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VULNERABILITY OF FIXED EXCHANGE RATE REGIMES: THE ROLE OF ECONOMIC FUNDAMENTALS

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INTRODUCTION

Fixed exchange rate regimes are vulnerable to periodic crises, which can lead to devaluations or regime shifts. From a policy perspective, an important question is whether changes in exchange rate arrangements are caused by a deterioration of identifiable economic fundamentals (*i e.* a policy that is in some sense inconsistent with the exchange rate arrangement) or by speculative pressure unrelated to policy imbalances

This paper attempts to assess the causes of exchange rate devaluations and regime shifts in 12 OECD countries over the period 1979-95. The sample comprises 63 actual "events" defined as devaluations or shifts of regime. The analysis presented here suggests that changes in several fundamental macroeconomic variables have played an important role in triggering devaluations or regime shifts in OECD countries. But the emergence of exchange rate pressure is also sensitive to changes in economic fundamentals, which are traditionally not thought of as being a direct determinant of "equilibrium exchange rates", such as changes in the rate of unemployment. Moreover, compared with the late 1970s/early 1980s, smaller deteriorations in economic fundamentals can result in exchange rate pressure. In some recent crises, it cannot be ruled out that speculative pressures unrelated to identifiable policy imbalances may have contributed to the crises.

Key elements of the theoretical literature and empirical background for the subsequent econometric analysis are summarised in the first section. In the following section, a non-linear estimation technique (probit) is used to see whether there is a relationship between the deterioration of a set of key macroeconomic variables and the timing of actual devaluations or the abandonment of fixed exchange rate regimes. Given that a reasonable fit is obtained between devaluations or regime changes and changes in macroeconomic variables, it could be inferred that episodes not explained by the model could have resulted from speculative pressure unrelated to fundamentals Finally, the main results and some policy conclusions are summarised

THE CAUSES OF EXCHANGE RATE CRISES

Fundamental factors

There is a fairly well-established theoretical literature concerning the role of macroeconomic fundamentals for currency crises in fixed exchange rate regimes. Initial contributions stressed the role of deteriorating economic fundamentals prior to an attack [1] These models (and their variants) predict that actual devaluations/ regime shifts are preceded by monetary and fiscal imbalances that are incompatible with the exchange rate setting Among the variables indicating imbalances are: increasing interest rate differentials, declining international reserves, an overvaluation of the domestic currency, an increase in budget deficits financed by domestic credit creation, and a large current account deficit While not traditionally viewed as a direct determinant of "equilibrium exchange rates", high and increasing rates of unemployment may also be important as market participants anticipate the authorities' temptation to stimulate economic activity by devaluing Furthermore, devaluations are more likely in periods of sluggish economic development

If the fundamentals of the economy remain inconsistent with the exchange rate peg, an adjustment of the fixed exchange rate or a collapse of the regime will almost inevitably occur. Although authorities may try to defend the peg with various measures *(e.g.* by raising short-term interest rates, intervening in foreign exchange markets or enforcing capital controls) they typically only buy time Private agents anticipate that a devaluation will eventually have to take place To avoid the windfall capital loss, or to reap a windfall capital gain at the time of the devaluation or regime switch, private agents have an incentive to attack the peg and deplete the authorities' reserves before the authorities have run out of reserves and the peg is abandoned. Under these circumstances the effect of speculative activity is to bring forward the date of the currency depreciation In this view, a collapse of the exchange rate can only be avoided by bringing fundamentals in line with the current peg prior to the threat of a depletion of reserves

Self-fulfilling expectations

In contrast to the traditional explanations of currency crises and speculative attacks, more recent theoretical research has focused on circumstances, where, prior to the attack, the authorities are following sound monetary and fiscal policies that are consistent with the prevailing level of the exchange rate In this set-up, self-fulfilling expectations, which may for example arise from misperceptions about the development of economic fundamentals or political uncertainties, are at the root of currency crises Following an attack it may be optimal for the authorities to abandon their original policy and thus validate the market behaviour

Table 1. **Exchange rate crises: stylised survey of selected empirical findings**

