaller, compared with the 1994 model, and larger for employment. In Germany, on the other hand, the impact of the ERM crisis appears, especially for employment, to be slightly larger in the 1992 version; the impact in any case remains relatively modest. In the earlier version of the GEM, the models for Belgium and the Netherlands were extremely simple: they only included equations for trade and the current balance. It is not possible therefore to compare the macroeconomic effects of the crisis in the two versions of the GEM for these smaller countries.

These results suggest that the more recent data, covering the 1992-93 crisis, may have partly affected some of the behavioural relationships. As mentioned in Section 2, the in-sample performance of the February 1994 version of GEM deteriorates slightly in 1993, in particular for France. It remains to be seen whether these changes are of a temporary or permanent nature. In the latter case the negative effects of the "crisis scenario" might be larger than those reported in Section 3. This issue needs to be investigated further.

4.4 Long term effects of the crisis

The exercise reported in Section 3 is based on the assumption that the effects of the crisis are limited to the 1992-93 period. The February 1994 version of the GEM assumes that exchange rates and interest rate differentials remain unchanged after returning close to their pre-crisis levels. This is not a fully consistent assumption. Already in the summer of 1994 interest rate differentials have widened again at all maturities, although by limited amounts, and some pressures were recorded in the foreign exchange rate markets. If one believes that such developments would not have occurred had the ERM remained calm during 1992-93, their repercussions have to be taken into account when assessing the costs of the ERM crisis.

To allow for this, the baseline is updated to 1998 with data available in September 1994. The yield curve indicates a positive short term interest rate differential for France, of 30 basis points in 1994, 20 in 1995 and 10 thereafter. The long term differential remains at 50 basis points until 1995 and decreases thereafter. The Belgian differential follows a similar pattern. Comparing this new baseline with the no-crisis scenario, as suggested in Figure 4, the crisis appears to have a slightly larger impact than that obtained in the simulation presented in Section 3. In France, GDP falls by an additional half percentage point in the 1995-97 period: the effect of the crisis now amounts to 1.5 per cent over 1993-96, cumulatively; in terms of employment, the loss amounts to over 100 thousand units, cumulatively. Domestic demand is affected the most, as a result of the higher short and long run interest rates. In Belgium the worsening of GNP is smaller because the original GEM baseline already accounted for a positive interest rate differential in 1994 and 1995.

In sum, this exercise suggest that if in the new wide-band system, created as a result of the 1992-93 crisis, exchange rate variability increased and was reflected in higher risk premia and wider interest rate differentials, the effects of the crisis would be longer lasting, with greater than expected repercussions on the economies of the respective countries. This is another avenue for further research.

5. Concluding remarks

During the time we have taken to reach the conclusions of the paper our astronaut has been able to glance at the previous two years' newspapers and catch up with the news about the "monetary earthquake" that shook Europe from mid-1992 to mid-1993. If he now looks back at the results of our simulations, he might be disappointed. The earthquake did some damage, but not as much as might have been expected. Indeed, our main simulation shows that in the no-crisis scenario the average annual French and Belgian GDP would have been higher by about 0.25 per cent, between 1993 and 1996. German and Dutch GDP would have increased only marginally. Taking account however of other factors, the effects of the turbulence may have been substantially larger.

What do these results mean with respect to the impact of financial turbulences on the real economy? Further research is required before daring to hazard an answer. This paper simply starts to address the issue using a somewhat simple methodology. The limitations of the analysis have been underlined. Macroeconometric models are a biased instrument with which to examine the effect of wide-ranging disturbances such as the ERM crisis, as they tend not to be very sensitive to major policy changes. However, the results of the

simulation exercises conducted with macromodels can be taken as a benchmark for further analysis.

A final consideration to bear in mind in examining the ERM crisis of 1992-93 is that, despite it being of major proportions, the response of the policy-makers was in many respects unprecedented. In particular, the authorities adopted measures previously unused, such as joint public statements in defence of currencies, huge foreign exchange interventions and special financing between central banks. Looking at the interest rate effect of the crisis in France and Belgium, one can only be surprised by the small increases in these countries during the crisis. Interest rate differentials with the DM never exceeded 4 percentage points on a monthly average and for relatively short periods. The average annual increase in the interest rate was small, around 100 basis points in 1992 and 1993. In other countries the crisis led to much larger interest rate increases. For instance, the short-term interest rate differential increased, on a yearly basis, by 160 and 320 basis points in 1992 and 1993 respectively in Denmark, by 200 and 110 points in Ireland, and by 100 and 200 points in Spain. Against this background, the impact on the real economy for France and Belgium may not really be considered as having been small. On the other hand, this suggests that the policy adopted, by France in particular, with the aim of reducing the impact of the crisis on domestic interest rates has been particularly helpful in limiting the repercussions on the real economy.

This paper is only a first attempt to assess the risks of an exchange rate system exposed to tensions that are not justified by underlying fundamentals and of the costs involved in counteracting these tensions. These preliminary results are presented in order to stimulate further research in this field.

