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Expected Devaluation and Economic Fundamentals

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Abstract

Recent incidents of exchange rate collapse have provoked interest in the extent to which such events are determined by economic fundamentals. This paper considers whether interest rate differentials are appropriate measures of the risk of devaluation and whether this measure of devaluation risk reflects the movements of variables which capture internal and external balance. The paper finds that interest rate differentials reflect devaluation risk but that movements in fundamental variables have only a weak effect on devaluation risk in France and Italy. The most significant influence on devaluation risk is the position of the currency in its band in that the lower is the exchange value of a currency within the band, the greater is the perceived risk of devaluation.

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Summary

The two episodes of exchange rate collapse within the Exchange Rate Mechanism (ERM) of the European Monetary System in September 1992 and August 1993 have kindled tremendous interest in understanding the causes of such forced parity changes. After a period of five years with fixed central parities, pressure built up during the summer of 1992 against the pound and lira which led to the suspension of both currencies from the ERM. At the beginning of August 1993, a communiqué was issued announcing the widening of the obligatory marginal intervention thresholds of the remaining participants in the ERM to ±15 percent around each central parity.

This paper addresses the question of whether--and if so, how--these episodes of exchange market pressure are related to economic fundamentals by considering the examples of France and Italy. It demonstrates that the interest rate differential corrected for expected depreciation within the band is a reasonable estimate of expected devaluation for France, Italy, and the United Kingdom. The estimate of expected devaluation for the French franc, unlike the estimate for the Italian lira, can partly be explained by variables which reflect external and internal imbalances. In the analysis, the dominant explanatory variable is the position of each currency in its target band, and this variable is only weakly related to standard macroeconomic fundamentals. When the band position variable is excluded from the analysis, official holdings of foreign exchange reserves become a significant determinant. However, the effect of the standard macroeconomic fundamentals is weak because no variable provides significant explanatory power for France and Italy over the whole period, and only the unemployment rate provides significant explanatory power for Italy for the subperiod 1987-92.

I. Introduction

The two episodes of exchange rate collapse within the Exchange Rate Mechanism (ERM) of the European Monetary System over the past year have kindled tremendous interest in understanding the causes of such forced parity changes. After a period of five years with fixed central parities, pressure built up during the summer of 1992 against the pound and lira for several reasons: uncertainty about the unanimous acceptance of the Maastricht treaty and the likelihood of meeting the Maastricht criterion, the strengthening of the deutsche mark relative to the dollar, the cyclical position of the United Kingdom, and the fiscal position of Italy. The suspension of the currencies of both countries from the ERM in mid September came a few days before the French referendum on the Maastricht treaty. Over the following months similar pressure was exerted on several other currencies. The Spanish peseta, the Irish punt and Portuguese escudo were devalued while the French franc was able to maintain its parity. Finally at the beginning of August 1993 a communiqué was issued announcing the widening of the obligatory marginal intervention thresholds of the remaining participants in the ERM to ± 15 percent around each bilateral rate. This paper addresses the question of whether--and if so, how--these episodes of exchange market pressure are related to economic fundamentals by considering the examples of France and Italy.

Bertola and Svensson (1990) were the first to consider the possibility of realignment risk in a target zone context. Their method of calculating this risk is to partition the change in the exchange rate into two components--the depreciation of the currency within a target band and the expected rate of change of the central parity. Expected depreciation within the target band is defined as the predicted value from a regression of the change in the exchange rate on its lagged level. The expected rate of change of the central parity is calculated as the difference between the nominal interest rate differential and expected depreciation within the target band. Svensson (1991b) has found that the extent of depreciation within a target band is sizeable, usually ± 5 percent per year. This compares with an average value of 10 percent for the expected change of the central parity.

Cukierman, Kiguel, and Leiderman (1993) analyze whether the expected central parity change is related to the distance between the position of a currency and the lower limit of its band. 1/ They perform this analysis for the currencies of Chile, Finland, Israel, Norway, and Sweden and find that the relationship is positive. This finding is consistent with their model where unexpected shocks to output are moderated by central bank currency intervention in a target band. As each currency moves towards the upper limit of its band, it becomes less likely that the amount of currency intervention needed to moderate the effects of an unexpected shock is consistent with the maintenance of a pre-set target band. Equivalently, the likelihood that the central bank must modify the central parity of the currency to maintain a prescribed amount of currency intervention increases.

1/ The exchange rate is measured as units of domestic currency per unit of foreign currency.

Drazen and Masson (1993) have related economic fundamentals to ten-year bond rate differentials in the context of the credibility of a regime. They argue that 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 of not adjusting in a later period. In their analysis the influence of fundamentals on the expected central parity change depends on the credibility of the government and on the cost of maintaining credibility in each period. The authors consider the unemployment rate to be both a signal of the stance of government policy and of the costs of maintaining a particular stance. They find that the unemployment rate has positively affected the expected central parity change in France since 1987 but had no effect on it between 1982 and 1986. They argue that this change of influence is due to the increased perceived cost to the French government of maintaining a fixed parity.

Caramazza (1993) has included both the position of a currency in its band and the unemployment rate as determinants of the expected central parity change for France since 1987. He finds that both variables influence the expected central parity change in the direction hypothesized by Cukierman, et al., and Drazen and Masson and documents that the inflation differential, a measure of competitiveness and government financing requirements are additional significant influences. Chen and Giovannini (1993) also include a number of macroeconomic variables as potential explanations of the expected central parity change and they find that its major determinants are the band position and the length of time since the previous devaluation.

The first part of this paper estimates the expected central parity change for the French franc, lira, and British pound and evaluates the usefulness of this variable as a measure of devaluation risk. The second part of the paper argues, in the spirit of Caramazza, and Chen and Giovannini, that the expected central parity change is influenced by persistent deviations from internal and external balance. These deviations are captured by the unemployment rate, the inflation differential, the relative level of unit labor costs and the change in the ratio of government debt to GDP. Institutional constraints, such as the availability of funds for a currency defense, are captured by foreign exchange reserves. Speculative behavior is measured by the position of a currency in its target band. The hypothesis that departures from external and internal balance determine the expected central parity change receives weak support from the results of this paper. When the band position variable is included in the analysis, the results indicate that the standard macroeconomic fundamentals provide some explanatory power for France but not for Italy. When the band position variable is excluded, the explanatory power of the standard macroeconomic fundamentals is much weaker.

II. Methodology

The basic approach draws on the work of Bertola and Svensson (1990) who model a theoretical target zone with a stochastic time-varying realignment

risk. Their method of calculating realignment risk, which is based on the assumption of uncovered interest parity, is briefly outlined below.

The assumption of uncovered interest rate parity has been rejected in a variety of empirical tests (see Froot and Thaler, 1990) and therefore may also seem an inappropriate assumption in this context. However, the standard test based on whether the forward exchange rate is an unbiased predictor of the future exchange rate may not be appropriate in a target band framework because of the peso problem. This problem was first documented by Rogoff (1979) and involves a situation where agents attach a small probability to a large change in fundamentals which does not occur in the sample. 1/ This situation produces a skew in the distribution of forecast errors. The peso problem is a small sample problem and may not be relevant for currencies which have experienced repeated realignments such as the French franc and Italian lira. Interestingly, the FF/DM 2/ exchange rate is the only target-zone currency combination which demonstrates support for uncovered interest parity. Therefore, for lack of a better alternative, the assumption is maintained in this analysis.

Uncovered interest parity implies that the interest rate differential between the domestic and foreign interest rate equals the expected rate of domestic currency depreciation.

$$\delta_t = E_t(\Delta s_{t+\tau}) \tag{1}$$

where $\delta_t = i_t - i^{*t}$, the differential between the domestic interest rate i and the foreign interest rate i^*, both of maturity τ and $E_t\Delta s_{t+\tau}$ is the expected rate of depreciation of the domestic currency during the interval τ. 3/

We can define

$$x_t = s_t - c_t \tag{2}$$

which is the deviation of the exchange rate from its central parity c_t. This permits a decomposition of the expected rate of depreciation into two elements.

1/ In target-zone currencies the large change in fundamentals may be represented by a change in the central parity.

2/ See Svensson and Rose (1991c).