Author(s)	Country and time period	Methodology and results
	Developing countries	
Blanco and Garber (1986)	Mexico 1973-1982	Estimation of small open economy model Development of domestic monetary conditions is important
Cumby and van Wijnbergen (1989)	Argentina 1979-1981	Estimation of small open economy model with uncertainty about the level of foreign reserves Large domestic credit growth undermined confidence in peg
Edwards (1989, 1992)	Selected developing countries 1954-71, 1962-82	Comparison of macroeconomic variables in countries that faced exchange rate crises to those of non-devaluation countries Prior to devaluation hscal indicators deteriorated. real exchange rate became overvalued and foreign reserves declined
Klein and Marion (1994)	17-mainly Latin American countries 1957-1991	Political economy model Probability of devaluation increases with size of overvaluation, declining level of foreign assets and openness of the economy
Goldberg (1994)	Mexico 1980-1986	Small open economy model Incompatible monetary and fiscal conditions triggered the crises
Agénor and Masson (1995)	Mexico 1994	Estimation of credibility model Some fundamentals (real exchange rate, current account) had deteriorated prior to the crisis However, markets appear to have underestimated the risk of devaluation
Frankel and Rose (1996)	105 developing countries 1971-1992	Estimation of pooled probit model Crashes tend to occur when FDI inflows dry up, reserves decline, domestic credit growth is high, the real exchange rate becomes overvalued and Northern interest rates rise
	Industrialised countries	
Frankel and Phillips (1992)	ERM member countries 1987-1991	Assessment of the credibility of EMS target zones by using survey data on forward exchange rates For most countries target zones have been less than fully credible
Eichengreen *et al* (1994)	22 industrialised countries 1967-1992	comparison of macroeconomic variables in crises and non-crises periods In ERM countries development of fundamentals was important for realignments In non-ERM countries expectation shifts were sometimes larger
Otker and Pazarbasioglu (1994)	5 European countries 1979-1993	Country-specihc probit model Fundamentals and speculative factors matter
Malz (1995)	France and the United Kingdom 1992-1993	Estimation of probability of realignment using option prices Expectations were highly unstable during the ERM crisis

With self-confirming beliefs, expectations about the development of fundamental factors such as high rates of unemployment may become increasingly important as market participants realise the authorities' hesitation to defend the existing peg by means that will put further upward pressure on unemployment, such as rising domestic interest rates. Shifts in market expectations about the authorities' unemployment objective and the resulting interaction between market participants and the authorities may lead to an attack, which can trigger a devaluation that would not have occurred under different expectations.*

Existing empirical findings

In spite of the relatively large number of actual exchange rate crises, empirical analyses of them are still limited Table 1 gives an overview of the main empirical methods and findings. A number of authors have found that deteriorating macroeconomic fundamentals have indeed played a key role In some cases, however, exchange rate crises appeared to have been more severe and pronounced than the development of fundamentals would have suggested. Mixed results have in particular been obtained for developed countries. It has been suggested that some of the recent exchange rate crises cannot be explained solely on the basis of the development of fundamental variables. This issue will be addressed below by focusing on devaluations and shifts of regime in 12 OECD countries since the late 1970s.

EMPIRICAL ANALYSIS FOR I2 OECD COUNTRIES

Data set and methodology

The analysis in this section provides empirical estimates of the role of economic fundamentals as causes for devaluations/exchange rate crises in France, Italy, the United Kingdom, Belgium, Denmark, Ireland, Mexico, the Netherlands, Norway, Portugal, Spain and Sweden over the period 1979-1995.[3] Specifically, the work seeks to:

- identify the variables which play a crucial role in determining the likelihood of crises;
- measure the degree to which economic fundamentals contribute to the emergence of crises; and
- give some measure of the severity of the crisis.

As the main focus of the analysis is to explain the occurrence of actual events, *i.e.* devaluations or regime shifts, a standard probit model in which the dependent variable represents the choice between the maintenance of the current exchange rate or a change (by realignment, floating) is used This binary dependent variable matches the devaluations of the central parity vis-8-vis the anchor currency or *vis-à-vis* the currency basket. It is set to one in the case of a devaluation and to zero

otherwise. The 1992/1993 European crises including the widening of the fluctuation margins in August 1993 are treated in the same way as the earlier devaluations. Although the binary dependent variable refers directly to actual devaluations/ regime shifts, periods in which fundamental pressure for a devaluation existed but no actual devaluation occurred will also be identified.[4] As the actual number of devaluations for each country is relatively small, data are pooled across both countries and time [5]

The analysis proceeds in three steps In the first, fundamental macroeconomic factors, which have played a crucial role in triggering exchange rate crises, are identified. Second, a weighted average of the significant fundamentals is calculated. This measure may be interpreted as an index of macroeconomic performance, from which probabilities of devaluation can be derived.[6] Third, these probabilities, combined with the hypothesis of uncovered interest rate parity, are used to calculate the predicted size of the devaluation which is then compared with actual devaluations

As possible determinants for exchange rate crises the study includes those fundamental variables that have figured prominently in the theoretical literature. These measures of the macroeconomic environment prior to the crisis are qualitatively evaluated in Table 2, which suggests that at least some economic fundamentals may have been poor in the period prior to a devaluation/crisis. In the empirical work here, all explanatory variables are lagged one quarter so that probabilities of exchange rate crises in the current quarter are predicted by developments up to and including the previous quarter.[7]