Table 1

EXERCISE 1: "NO-CRISIS SCENARIO" WITH 1994 MODEL (1)

	GDP (2)	Domestic demand (2)	Employ-ment (1000s)	Inflation (3)	Current account (mill.$)	Export volume (2)	Import volume (2)	Long-term rate (3)	Short-term rate (3)	Effective exch.rate (2)
France										
1992	0.03	0.08	0.17	-	-410	-	0.18	-0.55	-0.77	0.03
1993	0.23	0.49	8.04	-0.04	-1417	-0.02	0.92	-0.49	-1.18	0.87
1994	0.22	0.48	19.44	-0.09	-2513	-0.07	0.91	-0.07	-0.23	-
1995	0.26	0.38	27.65	0.06	-1240	0.11	0.50	-0.10	-	-
1996	0.22	0.28	27.97	0.03	-668	0.08	0.25	-0.02	-	-
1997	0.15	0.18	22.08	0.04	-314	0.04	0.09	-	-	-
Belgium										
1992	0.02	n.a.	0.01	n.a.	27	0.03	-	-	-	-
1993	0.05	n.a.	0.34	n.a.	-114	0.06	0.17	-0.41	-1.045	1.08
1994	0.33	n.a.	0.9	n.a.	-340	0.22	0.58	-0.65	-1.325	-
1995	0.19	n.a.	2.1	n.a.	-605	0.19	0.40	-0.35	-0.525	-
1996	0.11	n.a.	2.17	n.a.	-451	0.08	0.26	-0.02	-	-
1997	0.05	n.a.	1.82	n.a.	-240	0.03	0.15	-	-	-
Germany										
1992	-	-	0.2	-	54.9	0.01	0.01	-	-	-
1993	0.04	0.03	3.4	-	162.8	0.12	0.06	-	-	-0.25
1994	0.06	0.03	7.72	0.02	521.8	0.19	0.09	-	-	-
1995	0.04	0.02	7.3	0.02	385.2	0.12	0.08	-	-	-
1996	0.02	0.02	4.89	0.01	212.8	0.07	0.06	-	-	-
1997	0.01	0.01	2.07	0.01	67.6	0.02	0.04	-	-	-
Netherlands										
1992	0.01	n.a.	-	n.a.	23	0.02	-	-	-	-
1993	0.03	n.a.	0.27	n.a.	107	0.16	0.01	-	-	-0.3
1994	0.06	n.a.	0.66	n.a	172	0.21	0.10	-	-	-
1995	0.05	n.a.	1.09	n.a.	112	0.14	0.09	-	-	-
1996	0.04	n.a.	1.23	n.a.	43	0.09	0.07	-	-	-
1997	0.03	n.a.	1.19	n.a.	-7	0.04	0.05	-	-	-

(1) Difference from the baseline ("crisis scenario").
(2) Percentage difference.
(3) Difference in percentage points.

Table 2

EXERCISE 2: "NO-CRISIS SCENARIO" WITH STABLE LIRA/DM EXCHANGE RATE

	GDP (2)	Domestic demand (2)	Employ-ment (1000s)	Inflation (3)	Current account (mill.$)	Export volume (2)	Import volume (2)	Long-term rate (3)	Short-term rate (3)	Effective exch.rate (2)
France										
1992	-	-	-	-	6	0.01	-	-	-	-
1993	0.03	-	0.8	0.04	-368	0.05	-0.02	-	-	-0.82
1994	0.07	0.01	3.4	0.03	850	0.29	0.04	-	-	-0.10
1995	0.04	0.01	4.7	-0.01	363	0.11	-	-	-	-
1996	0.01	-	3.2	0.01	106	-0.01	-0.05	-	-	-
1997	-	-	0.6	0.01	-11	-0.04	-0.03	-	-	-
Belgium										
1992	-	n.a.	-	n.a.	6	-	-	-	-	-
1993	0.06	n.a.	0.2	n.a.	88	0.04	0.02	-	-	-0.35
1994	0.05	n.a.	0.6	n.a.	136	0.17	0.06	-	-	-0.04
1995	0.01	n.a.	0.5	n.a.	61	0.05	0.01	-	-	-
1996	-0.01	n.a.	0.3	n.a.	37	-0.01	-0.01	-	-	-
1997	-0.02	n.a.	0.1	n.a.	-2	-0.02	-0.03	-	-	-
Germany										
1992	-	-	-	-	11	-	-	-	-	-
1993	0.05	0.02	3.4	0.01	-399	0.07	0.02	-	-	-0.62
1994	0.11	0.05	13.5	0.04	1078	0.30	0.09	-	-	-0.07
1995	0.03	0.01	9.9	0.03	360	0.07	0.05	-	-	-
1996	-0.01	-	2.5	0.01	-43	-0.03	-	-	-	-
1997	-0.02	-0.01	-2.1	-	-194	-0.05	-0.02	-	-	-
Netherlands										
1992	-	n.a.	-	n.a.	6	0.01	-	-	-	-
1993	0.06	n.a.	0.2	n.a.	244	0.03	-0.05	-	-	-0.33
1994	0.05	n.a.	0.9	n.a	140	0.20	0.12	-	-	-0.04
1995	0.02	n.a.	1.0	n.a.	-6	0.03	0.04	-	-	-
1996	0.01	n.a.	0.7	n.a.	-63	-0.02	0.01	-	-	-
1997	-	n.a.	0.5	n.a.	-72	-0.03	-0.01	-	-	-
Italy										
1992	0.02	0.05	-	-	-211	-	0.12	-1.34	-1.84	-
1993	-0.12	0.49	-9.2	-0.57	-153	-0.46	1.02	-0.58	-0.43	5.52
1994	-0.13	0.57	-27.9	-0.03	-5369	-0.43	2.48	-	-0.04	0.64
1995	0.07	0.18	-11.0	0.27	-781	-0.01	0.32	-	-	-
1996	0.04	-0.03	0.6	0.04	504	0.02	-0.23	-	-	-
1997	0.04	-0.07	3.8	0.02	793	0.04	-0.28	-	-	-