3/ s_t is measured as units of domestic currency per unit of foreign currency.

$$E_t(\Delta s_{t+\tau}) = E_t\Delta x_{t+\tau} + E_t\Delta c_{t+\tau} \quad (3)$$

These represent the expected rate of depreciation relative to the central parity, $E_t\Delta x_{t+\tau}$, and the expected rate of change of the central parity $E_t\Delta c_{t+\tau}$. Following Svensson (1991b), the expected change of the central parity is referred to as expected devaluation in the following sections.

Let us first consider the theoretical foundation for estimating the expected rate of depreciation within the band. The theoretical analysis of target zones has developed from the work of Krugman (1991), which postulates that in a credible target zone the relationship between the exchange rate and its fundamental determinants follows a positively sloped S shaped curve labelled SS in Chart 1. When the exchange rate is near the upper end of the exchange rate band, the probability of it hitting the upper edge is higher. Therefore the probability that the central bank intervenes to strengthen the currency is higher. This expectation of a future currency appreciation translates into an immediate appreciation because the band is fully credible. The curve SS is therefore lower than under a free float system in which the exchange rate is a linear function of the fundamental (line FF) and is bounded by the exchange rate band. 1/ Svensson (1991a) has shown that as the time horizon of a forward contract becomes longer, the S shaped curve gradually becomes horizontal. This is a feature that expresses the mean-reverting behavior of credible target-zones.

Bertola and Cabballero (1992) argue that when the target zone is not completely credible, 2/ the relationship between the exchange rate and the fundamental is everywhere steeper than the corresponding relationship in a free floating regime (curve UU). In this case the exchange rate diverges from the free float line as it approaches the upper limit, which is the opposite of the honeymoon effect. Therefore depending on the likelihood of realignment, the exchange rate may exhibit mean reversion or mean diversion.

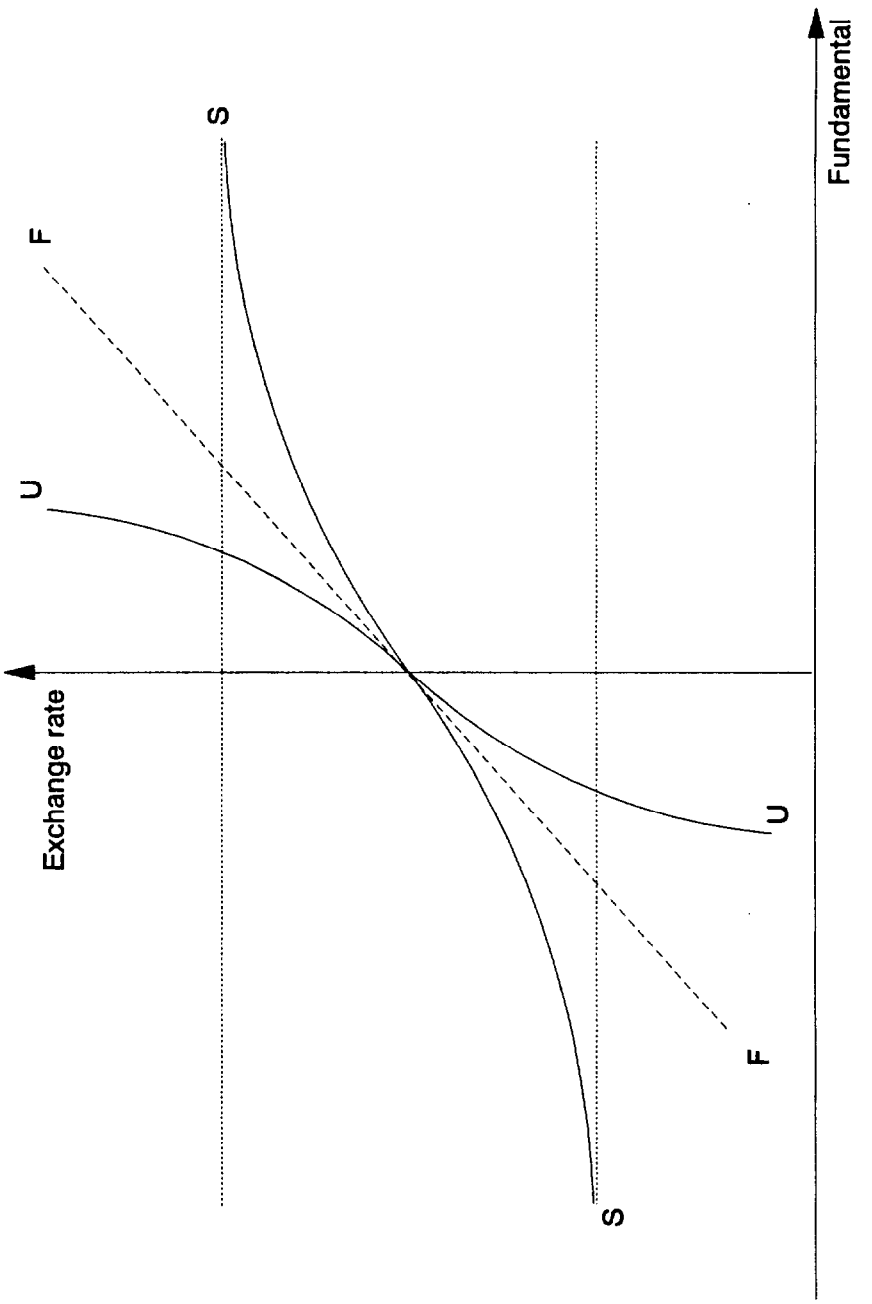
Once a value of the expected change within the target band is obtained, this value can be used to correct the interest rate differential for expectations of currency changes within the target band. This is the unexplained component of the difference in the expected return between two assets and is referred to as Δc_t in equation (3). It is expressed as follows:

$$E_t\Delta c_{t+\tau} = \delta_t - E_t\Delta x_{t+\tau} \quad (4)$$

1/ This behavior is called the honeymoon effect.

2/ The example they give is that the probability that the central bank will realign at a pre-specified intervention point is greater than 0.5.

Chart 1. The Krugman Model



The expected change of the exchange rate relative to its central parity can be separated into two terms.

$$E_t\Delta x_{t+\tau} = (1-p_{t+\tau}) \cdot E_t(\Delta x_{t+\tau}/no\ realignment) + p_{t+\tau}.E_t(\Delta x_{t+\tau}/realignment) \quad (5)$$

where $p_{t+\tau}$ is the probability at time t of a realignment during the time interval τ. 1/ Substituting equation (5) into equation (4) yields

$$E_t\Delta c_{t+\tau} + p_{t+\tau}.[E_t(\Delta x_{t+\tau}/realignment) - E_t(\Delta x_{t+\tau}/no\ realignment)] = \delta_t - E_t(\Delta x_{t+\tau}/no\ realignment) \quad (6)$$

The left hand side of equation (6) is the definition of the expected rate of devaluation assuming expectations are made on the basis of no realignment. If expectations of exchange rate depreciation are made on the basis of realignment the expression for expected devaluation is as follows.

$$E_t\Delta c_{t+\tau} + (1-p_{t+\tau}).[E_t(\Delta x_{t+\tau}/no\ realignment) - E_t(\Delta x_{t+\tau}/realignment)] = \delta_t - E_t(\Delta x_{t+\tau}/realignment)$$

Both expressions differ from the expected change in the central parity because they add an expression involving the change in expected depreciation resulting from a change in the likelihood of a realignment. There is no theoretical model outlining how the position of a currency relative to its central parity should jump at a realignment and therefore the expression in equation (6) avoids this issue by aggregating this jump with the central parity change. This aggregate value is postulated to be determined by variables which measure departures from internal and external balance and speculative behavior.

$$\delta_t - E_t(\Delta x_{t+\tau}/norealignment) = \phi(macroeconomic\ disequilibrium,\ speculation) \quad (7)$$

III. Data

In order to calculate expected rates of depreciation and devaluation we used daily data on the French franc-U.S. dollar (FF/$), deutsche mark-U.S. dollar (DM/$), lira-U.S. dollar (IL/$) and pound-U.S. dollar (pound/$) exchange rates and on three-month Euro-interest rates for the French franc, deutsche mark, Italian lira, and British pound obtained from DRI. The French franc series extends from January 1, 1981 to December 31, 1992, the Italian lira series extends from January 1, 1981 to September 12, 1992 and the British pound series is for the period September 16, 1991 to September

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1/ In this analysis τ is a 90-day period.