A *priori*, the probability of a realignment would be expected to increase if the real exchange rate appreciates (which could be due to spillovers resulting from a depreciation of an important trading partner's currency}, the unemployment rate rises, the interest rate differential increases, and reserves and industrial production decline. But a *priori* the expected signs on domestic credit growth, the budget deficit and the current account are ambiguous To the extent that rising domestic credit growth is associated with an investment upturn and a stronger economy it may be accompanied by upward pressure on the currency. However, if domestic credit growth starts rising excessively fast it may signal emerging inflationary pressures. Similarly, on the one hand, an expansionary fiscal policy may put upward pressure on domestic interest rates, leading to an increase in capital inflows (reflected in a deteriorating current account) and pressure for an appreciation of the currency. On the other hand, lax fiscal policies may also lead to an increase in the risk premium in interest rates, if the initial debt level is already perceived as being high and unsustainable Under those circumstances capital outflows may occur. Expansionary fiscal policies and large current account deficits would then increase the probability of a depreciation. Given the current high public sector indebtedness of most countries, a rise in the fiscal deficit would likely have the latter effect The

Table 2. **Macroeconomic environment in the quarter prior to the crisis'**

	Devaluation/ Crisis	Change in real exchange rate[2]	Change in reserves2	Budget deficit[3]	Current account deficit[3]	Domestic credit growth[3]	Change in nernployrnent rate[4]	Change in industrial production[4]
France	198104			X		X	X	
	198202		XX	X		X	X	
	1983Q1		XXX	X	X	X		
	198602	XX		X				
	I99303	X		XX			X	X
Italy	198101	X		XX	X	XX		
	198104			XXX		X		
	198202			XXX	X		X	
	1983Q1	XX	XX	XXX		xx		XX
	1985Q3			XXX		XX		
	1992Q3		XXX	XX	X	XXX		
United Kingdom	199203			XX			X	
Belgium	198104		XXX	XXX	XX	X	XX	X
	1982Q1		XXX	XXX	XX	X	XX	
	199303	X		XX			X	XX
Denmark	198104			XX	X	X	XX	
	199303	X		X			X	XX
Ireland	1981Q4			XXX	XXX	XXX	XX	
	1983Q1	X		XXX	X	XXX	X	XX
	198603	XXX	XX	XXX	X	XX		
	19930l	XX	XXX	X		XXX		
	I99303			X				
Mexico	199404		XXX		XX	XXX		
Norway	1982Q3	XX			X			
	198602	X			X	X		XX
	199204	X		X				
Portugal	199204	XX		X	X	XX		
	1993Q2	XX	X	XX	X	XX		X
	199303		XXX	XX		XX	X	XX
Spain	1992Q3	X		X	X		X	X
	I99204			X	X		X	
	1993Q3		XXX	XX			X	XX
	19950l			XX		X		
Sweden	198103	XX		X	X	X		
	198204		X	XX	x	X		
	199204	X		XX	X		XX	
Legend:	x	2/57!	-10/–20%	2/5%	2/5%	10/15%	1/2%	–2/–5%
	xx	5/10%	-20/–30%	5/10%	5/10%	15/20%	2/5%	–5/–10%
	xxx	> 10%	< *–30%*	> 10%	> 10%	> 20%	> 5%	< –10%

1 Selected events, where actual devaluations were larger than 5 per cent and including the 1992/93 ERM crises
2 Year-on-year in per cent
3 As a percentage of nominal GDP
4 Year-on-year in percentage points

Source OECD, IMF, Datastrearn

general impact of a larger current account deficit remains, however, even more complex Theoretically, substantial current account deficits may be sustainable and beneficial if the imported capital is used to raise productive capacity which, in the long-run may be associated with enhanced competitiveness and upward pressure on the exchange rate If imported capital is, however, mainly used for consumption purposes doubts may arise as to the sustainability of the current account deficit. Furthermore, the sustainability of the current account deficit also depends on the maturity structure of the foreign debt As a result it is generally difficult to predict what the relationship between current account deficits and the probability of devaluation will be, although "excessively" large current account deficits *ceteris paribus* should tend to increase the probability of devaluation

In the following application of the probit model, three possible outcomes may be distinguished. First, the model gives a large probability that a devaluation occurs for periods in which an actual devaluation/regime shift took place. Second the probability of devaluation is high but no such change occurred. Third, the likelihood of a devaluation, as calculated by the model, remains low but a devaluation/regime shift occurred. In the first case, deteriorating fundamentals should have been at the root of the currency crises. The second case focuses on circumstances in which the authorities have been able to avoid a devaluation/regime shift despite pressure from fundamentals As long as the model is held to be reasonably robust, speculative pressure unrelated to the development of fundamentals may account for the third case.