(1) Difference from the baseline ("crisis scenario").
(2) Percentage difference.
(3) Difference in percentage points.

Table 3

EXERCISE 3: "NO-CRISIS SCENARIO" WITH STABLE DM-DOLLAR EXCHANGE RATE (1)

	GDP (2)		Inflation (3)		Current account (mill. $)		Effective exch. rate (2)	
	A	B	A	B	A	B	A	B
France								
1992	0.24	-0.02	0.22	-0.01	842	-16	-1.64	0.18
1993	0.25	-0.37	0.24	-0.34	2412	-1346	-0.39	2.12
1994	0.07	-0.43	-0.08	-0.35	447	-3402	-	0.79
1995	0.02	-0.11	-0.01	0.13	-211	-329	-	-
1996	-0.03	-0.03	-	-0.01	-263	591	-	-
1997	-0.07	0.06	-	-0.01	-330	705	-	-
Belgium								
1992	0.44	-0.10	n.a.	n.a.	-303	-66	-1.35	0.15
1993	-0.04	-0.49	n.a.	n.a.	-322	811	-0.33	1.74
1994	0.13	-0.06	n.a.	n.a.	599	331	-	0.65
1995	-0.08	-0.18	n.a.	n.a.	-53	-1134	-	-
1996	-0.07	0.11	n.a.	n.a.	-134	-149	-	-
1997	-0.06	0.10	n.a.	n.a.	-107	-2	-	-
Germany								
1992	0.61	-0.03	0.11	-	125	259	-2.74	0.30
1993	0.50	-0.84	0.39	-0.20	5543	-2548	-0.65	3.59
1994	-0.14	-0.76	0.14	-0.54	1159	-7457	-	1.34
1995	-0.18	0.23	-0.05	-0.17	-121	-1126	-	-
1996	-0.17	0.25	-0.07	0.08	-35	794	-	-
1997	-0.17	0.23	-0.08	0.10	226	717	-	-
Netherlands								
1992	0.64	-0.09	n.a.	n.a.	1617	-269	-1.49	0.16
1993	-0.11	-0.73	n.a.	n.a.	-649	-2054	-0.35	1.93
1994	0.04	0.07	n.a.	n.a.	-504	666	-	0.72
1995	0.01	-0.09	n.a.	n.a.	-474	642	-	-
1996	-0.04	-0.01	n.a.	n.a.	-424	688	-	-
1997	-0.06	0.07	n.a.	n.a.	-362	639	-	-

Table 4

EXERCISE 4: "CRISIS SCENARIO" WITH 1992 MODEL (1)

	GDP (2)	Domestic demand (2)	Employment (1000s)	Inflation (3)	Current account (mill. $)	Export volume (2)	Imports volume (2)	Long-term rate (3)	Short-term rate (3)	Effective exch.rate (2)
France										
1992	-0.03	-0.07	-0.01	-	388.8	-0.01	-0.19	0.55	0.77	-0.03
1993	-0.23	-0.44	-8.02	-0.01	1165.8	0.01	-0.94	0.49	1.18	-0.95
1994	-0.17	-0.41	-20.64	0.09	2946.2	0.06	-0.68	0.07	0.23	-
1995	-0.20	-0.33	-29.10	-0.04	1539.8	-0.04	-0.46	0.10	-	-
1996	-0.15	-0.21	-33.20	-0.02	837.9	0.01	-0.18	0.02	-	-
1997	-0.09	-0.11	-30.50	-0.06	427.1	-	-0.01	-	-	-
Belgium										
1992	n.a.	n.a.	n.a.	n.a.	-139.6	-0.04	-0.01	n.a.	n.a.	-
1993	n.a.	n.a.	n.a.	n.a.	-171.7	-0.27	-0.07	n.a.	n.a.	-1.07
1994	n.a.	n.a.	n.a.	n.a.	-173.1	-0.22	-0.09	n.a.	n.a.	-
1995	n.a.	n.a.	n.a.	n.a.	-47.0	-0.11	-0.07	n.a.	n.a.	-
1996	n.a.	n.a.	n.a.	n.a.	91.1	-0.02	-0.03	n.a.	n.a.	-
1997	n.a.	n.a.	n.a.	n.a.	149.9	-0.04	-	n.a.	n.a.	-
Germany										
1992	-0.01	-0.01	-0.57	-	-72.2	-0.03	-0.03	-	-	-
1993	-0.07	-0.05	-7.58	-0.01	-22.0	-0.19	-0.16	-	-	0.29
1994	-0.06	-0.04	-12.24	-0.02	-373.0	-0.19	-0.13	-	-	-
1995	-0.03	-0.02	-10.22	-0.02	-98.1	-0.09	-0.07	-	-	-
1996	-0.01	-0.01	-7.50	-	185.9	-0.02	-0.03	-	-	-
1997	-	-	-4.64	-	323.8	-	-	-	-	-
Netherlands										
1992	n.a.	n.a.	n.a.	n.a.	-121.4	-0.02	-0.01	n.a.	n.a.	-
1993	n.a.	n.a.	n.a.	n.a.	-118.5	-0.15	-0.07	n.a.	n.a.	0.29
1994	n.a.	n.a.	n.a.	n.a	-125.1	-0.16	-0.09	n.a.	n.a.	-
1995	n.a.	n.a.	n.a.	n.a.	-32.1	-0.09	-0.06	n.a.	n.a.	-
1996	n.a.	n.a.	n.a.	n.a.	64.4	-0.03	-0.02	n.a.	n.a.	-
1997	n.a.	n.a.	n.a.	n.a.	117.3	0.01	-	n.a.	n.a.	-