15, 1992. The end date for the lira is the date preceding its devaluation by 7 percent within the ERM and the end date for the pound is the date of its suspension from the ERM. The calculated value of expected devaluation is averaged over three months to maintain consistency with the quarterly macro variables which are used as fundamentals. These include the inflation differential, the government debt/GDP ratio and the change in foreign exchange reserves obtained from the IFS, unit labor costs obtained from WEO and the unemployment--NAIRU differential obtained from the OECD database.

IV. Estimation of Expected Rate of Depreciation Within the Band

An estimate of the expected rate of depreciation can be obtained by regressing the change in the exchange rate on the current exchange rate, both measured relative to the central parity. This is a way of allowing the data to decide the extent to which the exchange rate exhibits mean reversion or mean diversion in the sample. For this estimate to be correct we must assume that the conditional expectation of realignment does not change over the whole sample period. 1/ The estimated equation is as follows

$$4(x_{t+n}-x_t) = \sum_i \beta_{0i} d_i + \beta_1 x_t + \epsilon_{t+n} \qquad (8)$$

Where x is the deviation of the exchange rate from central parity, n refers to a 90-day period 2/ and d_i is a dummy variable for each period between realignments of the currency. The time intervals between realignments are presented in Table 1. The dummy variable indicates whether the exchange rate has depreciated or appreciated over the period to achieve mean reversion. A positive dummy value indicates depreciation and a negative value indicates appreciation. Since the maturity of the interest rate contract is three months, the expected change in the exchange rate is based on the same time interval. The change in the exchange rate is also annualized to maintain time consistency with the interest rate. Krugman's theoretical analysis suggests that the relationship between the change in the exchange rate and its level is nonlinear. However the inclusion of nonlinear terms had an insignificant effect on the three month average value for expected depreciation which is used to form a quarterly estimate of

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1/ As there is no way of knowing whether the conditional expectation changed during the period, this assumption seems reasonable. Chen and Giovannini avoid the problem of evaluating a conditional expectation by using the change in the exchange rate as their measure of expected depreciation. They argue that the sample of observations is conditional on both realignment and no-realignment possibilities so that it is not possible to isolate one or the other.

2/ Each quarter has approximately 65 observations because weekends are ignored.

expected devaluation. Consequently, only an estimate from the linear relationship is considered. 1/

Table 1. Intervals Between Realignments

Coefficient	Time Interval	Percentage Change in Central Parity
France		
β_{01}	1/1/81-10/5/81	8.8
β_{02}	10/6/81-6/14/82	10.6
β_{03}	6/15/82-3/21/83	8.2
β_{04}	3/22/83-4/7/86	6.2
β_{05}	4/8/86-1/12/87	3.0
β_{06}	1/13/87-9/11/92	
Italy		
β_{01}	1/1/81-3/23/81	6.4
β_{02}	3/24/81-10/5/81	8.8
β_{03}	10/6/81-6/14/82	7.2
β_{04}	6/15/82-3/21/83	8.2
β_{05}	3/22/83-7/22/85	8.5
β_{06}	7/23/85-4/7/86	3.0
β_{07}	4/8/86-1/12/87	3.0
β_{08}	1/13/87-1/8/90	3.8
β_{09}	1/9/90-9/11/92	

Equation (8) was estimated separately for France, Italy and the U.K. using ordinary least squares with standard errors computed using a Newey-West covariance estimator. The results are presented in Table 2.

1/ The depreciation of the exchange rate within the band may also be influenced by macroeconomic fundamentals. These have not been included in the estimation because the equation is estimated on daily exchange rate data whereas the frequency for the macroeconomic variables is quarterly.

Table 2. Expected Depreciation Within the Band

Parameter	Estimate	Standard Error	t-statistic
France			
β_{01}	0.0392	0.0037	10.7096
β_{02}	0.0343	0.0056	6.1628
β_{03}	0.0063	0.0025	2.4869
β_{04}	-0.0066	0.0008	-7.7444
β_{05}	0.0288	0.0023	12.7274
β_{06}	0.0244	0.0010	23.3449
β_1	-2.5698	0.0894	-28.7310
R^2 = 0.5014			
Number of Observations = 2,676			
Italy			
β_{02}	0.0117	0.0048	2.4356
β_{03}	0.0483	0.0074	6.5328
β_{04}	0.0154	0.0059	2.6265
β_{05}	-0.0075	0.0033	-2.2652
β_{06}	0.0128	0.0033	3.8669
β_{07}	-0.0094	0.0020	-4.7691
β_{08}	0.0360	0.0020	18.0601
β_{09} 1/	0.0018	0.0015	1.2132
β_1	-1.7145	0.0849	-20.1833
R^2 = 0.2575			
Number of Observations = 2,343 2/			
United Kingdom			
β_{01}	0.0660	0.0051	12.0917
β_1	-3.0199	0.2317	-13.0327
R^2 = 0.1679			
Number of Observations = 433			

1/ During this sample interval the band width was reduced from 6 percent to 2.25 percent.

2/ The number of observations differ between France and Italy because three months of observations have been excluded prior to each realignment date so that there are no overlapping observations across target bands. This is also why there is no dummy variable for the first realignment interval for Italy.

The significant negative coefficient on the level exchange rate term for France, Italy and the United Kingdom indicates that there is evidence of mean reversion in all three currencies. A Dickey-Fuller critical value of -2.58 indicates that the null hypothesis that x_t is nonstationary is rejected. This result is consistent with the fact that the variability of an exchange rate within a band cannot a priori follow a random walk. Similar analyses by Caramazza and Svensson also find mean reversion. Caramazza uses a monthly frequency of quarterly exchange rate changes and finds an annualized value of -1.77 for France. This is slightly lower than the value obtained in this paper and may be due to the different sampling frequency. Svensson uses daily exchange rate changes over a monthly period and his coefficient estimates of β_1 are -1.99 for France and -1.16 for Italy. These values compare with my estimates of -2.57 and -1.71 over a 90-day period. The considerable drop in the value of the coefficients over a 90-day time horizon demonstrates that the future exchange rate is approaching its long-run mean through time. This is a characteristic of mean reversion.

The majority of dummy variable values are positive. This reflects a tendency for the exchange rate to be located at the lower edge of the band after a realignment so that over time the currency depreciates to achieve mean reversion. The exceptions to this behavior are during the period March 1983 through April 1986 for France and during March 1983 through July 1985 and April 1986 through January 1987 for Italy when the respective currencies have appreciated to achieve mean reversion.

Chart 2 presents a time series plot of three-month averages of the daily predicted exchange rate change estimated in equation (8) for France and Italy. Both plots resemble each other closely which suggests that both currencies have been frequently positioned on the same side of the band. There are two noticeable differences. In 1985 there was a realignment upwards of the central parity of the Italian lira by 8.5 percent with no simultaneous change in the French franc parity value. In the first two quarters of 1992 the lira moved gradually to the upper limit of its band whereas the franc appreciated towards its lower limit. Once a realignment takes place, the exchange rate is frequently positioned at the lower end of its new band where it is expected to depreciate within the band. This is visible in 1981:4, 1982:3, 1983:2 (1985:3 for Italy), 1986:2 and 1987:1; all quarters which follow realignments.

In Chart 3, the time series plots of the interest differential 1/ for both countries are also remarkably similar. The FF/DM differential has gradually fallen from a high point of 17 percent in 1981:3 to a value of zero in 1992:2, and the IL/DM differential has fallen from 23 percent in 1981:4 to 3 percent in 1992. Chart 4 presents the expected rate of devaluation for both currencies defined as the difference between the series in Charts 2 and 3 for each country. It is at its peak during periods which precede realignments and falls once a realignment takes place. There are

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1/ This is a three-month average of the daily interest rate differential.

two possible reasons for this behavior. Since expected devaluation is defined as the difference between the interest differential and expected depreciation, if the interest differential is constant, movements in expected devaluation mirror expected depreciation ceteris paribus. Movements in the interest rate differential also contribute to the reduction in expected devaluation at realignments. This is the case in 1981:3, 1982:2, 1983:1, and 1986:1 when realignments are accompanied by a reduction in the interest rate differential. The relationship is weaker in the late eighties because there is little change in the interest rate differential in 1987:1 and 1990:1, the two most recent realignment periods in the sample interval (see Charts 5 and 6). This suggests that in the early 1980s, changes in the interest rate differential were more heavily influenced by changes in expected devaluation than changes in exchange rate depreciation within the target band.