Empirical results

Regression results from two samples are summarised in Table 3.[8] The first focuses on 11 European countries, and the second also includes the recent Mexican crisis. Figure 1 depicts the calculated probabilities From the list of fundamentals the current account was the only variable which was not significant and was dropped.[9] A possible explanation is the theoretical indeterminacy of the correct sign on this variable. Though theoretically also ambiguous large domestic credit growth as well as rising government deficits increase the probability of devaluation. The double digit growth rates of domestic credit observed in some cases prior to actual devaluations were apparently signalling monetary imbalances rather than only reflecting investment driven credit demand Given the current high level of government debts in many countries increasing budget deficits are a sign of weakness and may put downward pressure on the domestic currency. All other variables have the expected sign.

From the results, deteriorating economic fundamentals seem to have played a major role in currency crises. In many cases, the probabilities of devaluations increased prior to actual devaluations Also, these probabilities were generally

Table 3. **Pooled regression results for 12 OECD countries'**

	Regression 1 (11 countries)[2]		Regression 2 (12 countries)[3]	
	Coefficient	t-statistics	Coefficient	t-statistics
Constant	–2 100	–9.05***	–2 000	–9 14***
Change in reserves (– 1)	–0010	–2 73***	–0 011	–3 10***
Interest rate differential (–1)	0 092	2 40**	0 068	1 97**
Change in real exchange rate (–1)	0 052	2 89***	0 046	2 62***
Change in unemployment (–1)	0 190	2 32**	0 165	2 06**
Budget balance (–1)	–0 036	–1 86*	–0 043	–2 26**
Change in industrial production (–1)	–0 040	–2 23**	–0 037	–2 04**
Change in domestic credit (–1)	0 025	1.73*	0021	155
Number of devaluations		62		63
Log likelihood		–164 48		–169 63

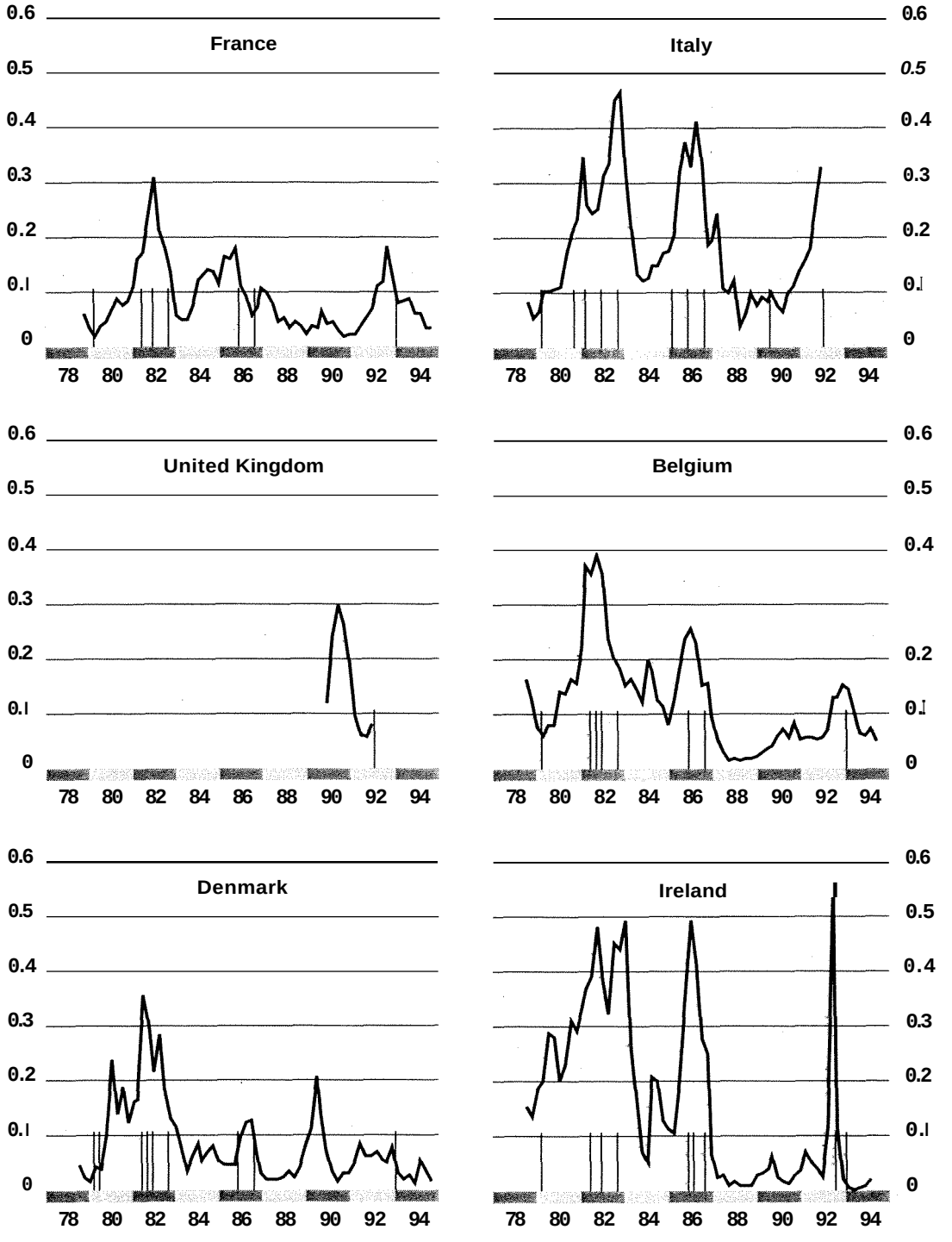
1 Pooled regression results for Belgium, Denmark. France. Ireland Italy, Spain. Mexico, the Netherlands, Norway, Portugal, Sweden and the United Kingdom
2 Excluding Mexico
3 Including Mexico
*, ** and *** denote the coefficient is signihcant at the 10, 5 and 1 per cent level respectively
Source OECD