(1) Difference from the baseline ("no-crisis scenario").
(2) Percentage difference.
(3) Difference in percentage points.

Table 5

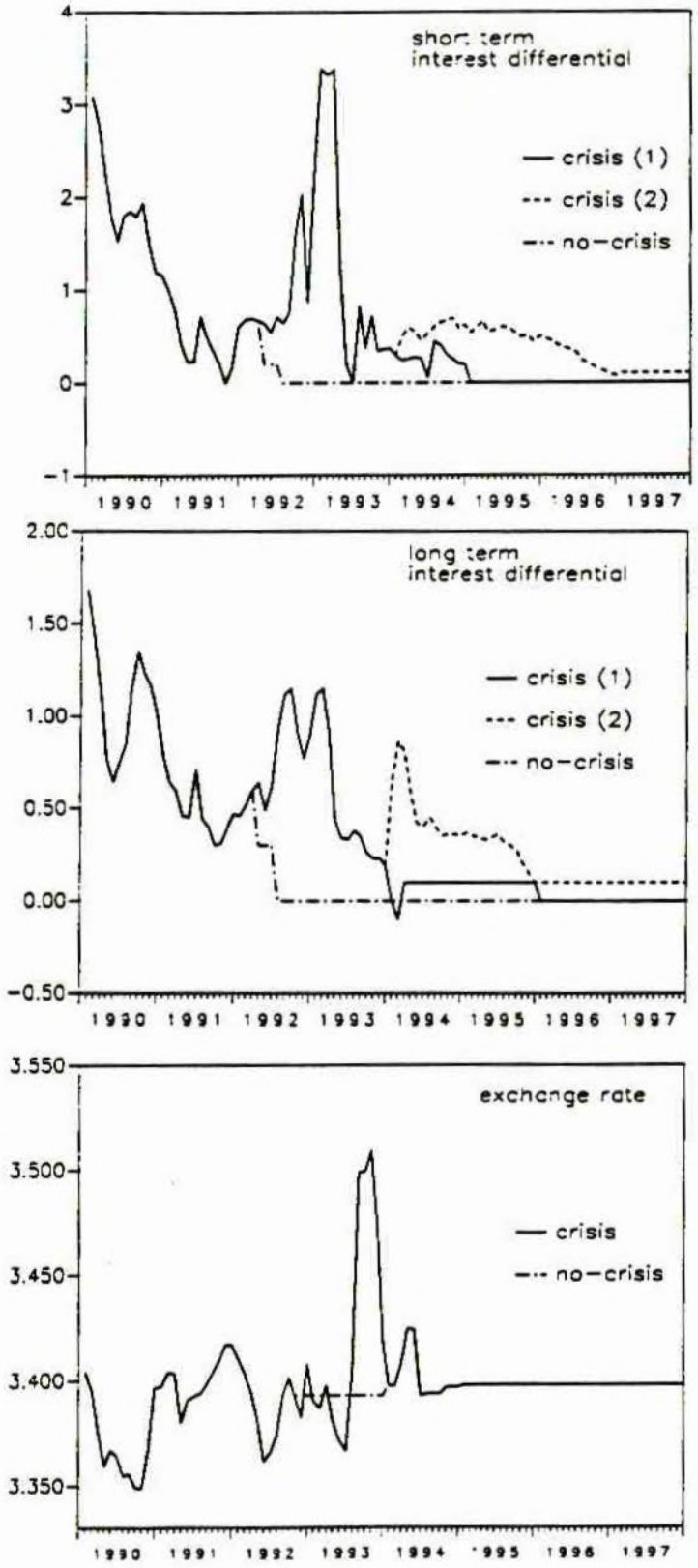
EXERCISE 5: "NO-CRISIS SCENARIO" WITH 1994 MODEL (1)