The assumption of uncovered interest rate parity has had mixed success in the empirical literature and therefore its validity in determining a value for expected devaluation is questionable. In contrast, Chart 4 has demonstrated that there is a close relationship between the definition of expected devaluation used in this paper and the timing of realignments. This issue is further developed by considering the extent to which the constructed expected devaluation variable used in this paper predicted the timing of the currency crisis in September 1992. Chart 7 therefore presents the estimates of expected devaluation from table 2 for the period January 1, 1992 to December 31, 1992 for France, from September 13, 1991 to September 12, 1992 for Italy and from September 16, 1991 to September 15, 1992 for the United Kingdom. The chart demonstrates a considerable fall in expected devaluation in France between January and May and then a steep rise through September with a subsequent fall and rise to its previous peak in December. The corresponding graph for Italy indicates a gradual increase in expected devaluation through 1992 with a heightening in July and subsequently in September. The expected devaluation of the pound is considerably more erratic than the other two series and does not indicate markedly different behavior in September compared to other times. There is, therefore, a strong positive relationship between expected devaluation and the timing of the realignment in Italy but not in the United Kingdom. Values of expected devaluation of 8 percent were present for Italy during 1987 and 1988 with no corresponding realignment so that only over this threshold can future devaluations be predicted with any degree of certainty. In 1992 this threshold was reached in early July and in early September. The threshold of a 6 percent expected devaluation of the pound was reached for the first time in late August of 1992.

V. Determinants of Expected Devaluation

The previous sections have presented supporting evidence for using the interest rate differential, corrected for depreciation, as a measure of expected devaluation. This section proceeds to discover the determinants of this measure based on the perceived macroeconomic objectives of the government.

Chart 2.
FF/DM, IL/DM Expected Rate of Change of the Exchange Rate within the Band
(In percent)

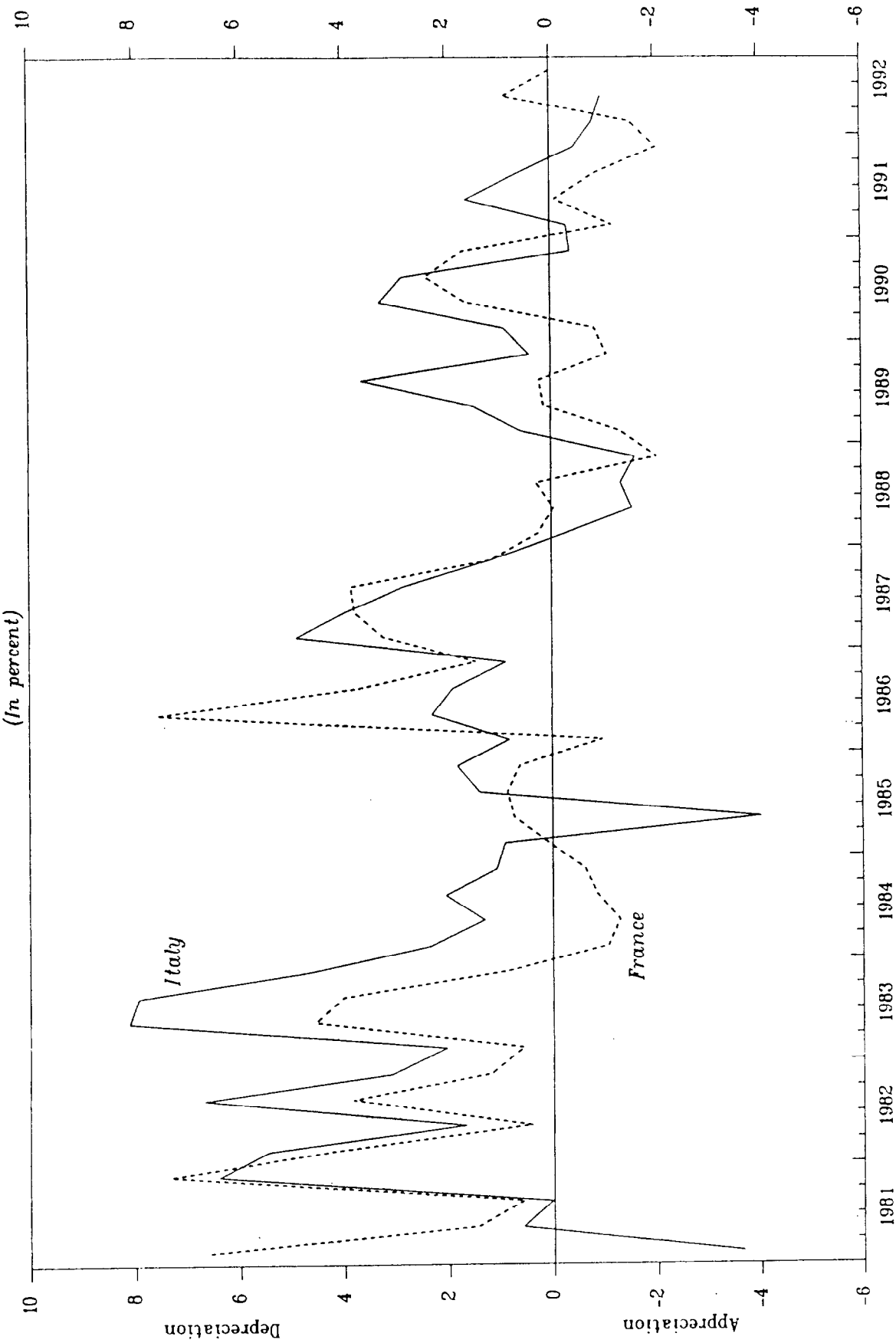


Chart 3.
FF/DM, IL/DM Interest Rate Differentials
(In percent)