higher in the early 1980s when actual devaluations were more frequent and large fundamental divergences existed across countries. Finally, Probabilities reached their highest level in countries with large "fundamental disequilibria", such as Italy, Ireland, Spain and Portugal.

In some cases, probabilities of devaluation had surged, although no actual devaluation occurred (e.g. Norway, 1987Q4/1988Q1; United Kingdom, 1990Q4/1991Q1; and Mexico, 1992Q4). However, in all these cases exchange rate pressure emerged. At the end of 1987, heavy intervention in support of the Norwegian Krona was necessary to prevent the exchange rate from dropping out of the target range [10] Similarly, Sterling had dropped near to the bottom of the ERM and remained there until mid-March 1991, as the persistence of underlying inflation had become apparent to market participants and the Deutschemark was strengthening against the dollar affecting ERM countries competitive positions.[11] In the case of Mexico, interest rate differentials had started to rise again in mid-1992 and the exchange rate had approached the bottom of the intervention band.[12]

The probability of devaluation also increased in a number of countries at around the time of German unification. The large fiscal shock led to a reversal in the German current account and put upward pressure on the Deutschemark. At the time governments opted (and managed) to keep parities unchanged until the ERM crisis in 1992/1993. Some evidence exists that the 1992/1993 crises occurred at a time when fundamentals had slightly deteriorated in some European countries. But the

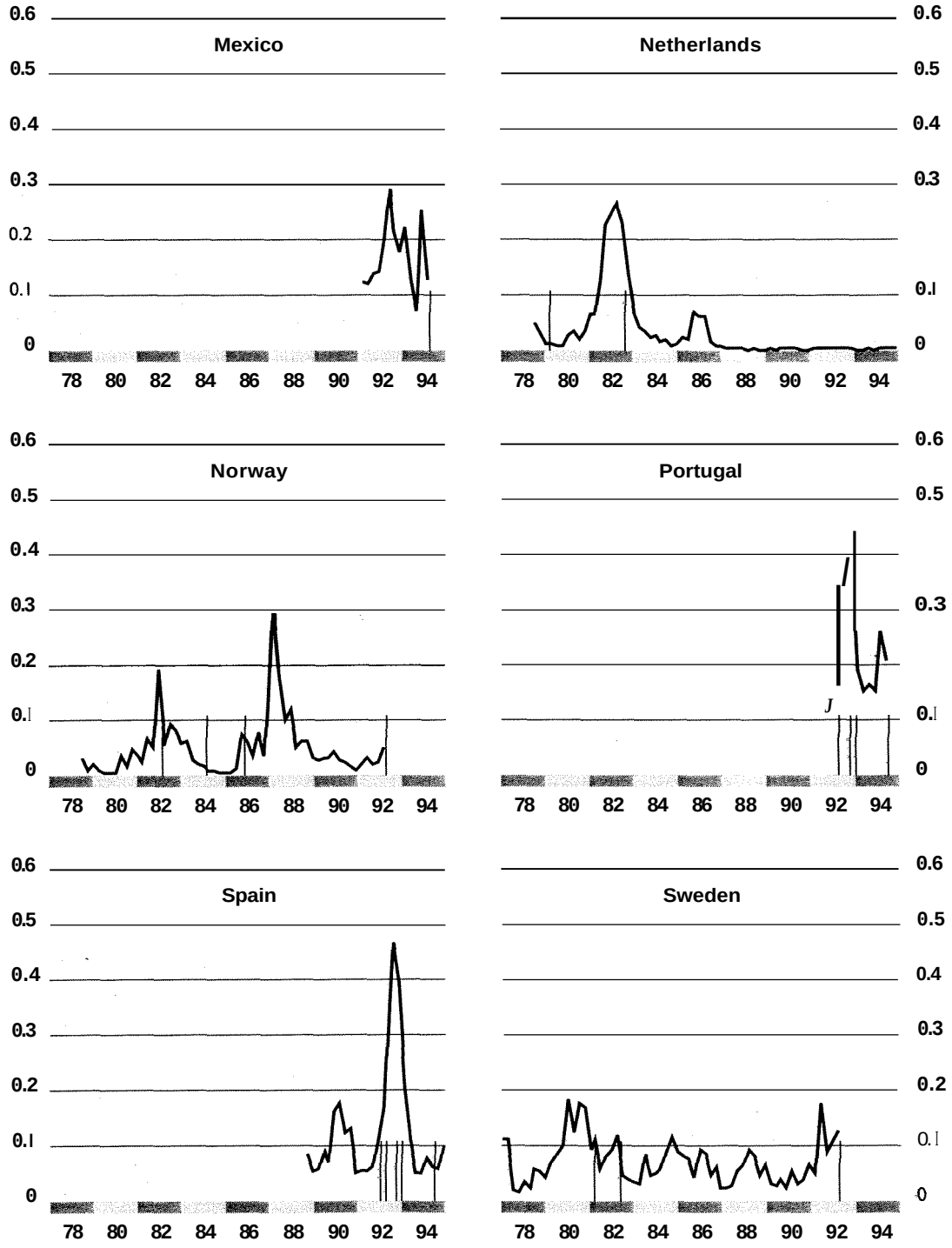
Figure 1. ***Probabilities of realignments/exchange rate crises'***