	GDP (2)	Domestic demand (2)	Employ-ment (1000s)	Inflation (3)	Current account (mill.$)	Export volume (2)	Import volume (2)	Long-term rate (3)	Short-term rate (3)	Effective exch.rate (2)
France										
1992	0.03	0.08	0.17	-	-410	-	0.18	-0.55	-0.77	0.03
1993	0.23	0.49	8.04	-0.04	-1417	-0.02	0.92	-0.49	-1.18	0.87
1994	0.28	0.61	20.34	-0.09	-3122	-0.06	1.21	-0.37	-0.57	-
1995	0.41	0.65	35.15	0.06	-2348	0.14	0.97	-0.29	-0.55	-
1996	0.38	0.52	42.07	0.03	-1501	0.11	0.56	-0.09	-0.27	-
1997	0.29	0.40	38.18	0.05	-1045	0.06	0.33	-0.10	-0.10	-
Belgium										
1992	0.02	n.a.	0.01	n.a.	27	0.03	-	-	-	-
1993	0.05	n.a.	0.34	n.a.	-114	0.06	0.17	-0.41	-1.04	1.07
1994	0.36	n.a.	0.90	n.a.	-298	0.27	0.59	-0.65	-1.32	-
1995	0.25	n.a.	2.3	n.a.	-548	0.30	0.47	-0.45	-0.66	-
1996	0.17	n.a.	2.67	n.a.	-480	0.17	0.36	-0.13	-0.24	-
1997	0.11	n.a.	2.42	n.a.	-311	0.09	0.25	-0.10	-0.10	-
Germany										
1992	-	-	0.2	-	54.9	0.01	0.01	-	-	-
1993	0.04	0.03	3.4	-	162.8	0.12	0.06	-	-	-0.25
1994	0.07	0.04	8.3	0.02	624.8	0.22	0.11	-	-	-
1995	0.06	0.04	9.9	0.02	602.2	0.19	0.12	-	-	-
1996	0.04	0.03	8.1	0.02	405.8	0.13	0.10	-	-	-
1997	0.03	0.02	4.7	0.02	211.6	0.06	0.08	-	-	-
Netherlands										
1992	0.01	n.a.	-	n.a.	23	0.02	-	-	-	-
1993	0.03	n.a.	0.27	n.a.	107	0.16	0.01	-	-	-0.3
1994	0.07	n.a.	0.66	n.a	213	0.25	0.11	-	-	-
1995	0.08	n.a.	1.39	n.a.	195	0.22	0.13	-	-	-
1996	0.06	n.a.	1.73	n.a.	105	0.16	0.11	-	-	-
1997	0.05	n.a.	1.79	n.a.	33	0.09	0.09	-	-	-

(1) Difference from the baseline ("crisis scenario").
(2) Percentage difference.
(3) Difference in percentage points.