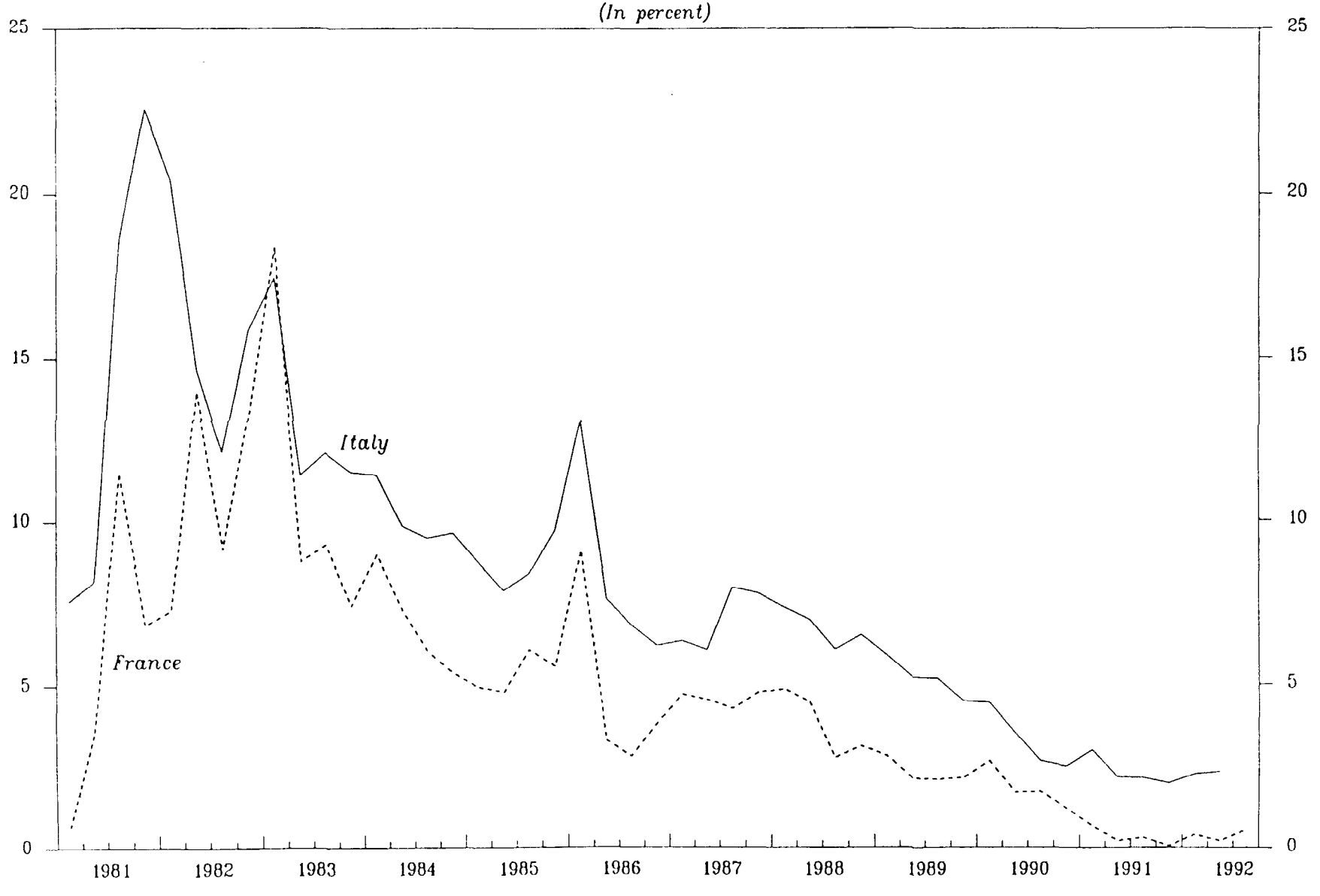


Chart 4.
FF/DM, IL/DM Expected Rate of Devaluation

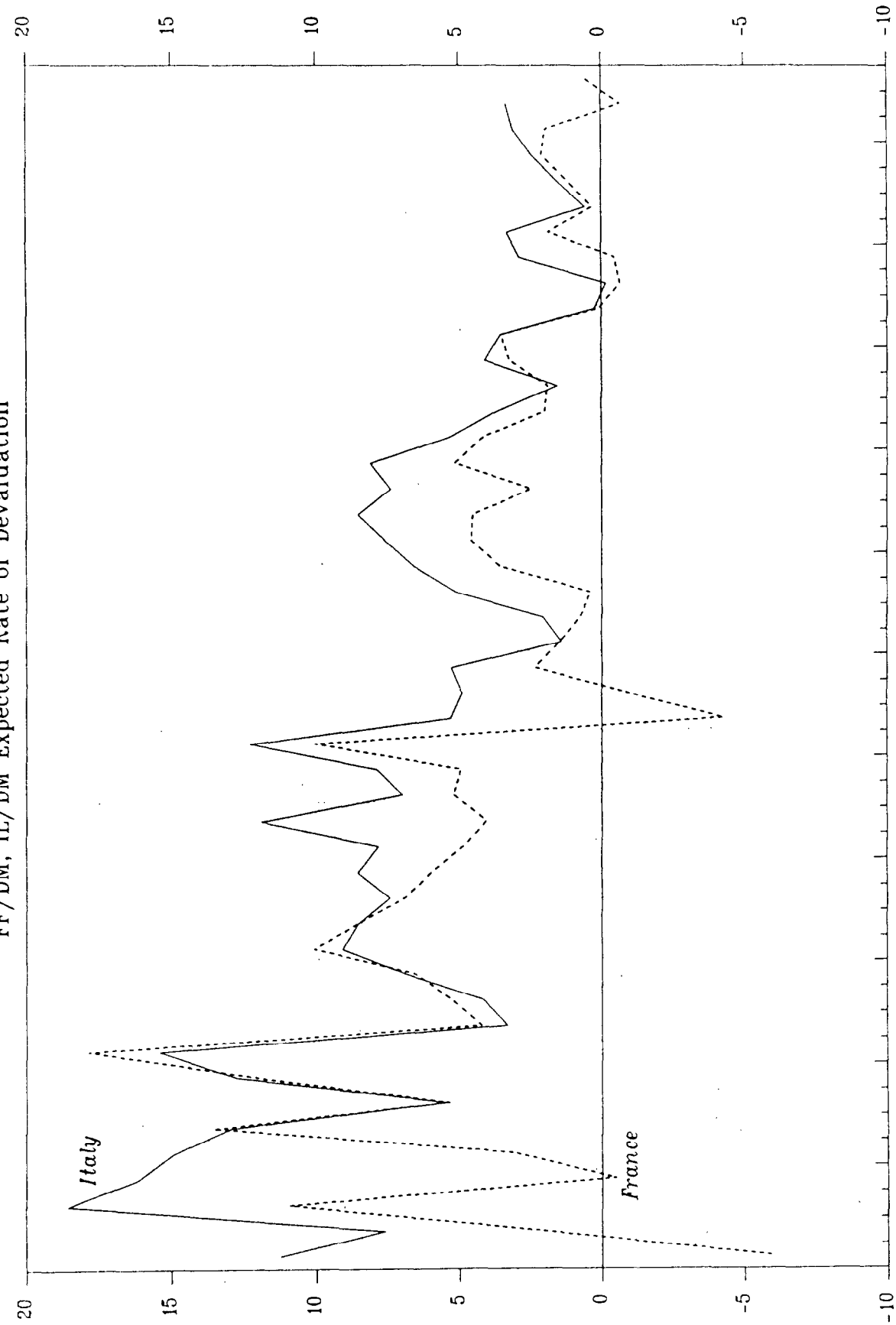


Chart 5.

FF/DM Expected Rate of Change of the Exchange Rate within the Band and Interest Rate Differential

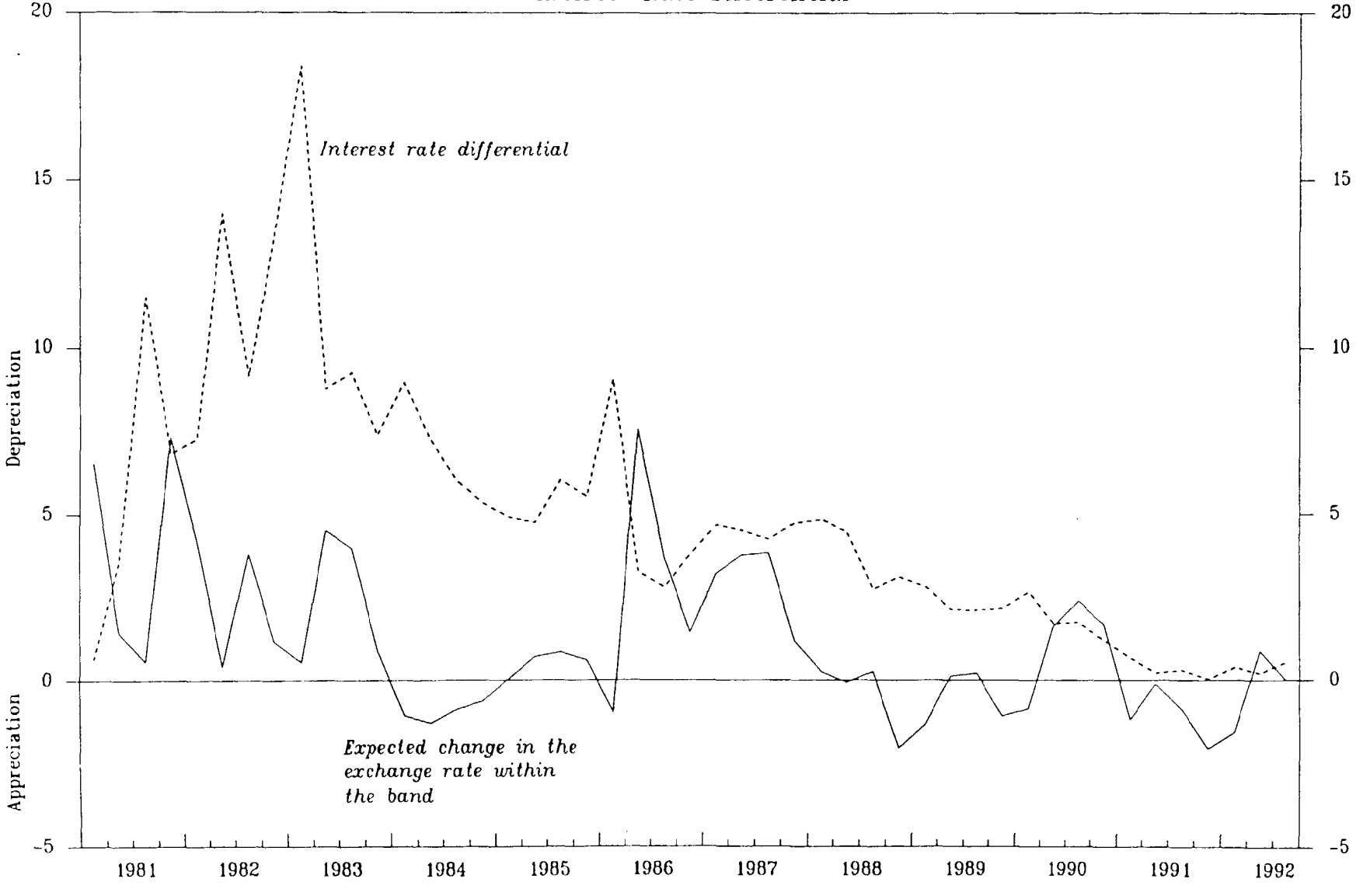


Chart 6.