1. Vertical lines indicate periods of realignments/exchange rate crises.

Source: **OECD.**

Figure 1. *(cont.)* ***Probabilities of realignments/exchange rate crises'***



1. Vertical lines indicate periods of realignments/exchange rate crises.

Source: OECD.

deterioration of fundamentals does not seem to have been large enough to explain the magnitude of the crisis.

To test this, the probability of devaluation can be used to make back-of-the-envelope calculations of the predicted size of the devaluation.[13] If the predicted size of the devaluation is small compared with the actual devaluation it could indicate that the crisis cannot be explained solely on the basis of fundamentals Table 4 compares the predicted devaluations calculated on the basis of the probit model with actual outcomes for large devaluations (defined as more than 5 per cent).

Fairly large gaps between the size of predicted and actual devaluations exist in general during the 1992-1993 crises. Similarly, the predicted devaluation in Mexico was less than half the size of the actual devaluation Although in ail these cases some fundamentals had deteriorated, the actual devaluation appears to be substantially greater than implied by this deterioration Speculative pressures, based in part on concerns that fundamentals would worsen further as well as the handling of the crises may have increased their severity.

There were only a few cases when a devaluation or a regime change happened that the model failed to indicate: the probabilities of a devaluation were below 10 per cent in the United Kingdom (1992); in Denmark and Ireland (August 1993); in Norway (1986 and 1992); as well as in Spain (1995) Different factors may account for this For example, in the United Kingdom a deterioration of fundamentals had already taken place in the preceding quarters. Ireland had already a larger than predicted 10 per cent devaluation a couple of months prior to the August 1993 crisis. In the case of Norway, macroeconomic fundamentals do not appear to have deteriorated significantly prior to the 1992 crisis However, the short-term interest rate had increased sharply when the exchange rate crises had occurred in neighbouring countries Spill-over effects may have caused the Norwegian breakdown of the peg

Sensitivity analysis

The empirical results may be sensitive to the exact way in which devaluations/regime shifts are modelled and the statistical model itself may suffer from over-parameterisation In particular, high interest rate differentials and reserve losses may be symptoms rather than causes of exchange rate pressure. In addition, both variables may not only reflect fundamental factors but also factors unrelated to economic fundamentals. Omitting those two variables from the regression does not, however, change results qualitatively The remaining explanatory variables are all significant (see Table 5, regression 2a)

The results may also depend on the observation period, if the underlying relationship has changed over time Some indication of potential structural shifts

Table 4. **Predicted devaluations by the Probit model and actual devaluations compared]**