Fig. 1

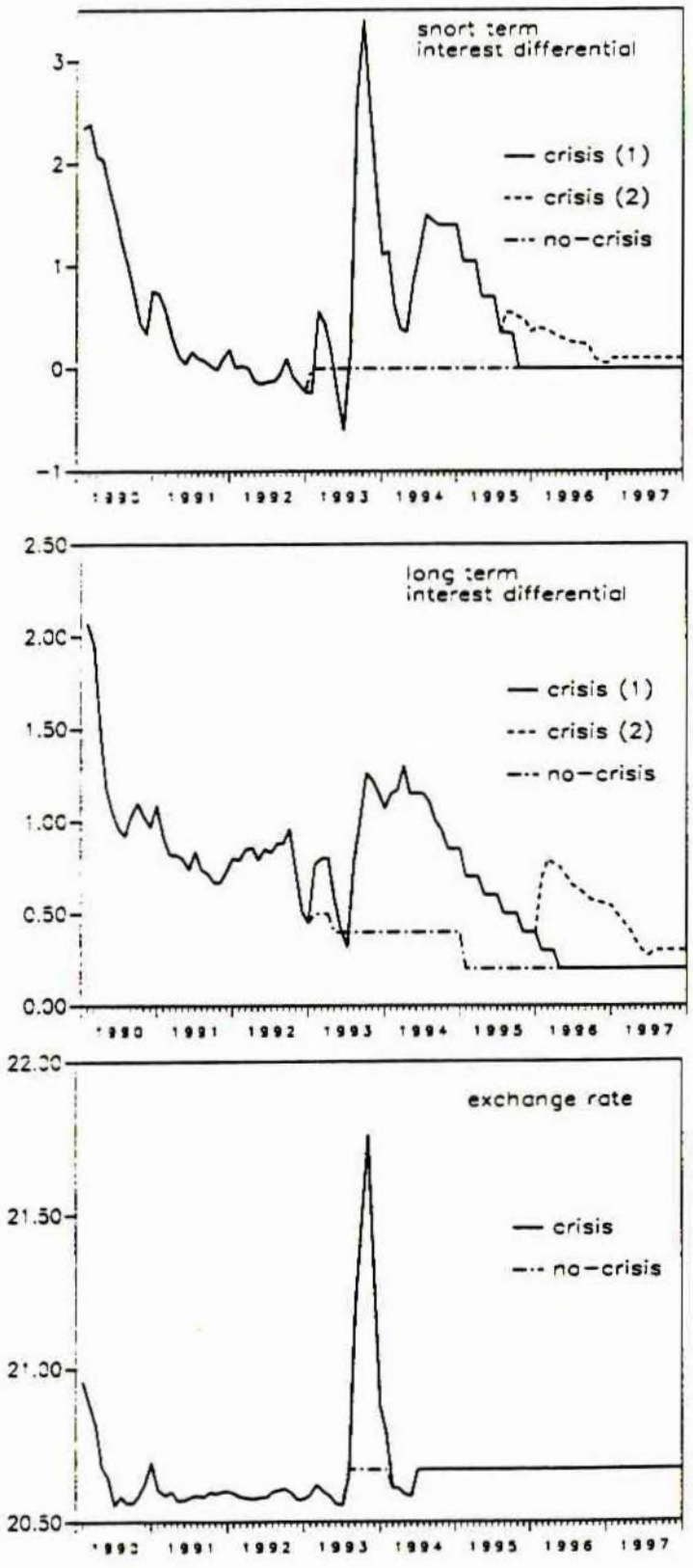
FRENCH FRANC-DEUTSCHE MARK INTEREST DIFFERENTIALS AND THE EXCHANGE RATE



(1) Feb. 1994 baseline. (2) Updated baseline.

Fig. 2

BELGIAN FRANC-DEUTSCHE MARK INTEREST DIFFERENTIALS AND THE EXCHANGE RATE



(1) Feb. 1994 baseline. (2) Updated baseline.