IL/DM Expected Rate of Change of the Exchange Rate within the Band and Interest Rate Differential

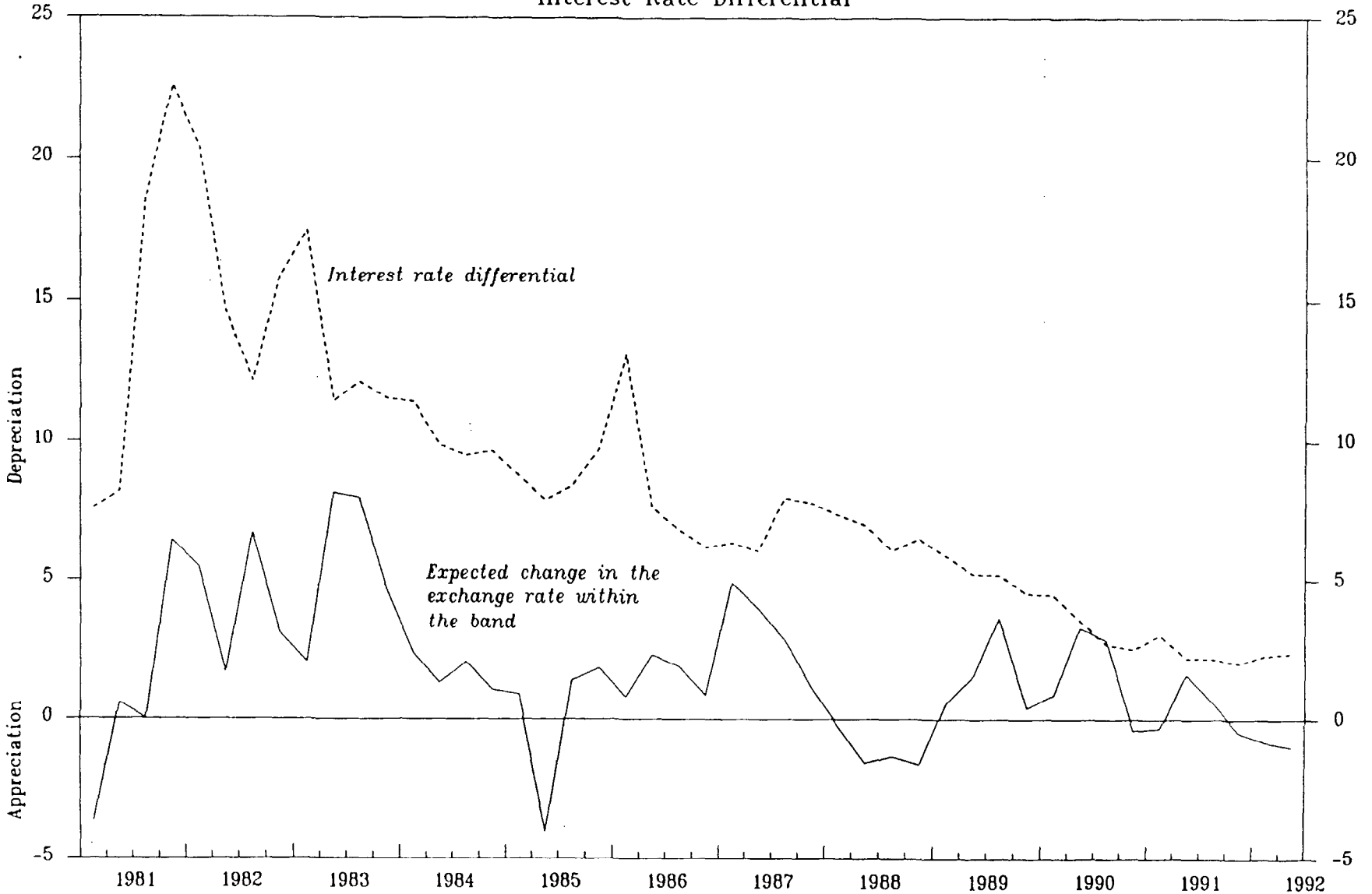
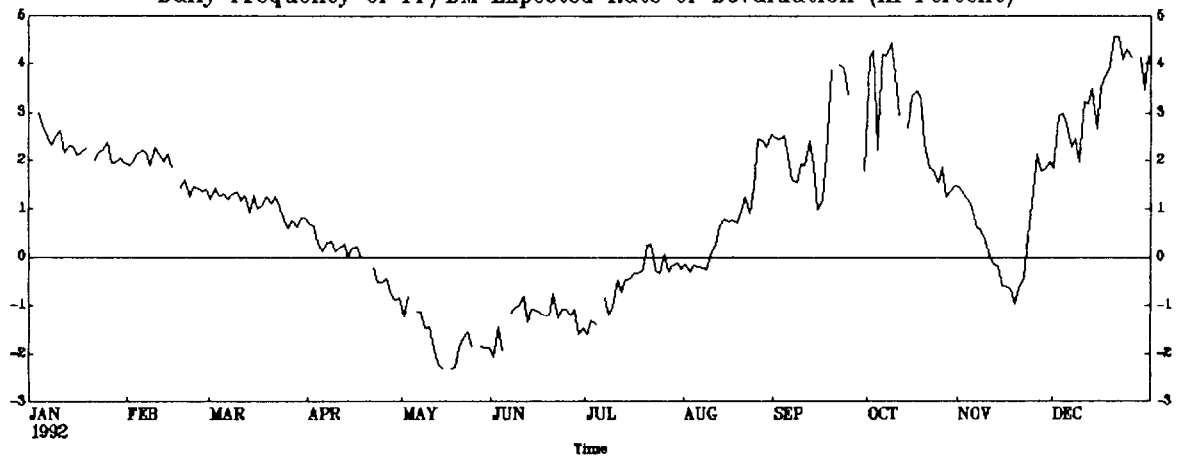
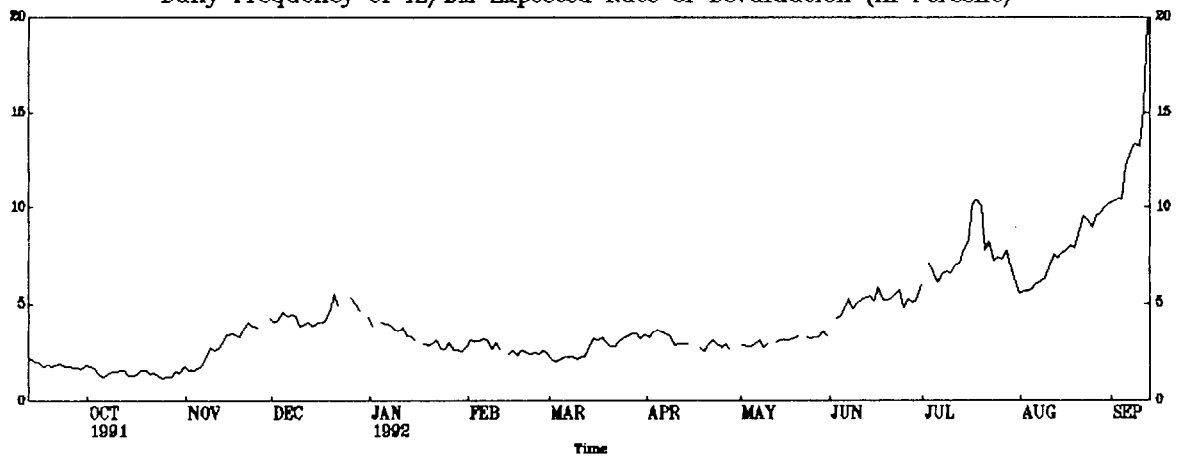


Chart 7.