	Date	Predicted devaluation	Actual devaluation
France	198104	71	84
	I98202	49	101
	1983Q1	79	79
	I98602	56	60
	1993Q3	07	39
Italy	198101	95	62
	198104	45	84
	1982Q2	98	70
	1983Q1	63	79
	198503	134	82
	1992Q3	24	136
United Kingdom	1992Q3	N[2]	162
Belgium	1981Q4	21	54
	19820l	30	89
	I99303	03	50
Denmark	198104	97	54
	199303	N[2]	62
Ireland	198104	24	54
	1983Q1	34	89
	1986Q3	28	83
	I9930l	64	105
	I99303	N[2]	44
Mexico	199404	209	56.5
Norway	1982Q3	147	66
	I98602	N[2]	12.0
	199304	N[2]	45
Portugal	199204	65	62
	1993Q2	21	67
	199303	35	78
Spain	199203	62	51
	199204	56	6.2
	199303	30	53
	19950l	N[2]	73
Sweden	1981Q3	97	100
	I98204	112	160
	199204	104	187

a

1 For actual devaluations larger than 5 per cent (including the 1992/1993 crisis) Calculations are based on the probability of devaluation/regime shifts as calculated by the Probit model and the uncovered interest rate parity condition Let i^d denote the annualised short-term interest rate differential p the probability of devaluation and d the size of the devaluation if it occurs one gets on a quarterly basis (approximately) the following relationship $p \times d = (1 + i^d)^{1/4} - 1$ Actual devaluations refer to the change in the bilateral central parity *vis-à-vis* the Deutschemark and *vis-a-vis* the currency baskets for the Scandinavian countries Average changes are calculated from logarithmic differences In the case of regime shifts devaluation refers to the percentagechangc of an 8 week average starting 4 weeks before and after the crisis respectively

2 Probability < *10%*

Source OECD

Table 5. **Sensitivity analysis: pooled regression results for 12 OECD countries**[1]

	Regression 2a		Regression 2b[2]	
	Coefficient	t-statistics	Coefficient	t-statistic
Constant	−1 910	−10 82***	−2 784	-6 98***
Change in real exchange rate (−1)	0 038	2 35**	0 080	2 40**
Change in unemployment (−1)	0 223	2 86***	0 632	3 89***
Budget deficit (−1)	−0 044	−2 94***	−0 094	−2 85***
Change in domestic credit (−1)	0 038	3 30***	0 052	2 61***
Change in industrial production (−1)	−0 032	−1 80*	0 003	0 04
Number of devaluations	63		20	
Log likelihood	−177 24		−56 89	

1 Pooled regression results for Belgium Denmark France Ireland Italy Spain Mexico the Netherlands Norway Portugal Sweden and the United Kingdom Regression results excluding the interest rate differentials and the change in reserves

2 Observation periods starts in 198702 following the last realignment in the ERM in the 1980s

* ** and *** denote the coefficient is significant at the 10 5 and 1 per cent level respectively

Source OECD

may be obtained by comparing regression results based on the full sample period since the late 1970s with results focusing only on more recent devaluations. If only devaluations since the second half of 1987 are considered, the coefficient on industrial production is no longer significant and the absolute size of the remaining coefficients is somewhat larger (Table 5, regression 2b) The latter finding may hint at an increased sensitivity of financial markets to changes in economic fundamentals.

The regression results suggest that markets focus on a number of economic fundamentals rather than one specific fundamental factor. Generally, the relative importance of specific fundamentals is difficult to gauge as the effect of a change in one explanatory variable on the probability of devaluation depends on the development of all other explanatory variables. In order to shed some light on the effects of individual fundamentals and as probit coefficients are not easily interpretable, Table 6 reports for both observation periods the effects of a one unit change of the explanatory variables on the probability of devaluation, evaluated at the mean of the data for the 1990s. Noticeable here is the fact that the effect of a one unit change of the rate of unemployment has changed significantly. This suggests a general increase in the market's sensitivity to changes in unemployment which are generally higher than in the early 1980s.

Table 6. **Effects of fundamentals on the probability of devaluation'**

Using two different estimation periods

	(1979-1995)	(1987-1995)
Real effective exchange rate appreciation by 1 per cent	0.53	0 70
Drop in industrial production by 1 per cent	0.42	0.29[2]
Rise in unemployment rate by 1 percentage point	2.07	5 47
Increase in government deficit by 1 percentage point	0.49	0 65
Increase in domestic credit by 1 per cent	0 18	0 20

1 Effects of a 1 unit change in the regressors on the probability of devaluation (expressed in percentage points) evaluated at the mean of the data for the 1990s Estimates are based on two models The hrst model focuses on the whole time period while the second model only takes more recent devaluations into account