Fig. 3

DEUTSCHE MARK-US DOLLAR EXCHANGE RATE

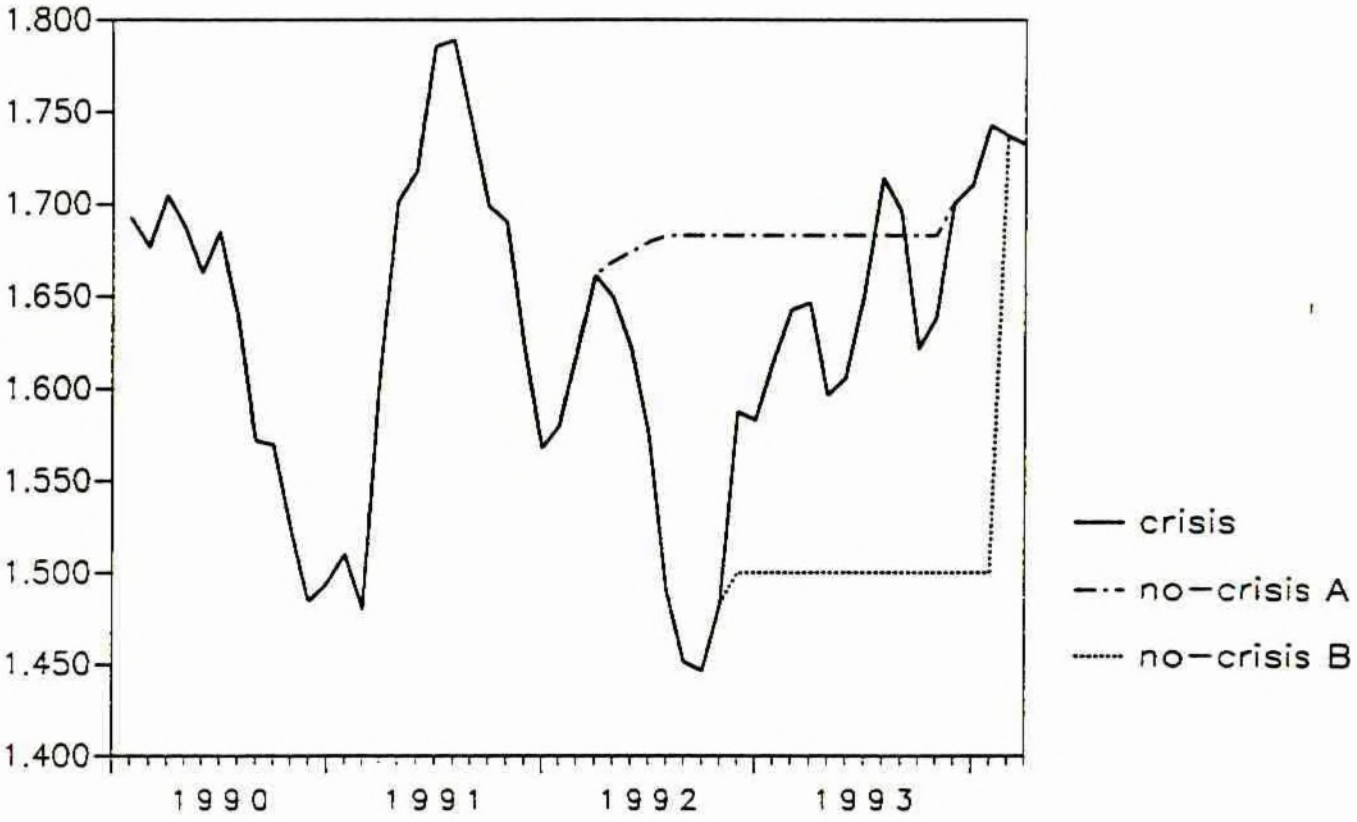
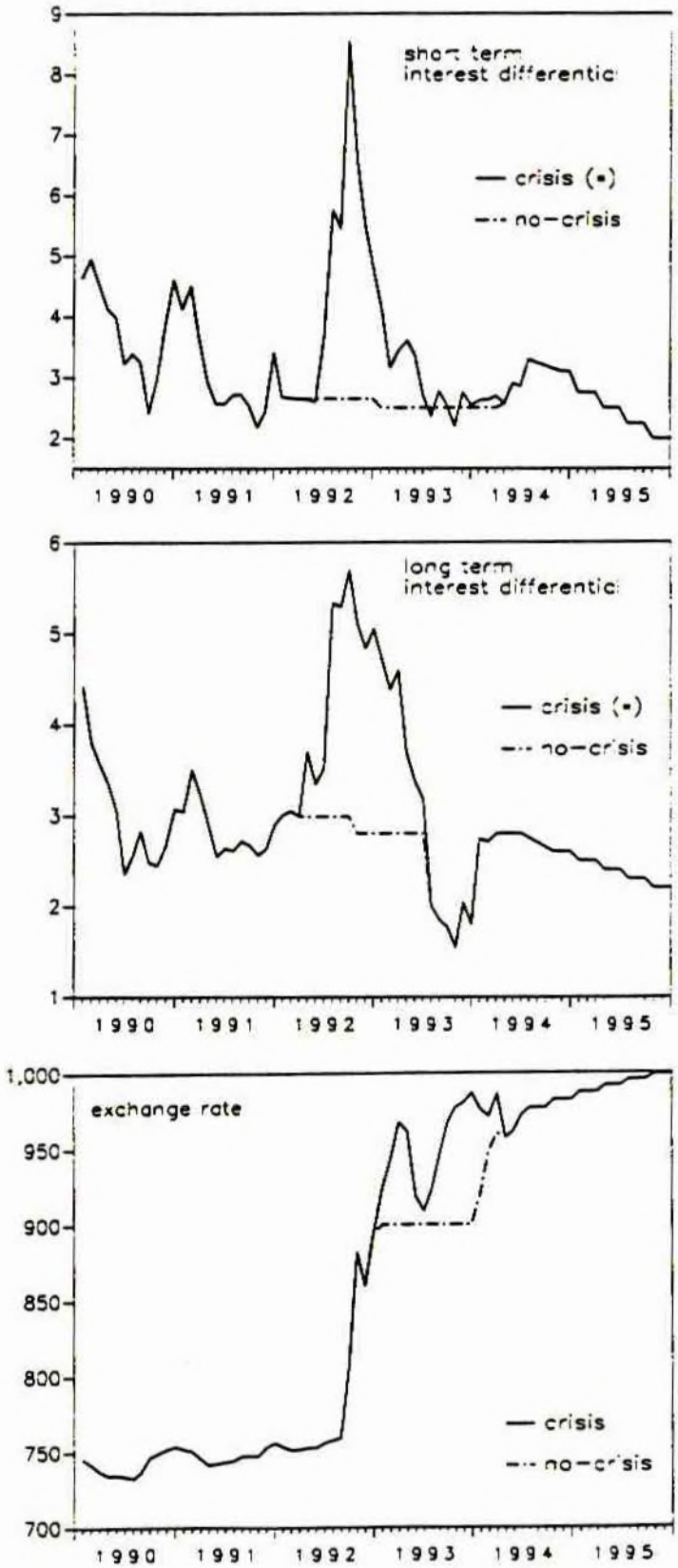


Fig. 4

ITALIAN LIRA-DEUTSCHE MARK INTEREST DIFFERENTIALS AND THE EXCHANGE RATE



APPENDIX

The structure of GEM

Here we provide a brief description of the structure of the GEM used in our simulation exercises. As already mentioned, we use the February 1994 version, with one modification to the equation for the stock of foreign assets, which did not perform consistently with the others in the simulations, as discussed below. The main equations for the major countries can be grouped into 8 blocks: a) trade and the balance of payments; b) national income, output and employment; c) wages, prices and costs; d) personal income; e) financial sector; f) public sector; g) wealth and debt; h) exchange rates and competitiveness.[1]

a) Trade and the balance of payments

The current account balance identity, with variables expressed in dollars, is given by:

$$CBV = XGV - MGV + XSER - MSER + IPDC - IPDD + BPT$$

where CBV : current account balance
XGV : exports of goods
MGV : imports of goods
XSER : exports of non-factor services
MSER : imports of non-factor services
IPDC : property income credits
IPDD : property income debits
BTP : unrequited transfers

(1) Trade volumes

1 Users can conduct simulations by making assumptions about exogenous variables or by modifying the residuals of the equations for endogenous variables in order to determine new paths for them.