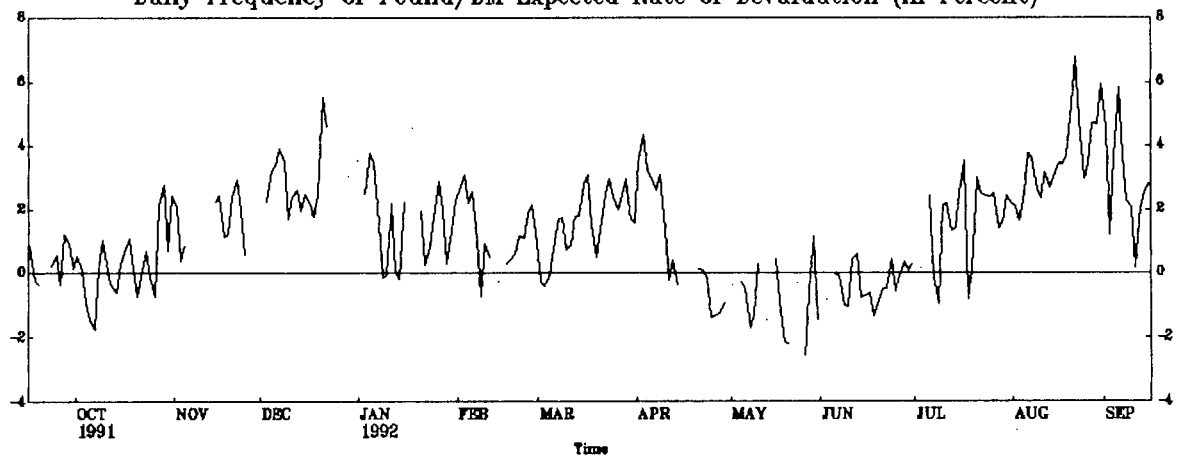
Daily Frequency of FF/DM Expected Rate of Devaluation (in Percent)



Daily Frequency of IL/DM Expected Rate of Devaluation (in Percent)



Daily Frequency of Pound/DM Expected Rate of Devaluation (in Percent)



Internal and external balance are two medium-term objectives that governments pursue. These objectives are the basis for the fundamental equilibrium exchange rate (FEER) calculations of Williamson (1991). He argues that the FEER should be consistent with macroeconomic balance in the medium term which he defines as the simultaneous maintenance of internal and external balance. It is not necessary for the government to be actively targeting these objectives for there to be changes in expected devaluation. If the major players in the foreign exchange market believe that medium-term objectives are being targeted, irrespective of whether this is true in reality, a divergence between the hypothesized targets and their current outcomes may cause an increase in expected devaluation.

Internal balance is defined as the difference between the current unemployment rate and the level that is consistent with a nonaccelerating rate of inflation (NAIRU). The estimate of NAIRU used in this paper is taken from the calculation of Coe and Moghadam (1993) who base it on a quadratic trend of the 24-50 year old male unemployment rate. A positive difference between the unemployment rate and the NAIRU is associated with a greater likelihood of devaluation if the perceived cost to the government is high (see Drazen and Masson for details).

External balance is defined as the value of the current account which is consistent with the investment and demographic needs of the country in question. It does not necessarily imply current account balance because capital flows may support a current account deficit for a considerable period of time. External balance is influenced by the level of competitiveness which is captured in this paper by the ratio of unit labor costs. This relative price measure attempts to capture the extent to which the exchange rate differs from its long run equilibrium. A positive difference in the ratio of unit labor costs is therefore expected to exert upward pressure on expected devaluation. Relative price equality is a long-run concept and therefore the inflation differential is also included because it may be more appropriate as an indicator of external imbalance for the time horizon considered in this analysis. A persistent positive inflation differential exerts upward pressure on expected devaluation.

The role of fiscal variables as potential determinants of expected devaluation is debatable. There are generally two reasons for their inclusion in this kind of analysis. Firstly, high debt countries may be induced to inflate away the portion of debt denominated in domestic currency. In this case the inflation rate is 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 justification for the added inclusion of fiscal variables is that they are better predictors of future inflation than the current rate. The second argument for including fiscal variables is that they represent default risk. However, it seems unlikely that the Republic of Italy would gain much by defaulting on its Eurodollar bonds whereas the signal of default may be extremely costly in terms of reputation. This suggests that default risk is extremely small in the context of the Eurodollar market.

Central banks use foreign exchange reserves to defend target zone currencies and therefore a persistent reduction in the stock of foreign exchange reserves is likely to put pressure on a government to change its central parity. Of course, a European central bank can borrow foreign exchange from other central banks in the currency union but this becomes more difficult as its stock of reserves dwindle and its foreign exchange needs increase. A reduction in foreign exchange reserves may be expected to increase expected devaluation.

A perfectly credible target band causes downward pressure to be exerted on a currency located at the upper limit of its band through central bank intervention. In contrast, the franc and lira have often been devalued when they have been near the top of their respective bands. This suggests that the position of a currency in its target band may reflect expected devaluation in the sense that a currency located at the upper edge of the band is more likely to devalue than at any other point in the band.

The above discussion suggests that the following expression captures the determinants of expected devaluation with coefficient signs representing the expected direction of causation.

$$\Delta E(c_t) = \alpha_0 + \alpha_1(\Pi_t - \Pi_t^f) + \alpha_2 P_t/P_t^f + \alpha_3 u_t + \alpha_4(GD_t - GD_t^f) + \alpha_5(s_t - \bar{s}_t) - \alpha_6 \Delta R_t + \epsilon_t \quad (9)$$

where π_t and P_t are the domestic inflation rate and unit labor cost index, π_t^f and P_t^f are the foreign inflation rate and unit labor cost index, u_t is the difference between the unemployment rate and the NAIRU, GD_t and GD_t^f are the domestic and foreign government debt/GDP ratios, $\bar{s}_t$ is the lower limit of the currency band, and ΔR_t is the rate of change of the stock of foreign exchange reserves.

Equation (9) was estimated jointly for both France and Italy during the period 1981:1 to 1992:2 using the SUR estimator. The hypothesis that the coefficients for France and Italy are equal was rejected and therefore the estimates are distinguished by country in Table 3.

Table 3. Determinants of Expected Devaluation

Parameter	Estimate	Standard Error	t-statistic
France			
α_0	0.2738	0.1437	1.9052
α_1	0.8954	0.4967	1.8026
α_2	0.4445	0.1717	2.5882
α_3	-1.6780	1.2373	-1.3562
α_4	-0.0471	0.2172	-0.2169
α_5	0.8028	0.1868	4.2978
α_6	0.0127	0.0557	0.2283
R^2 = 0.4716			
Number of Observations = 46			
Italy			
α_0	0.3857	0.0593	6.5020
α_1	-0.2188	0.3386	-0.6461
α_2	0.0866	0.0792	1.0927
α_3	-0.4597	0.7384	-0.6226
α_4	-0.3720	0.0712	-5.2223
α_5	0.3456	0.0564	6.1297
α_6	-0.0144	0.0192	-0.7508
R^2 = 0.8016			
Number of Observations = 46			

The table indicates that the inflation differential provides significant explanatory power for expected devaluation in France but not in Italy. The significant positive coefficient on the relative unit labor cost variable indicates that disparities in competitiveness also lead to increases in expected devaluation in France. However this variable has no effect on expected devaluation in Italy. The ratio of the unemployment rate to the NAIRU is insignificant in both countries and is incorrectly signed.

The influence of the relative government debt to GDP ratio is insignificant for France but is significantly negative for Italy. The significant negative effect for Italy reflects the fact that expected devaluation has gradually fallen over time as the relative government debt/GDP ratio has widened (see Chart 4). When the period since 1987 is

estimated separately, the government debt/GDP ratio becomes insignificant (see Table 4). When we include the change in the government debt/GDP ratio as an additional explanatory variable, the coefficient of the change variable is positive for both countries but only significant for France. The level variable is significantly negative for both countries. The flow variable conforms to the correct theoretical prediction of a positive relationship between the risk of devaluation and the rise in government debt whereas the sign of the level relationship has no theoretical foundation. This may reflect the ability of the government to increase debt up to a certain threshold without the risk of devaluation, at which point further increases in debt lead to a speculative attack. An increase in the disparity of the level variable may therefore indicate the growing importance of the corresponding flow variable in determining devaluation risk, a phenomenon which may explain the opposite signs of the change and level price variables in Table 4.