2 Not significant at the 10 per cent level

Source OECD

CONCLUSIONS

The purpose of this paper was to analyse the role of macroeconomic fundamentals in triggering devaluations and regime shifts in 12 OECD countries since the late 1970s. Results are based on pooled regression analyses The model is relatively simple and does not claim to capture all the aspects of currency crises. Nevertheless, a tentative conclusion appears to be that economic fundamentals have played a prominent role in determining the fate of fixed exchange rate regimes in OECD countries. The increase in the probability of devaluation prior to most actual devaluations/regime shifts supports the by now well-known view that the consistency of fiscal and monetary policies is a necessary condition for a successful exchange rate peg

However, prospects of devaluation also appear to be sensitive to changes in key domestic variables, not traditionally viewed as direct determinants of the appropriate level of the exchange rate ("equilibrium exchange rate"),such as changes in the rate of unemployment. In addition, compared with the late 1970s/early 1980s smaller deteriorations in fundamentals now appear to suffice to trigger a crisis Although fundamentals matter, it cannot be ruled out that a crisis will occur when most fundamentals are sound. The credibility of fixed exchange rate regimes largely depends upon perceptions about the soundness of policies in the future. Thus concerns about future policies, even if misplaced can increase the vulnerability of such regimes to pressures.

DATA SOURCES AND DEFINITIONS

Change in reserves: year-on-year percentage change of official reserves excluding gold (expressed in national currencies).

Interest rate differential: short-term interest rate differential with respect Germany and the United States (in the case of Mexico).

Change in domestic credit: year-on-year percentage change in domestic credit.

Change in real exchange rate: year-on-year percentage change in the real effective exchange rate.

Change in unemployment: year-on-year percentage point change in the unemployment rate.

Change in industrial production: year-on-year percentage change in industrial production.

Current account balance: current account balance as a percentage of nominal GDP.

Budget balance: general government financial balance as a percentage of nominal GDP.

Sources: OECD, IMF, Datastream.

NOTES

1. See: Krugman, Paul (1979), and Flood, Robert P. and Peter M. Garber *(1984).* For two recent surveys on this literature see: Agénor, Pierre-Richard *et al.,* (1992), and Blackburn, Keith and Martin Sola *(1993).*

2. See *e.g.* Obstfeld, Maurice *(1994, 1995).*

3. The observation period differs from country to country. In each case the whole period of the most recent adjustable peg exchange rate regime since the late 1970s is included. The sample size consists of *569* observations. Finland was not included because the present approach focuses on the usual developments of currency pegs, *i.e.* that countries either manage to keep their official parities unchanged or have to devalue *vis-a-vis* the anchor currency. The third option that a currency may also be revalued, as in the case of Finland in *1989,* is not considered.

4. For a more explicit analysis of speculative attacks that have been successfully warded off by the authorities, see Eichengreen, Barry, Andrew K. Rose and Charles Wyplosz (*1994).*

5. The approach is similar to the one of Frankel and Rose (1996), who analyse currency crashes in emerging markets. This procedure can be justified on the grounds that the group of European countries is relatively homogeneous. To test for non-homogeneity, country-specific dummies were employed in the regression results and found to be insignificant. Furthermore, two regression results are reported, one for 11 European countries and a second one including Mexico. One qualification, however, is necessary regarding the reliability of the estimates for predicting future regime changes. As the underlying relationships may change, results based on historical data may also be subject to larger margins of error (see e.g. Meese, Richard M., *1986,* and West, Kenneth D., 1988).

6. In a probit model the cumulative normal distribution function provides the appropriate transformation. As the underlying relationship is unknown and a number of cumulative probability functions converge to the cumulative normal distribution function in large samples, our choice should not severely restrict the analysis. Results were, for example, similar, when the cumulative logistic function was used (logit model).

7. A number of different specifications of variables were tested. In most cases simple year-on-year changes performed best. Nonetheless, there remains some uncertainty as to which set of variables market participants focus on.

8. Estimations include two dummies, a constant dummy for the first period of the ERM up to end *1986* and an interactive interest rate dummy for the same period to capture the effects of extensive capital controls.

9. In a similar analysis for currency crashes in 105 developing countries Frankel and Rose *(1996)* also found that the effects of the current account on the probability of a currency crash were not statistically significant.

10. See, OECD *(1988/1989) Economic Surveys, Norway.*

11. See, OECD *(1990/1991) Economic Surveys, United Kingdom.*

12. See, OECD (1995), *Economic Surveys, Mexico.*

13. Calculations are based on the uncovered interest rate parity condition. Let i^d denote the annualised short-term interest rate differential, p the probability of devaluation and d the size of the devaluation if it occurs. One gets on a quarterly basis (approximately) the following relationship: $p \times d = (1 + i^d)^{1/4} - 1$ which can be solved for d. The so calculated predicted size of the devaluation, if it occurs, should be interpreted with some care. As is well known, uncovered interest rate parity condition is based on a number of restrictive assumptions, *e.g.* no (constant) risk premia.

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