The volumes of exports and imports are determined by foreign and domestic demands and by competitiveness as measured by relative prices or relative costs. The equations have the following general forms:

$$XGI = f\ (S,\ RPX,\ RULT)$$
$$MGI = g\ (TFE,\ RPM,\ RULT)$$

where XGI : exports of goods (volumes)
MGI : imports of goods (volumes)
S : import demand in the country's export markets
TFE : domestic total final expenditure
RPX : relative export prices
RPM : relative import prices
RULT: relative unit labour costs

(2) Trade prices

Each economy has equations for export and import prices of manufactured goods and of all goods. Manufactured export prices depend on domestic wholesale prices, world price of manufactured exports and the dollar exchange rate. Manufactured import prices depend on the export prices in all the other countries. Overall (import and export) prices depend on manufactured goods trade prices and on the importance of oil and commodity prices in each country's trade.

(3) Invisibles

Invisibles are disaggregated into non-factor services, returns on foreign assets and on domestic assets held by foreign residents and unrequited transfers. Exports and imports of services are determined by foreign and domestic income and by relative prices. The stocks of assets and

liabilities are posited to grow in line with each other and with nominal GDP, as a constant foreign assets to income ratio is assumed in equilibrium.

b) National income, output and employment

(1) National income

The national income identity at constant prices is written as follows:

$$Y = C + IB + IH + G + DS + XGI - MGI$$

where Y : national income
C : consumers'expenditure
IB : business investment
IH : residential construction
G : government spending
DS : stockbuilding

The determination of the volumes of exports and imports has been discussed above. The remaining components of national income are determined as follows:

$$C = f\ (RPDI, R3M, CED, RW)$$
$$IB = h\ (Y, LR, CED)$$
$$IH = k\ (Y, R3M, CED)$$
$$DS = l\ (Y, R3M, CED)$$

where RPDI: real personal disposable income
R3M : 3-month interest rate
LR : long-term rate
CED : consumer prices
RW : real wealth

Government expenditure is determined by policy.

(2) Output and employment

Industrial production depends on GDP and a time trend. Total employment is assumed to grow with output, but there are a negative real wage effect and a positive time trend reflecting neutral technical progress. Manufacturing employment depends on industrial production.

c) Wages, prices and costs

(1) Earnings and costs

The model contains equations for both total compensation of all employees and an index of average earnings in manufacturing. Total compensation depends on output prices, unemployment, employees in employment, GDP, productivity, expected prices and the index of average earnings in manufacturing; the index depends on employees in employment and total compensation. Trend unit labour costs are a function of average earnings in manufacturing and an estimate of the relevant level of productivity growth.

(2) Prices

Four price indices are available for the major eight economies: wholesale prices, the GDP deflator, the consumers' expenditure deflator and the consumer price index.

d) Personal income

The personal income identity is:

PDI = COMP + TRAN + OPI - TAX

where COMP : total compensation of all employees
TRAN : transfers to the personal sector
OPI : other personal income
TAX : income tax

Transfers depend on unemployment and on prices. Other personal income is a function of wealth and short and long-term interest rates. Real personal disposable income is defined by using the consumers' expenditure deflator.

e) Financial sector

The money demand functions have the standard form:

M1 = f (Y, CED, R3M)
M3 = g (Y, CPI, R3M)

where M1 : narrow money
M3 : broad money
CPI: consumer price index
CED: consumers' expenditure deflator

f) Public sector

For the major seven economies and Spain the government deficit is defined as:

BUD = TAX + MTAX - (GC*PY/100) - (GI*PY/100) - TRAN-
GIP

where BUD : government deficit
MTAX: miscellaneous taxes (including indirect taxes)
GC : government consumption
PY : GDP deflator
GI : government investment
GIP : government interest payments

g) Wealth and debt

Net financial wealth is defined as:

NW = MASC + DEBTP + (NA/100) - LIABS

where NW : net financial wealth
MASC : miscellaneous assets of the personal sector
DEBTP: public debt held by the personal sector
NA : net foreign assets
LIABS: personal sector liabilities

The existing stock of government bonds is revalued each period in line with changes in the long interest rates.

Foreign assets change either because the current account is not in balance or because of changes in the valuation of foreign assets and liabilities. The second effect is captured through the following ad hoc structure: gross foreign assets are revalued by a weighted average of the changes in equity prices in the other major economies and foreign liabilities are revalued by the change in domestic equity prices; the fact that not all foreign assets have to be revalued (e.g. government debt held by foreign residents)

is also taken into account. However, this structure often leads to an inconsistency in our simulations. More precisely, net foreign assets (depending on gross assets) were found to be decreasing at times when high current account surpluses occurred. We have therefore simplified the equation for net foreign assets in the countries hit by the financial shock and constructed a new series by assuming the net acquisition of foreign assets to equal the current account balance. The new variable has then been exogenised in the simulation.

The miscellaneous assets category mainly contains equities and is therefore revalued in line with equity prices.

h) Exchange rates and competitiveness

The model contains the dollar exchange rates of each major country. Each country also has a nominal effective exchange rate and a real exchange rate adjusted for consumer prices.

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