The significance of the variables which capture the institutional and speculative determinants are mixed. Foreign exchange which captures usable funds for a currency defense is insignificant in both countries whereas the position of each currency relative to its lower limit is highly significant. The positive coefficient indicates that the further away each currency is from the lower limit of its band, the greater the likelihood of devaluation. The coefficient estimate for France indicates that if the currency is at its upper limit i.e., 4.5 percent above the lower limit, this results in an increase of 3.6 percent in expected devaluation. The same effect for Italy is an increase of 4.1 percent in expected devaluation. The effect on Italy is greater because the spread between the upper and lower limits was 12 percent until January 1990, at which point it was reduced to 4.5 percent. 1/

Drazen and Masson (1993) have argued that the credibility of the French commitment to a target zone has varied during the 1980s in response to the changing importance placed on the costs of holding such a commitment. This is verified in their analysis by the change in the influence of the unemployment rate on expected devaluation over time. It is insignificant during the period 1982-86 but is significantly positive between 1987-91. When this analysis is repeated for the subperiod 1987:1 to 1992:2, it also demonstrates a change in the significance of the relationship, as indicated in Table 4.

1/ It has been argued (Goldstein, et al., 1993) that the large capital inflow and resulting increase in net foreign assets in Italy over 1987-91 reflected an overestimation of exchange rate risk as measured by interest rate differentials. However it is not clear why lenders and borrowers would have differing opinions as to the likelihood of devaluation to warrant this premium. A test of this supposition was carried out by including a dummy for the period 1988:1 to 1991:1 (during which time there was a large increase in the net capital flow into Italy) as an explanatory variable in the Italian equation. The dummy was insignificant indicating no overestimation of devaluation risk by the market at this time.

Table 4. Determinants of Expected Devaluation

(For the subperiod 1987:1 to 1992:2)

Parameter	Estimate	Standard Error	t-statistic
France			
α_0	-0.0228	0.0431	-0.5307
α_1	1.2637	0.2890	4.3714
α_2	-0.1040	0.1129	-0.9212
α_3	0.7019	0.3864	1.8165
α_4	-0.0738	0.0785	-0.9407
α_5	0.8073	0.0897	8.9964
α_6	0.0294	0.0257	1.1403
R^2 = 0.8484			
Number of Observations = 22			
Italy			
α_0	0.0339	0.0715	0.4733
α_1	0.5778	0.3568	1.6195
α_2	-0.1421	0.0816	-1.7401
α_3	-0.1058	0.5256	-0.2013
α_4	0.1051	0.0916	1.1482
α_5	0.4326	0.0381	11.3582
α_5	0.0019	0.0115	-0.1668
R^2 = 0.9335			
Number of Observations = 22			

The most noticeable change in behavior in France during the sub-period 1987:1 to 1992:2 is that the effect of the unemployment rate is significant and the effect of the relative unit labor cost variable is insignificant. The unemployment effect is consistent with the results of Masson and Drazen and Caramazza. For Italy, the major change in behavior is the insignificance of the ratio of government debt to GDP in the latter period in contrast to its negative significance over the whole period. This may reflect a change in perceptions regarding the sustainability of the build up of government debt in Italy and may have influenced the abandonment of its

target zone commitment in September 1992. Once again, the band position variable is highly significant.

The significance of the band position variable is surprising given that there is apparently no theoretical reason for its inclusion apart from its ability to capture speculative motives which are uncorrelated with standard macro fundamentals. Since the determinants of the band position are unknown, we isolate the contribution of only the macroeconomic variables to the explanation of devaluation risk in Table 5 by excluding the band position variable from the analysis.

Table 5. Determinants of Expected Devaluation

(Excluding band position)

Parameter	Estimate	Standard Error	t-statistic
France			
α_0	0.0805	0.1587	0.5070
α_1	0.7490	0.5271	1.4210
α_2	0.1651	0.1884	0.8767
α_3	-0.5580	1.3760	-0.4055
α_4	0.1987	0.2381	0.8345
α_6	-0.1104	0.0492	-2.2444
R^2 = 0.2548			
Number of Observations = 46			
Italy			
α_0	0.3454	0.0770	4.4831
α_1	-1.1569	0.3806	-3.0397
α_2	-0.2266	0.0816	-2.7754
α_3	-0.5655	0.9236	-0.6123
α_4	-0.3606	0.0928	-3.8869
α_6	-0.0483	0.0231	-2.0950
R^2 = 0.6407			
Number of Observations = 46			

There are a few differences between Table 5 and Table 3. The most obvious difference is that the explanatory power of the regressors has declined in France from 0.47 to 0.25 and in Italy from 0.80 to 0.64. This is a sizeable reduction and testifies to the strength in explanatory power of the band position variable. The variable capturing the change in foreign exchange is now significantly negative in both countries in contrast to its insignificance in Table 3 which reflected its high collinearity with the band position variable. 1/ The disturbing aspect of the table is that inflation, unit labor cost, and the government debt/GDP ratio are incorrectly signed for Italy.

When the period since 1987 is estimated separately (Table 6) the change in foreign exchange remains significant and the unemployment rate becomes significant in Italy but remains insignificant in France.

1/ A regression of the band position variable on the macroeconomic fundamentals indicates that it is weakly correlated with all variables except for the change in foreign exchange reserves with which it is significantly negatively related.

Table 6. Determinants of Expected Devaluation

(Excluding band position during sub-period 1987:1 to 1992:2)

Parameter	Estimate	Standard Error	t-statistic
France			
α_0	-0.0247	0.0655	-0.3769
α_1	0.5550	0.4411	1.2583
α_2	-0.0528	0.1866	-0.2831
α_3	0.2936	0.5819	0.5045
α_4	0.1481	0.1228	1.2061
α_6	-0.0717	0.0306	-2.3403
R^2 = 0.1270			
Number of Observations = 22			
Italy			
α_0	0.1410	0.1419	0.9945
α_1	0.0136	0.6595	0.0206
α_2	0.0360	0.1694	0.2125
α_3	1.6567	0.9327	1.7762
α_4	-0.1469	0.1804	-0.8140
α_6	-0.0520	0.0225	-2.3118
R^2 = 0.3754			
Number of Observations = 22			

Finally Table 7 includes estimates of the contribution of the macroeconomic variables to expected devaluation for France extending through the third quarter of 1992. As in Table 5 the contribution of the explanatory variables is weak with only the change in foreign exchange significant.

Table 7. Determinants of Expected Devaluation for France

(Excluding band position during sub-period 1987:1 to 1992:3)

Parameter	Estimate	Standard Error	t-statistic
France			
α_0	-0.0671	0.2251	-0.2982
α_1	0.0362	0.6183	0.0585
α_2	0.1649	0.2643	0.6241
α_3	-0.6367	0.8084	-0.7876
α_4	0.0241	0.0290	0.8313
α_6	-0.0893	0.0495	-1.8049
R^2 = 0.2438			
Number of Observations = 23			

VI. Conclusion

The suspension of the British pound and Italian lira from the ERM and the widening of the target-zone bands of all remaining ERM currencies except the Dutch guilder have provoked interest in the extent to which these events are determined by the economic fundamentals of the individual countries. This paper has demonstrated that the interest rate differential, corrected for expected depreciation within the band, is a reasonable estimate of expected devaluation for France, Italy and the United Kingdom. The estimate of expected devaluation for the French franc can partly be explained by variables which reflect external and internal imbalances but not the estimate for the Italian lira. In both analyses the dominant explanatory variable is the position of each currency in its target band and this variable is only weakly related to standard macroeconomic fundamentals. Therefore a considerable percentage of the variability of expected devaluation is explained by a variable whose driving force is unknown. When the band position variable is excluded from the analysis, official holdings of foreign exchange reserves become a significant determinant. However, the effect of the standard macroeconomic fundamentals is weak because no variable provides explanatory power for France and Italy over the whole period and only the unemployment rate provides explanatory power for Italy for the subperiod 1987-92.

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