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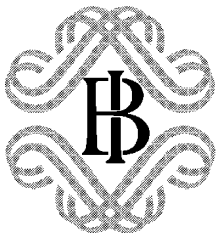
The Behaviour of the Dollar and Exchange Rates in Europe: Empirical Evidence and Possible Explanations

by Paolo Del Giovane and Alberto Franco Pozzolo



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THE BEHAVIOUR OF THE DOLLAR AND EXCHANGE RATES IN EUROPE: EMPIRICAL EVIDENCE AND POSSIBLE EXPLANATIONS

by Paolo Del Giovane and Alberto Franco Pozzolo (*)

Abstract

The analysis of the day-by-day evolution of currency markets often emphasises the relationship between the behaviour of the US dollar and that of the exchange rates between the other major currencies, in particular the tendency of EMS currencies to appreciate vis-à-vis the DM in periods of dollar strength. In this paper we systematically analyse this relationship. In particular, we examine the extent to which it has changed in the last ten years, a span of time that included a period without realignments in the EMS, the crisis of the System, the suspension of the lira's participation in the ERM and the withdrawal of the pound, the "widened" band for the other currencies, and the re-entry of the lira. We also suggest a possible explanation for this relationship and find supporting empirical evidence for it: we show that the reactions of each bilateral exchange rate to shocks to the value of the dollar are related to the different orientation of monetary and exchange-rate policies in the various European countries, and that these differences are consistent with the potential effects of variations in the exchange rates vis-à-vis the dollar and the DM on each country's rate of inflation.

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1. Introduction[1]

The analysis of the day-by-day evolution of currency markets often emphasises the relationship between the behaviour of the US dollar and that of the exchange rates between the other major currencies, in particular the tendency of EMS currencies to appreciate vis-à-vis the DM in periods of dollar strength.

The phenomenon is important for several reasons. On various occasions depreciations of the dollar contributed to tension in the ERM, a phenomenon particularly clear in the 1992 crisis. Although the widening of the EMS fluctuation band in August 1993 has formally increased the monetary authorities' flexibility in defending exchange-rate parities, it is perceived that the System could still suffer from speculative pressures and be significantly affected by changes in the external value of the dollar, in particular during the period preceding the fixing of exchange rates envisaged by the EMU process. Furthermore, the evolution of the relationship between the behaviour of the US dollar and that of the intra-European exchange rates may provide indications on the ability of the EMS to insulate European exchange rates from external shocks - one of the reasons for the creation of the System - and indirectly on the commitment of the monetary authorities of the various member countries to the exchange rate objective vis-à-vis the anchor currency of the System (and the way the markets perceive this commitment). Although the existence of the phenomenon is unanimously agreed upon, there is no

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consensus on the explanation: various hypotheses have been put forward in the literature, but none of them seems to be completely convincing in the light of empirical tests.

In this paper we systematically analyse the relationship between the behaviour of the US dollar and the bilateral exchange rates of other major currencies, in particular the European ones, vis-a-vis the DM. In particular, we examine the extent to which this relationship has changed in the last ten years, a span of time that included a period without realignments in the EMS, the crisis of the System, the suspension of the lira's participation in the ERM and the withdrawal of the pound, the "widened" band for the other currencies, and the re-entry of the lira. We also suggest a possible explanation for this relationship and find some supporting empirical evidence for it. In particular, we show that the reactions of each bilateral exchange rate to shocks to the value of the dollar are related to the different orientation of monetary and exchange-rate policies in the various European countries, and that these differences are consistent with the potential effects of variations in the exchange rates vis-à-vis the dollar and the DM on each country's rate of inflation.

In Section 2 we explain the choice of the nominal effective US dollar exchange rate to capture the idiosyncratic shocks to its external value. In Section 3 we present empirical results on the relationship between the behaviour of the dollar and that of the other major currencies vis-à-vis the DM. Section 4 considers the explanations put forward in the literature for the observed empirical regularities, and discusses their plausibility. In Section 5 we suggest an interpretation in which these regularities are related to the different orientation of monetary and exchange-rate policies in the various countries. We also suggest that the different

orientations may be the consequence of the different impact on inflation in the countries considered of the variations in the exchange rates vis-à-vis the two main currencies. Section 6 summarises the main conclusions of the paper.

2. Bilateral and global measures of exchange rates

The effects of fluctuations of the dollar's external value on the exchange rates of other currencies has been analysed in several different ways. Considering the bilateral exchange rate as the relevant variable, some authors have examined how changes in the DM-dollar exchange rate affect the bilateral rates of the other European currencies vis-à-vis the DM.[2] Using the bilateral DM-dollar rate, however, does not allow one to discriminate between idiosyncratic shocks to the dollar (caused for instance by shocks to the US economy or by shifts in the Federal Reserve's monetary stance) and shocks to the DM. Since a change in the DM-dollar rate, e.g. a depreciation of the dollar, can have very different effects on the value of other currencies depending on whether it is determined by a negative shock to the dollar (a depreciation of its external value) or by a positive shock to the DM (an appreciation), it is advisable to use a "synthetic" measure of the value of one or the other of the two currencies, thereby capturing their idiosyncratic shocks, and then study the effects of its changes on the bilateral exchange rates between other currencies.[3]

The most frequently used measure of this type is the nominal effective exchange rate, calculated by weighting the

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[2] See, for example, Padoa-Schioppa (1985), Haldane and Hall (1991) and Levy (1995).

[3] Giavazzi and Giovannini (1985, 1989) and Rinaldi and Santini (1998) use this approach; Frankel (1985b) studies the correlation between the effective exchange rates of both the dollar and each of the other European currencies.

bilateral rates vis-à-vis a basket of currencies on the basis of their relative importance in the commercial transactions of the selected country.[4] An alternative measure can be obtained by using a methodology based on the principal components; however, since the results of this paper do not change significantly between the two measures, we only present the results obtained with the effective exchange rate.[5] We used the effective exchange rates calculated by the Bank of Italy on the basis of the commercial transactions with 14 main industrial countries.[6]

3. Relationship between the dollar's behaviour and the exchange rates of the other main currencies

In order to study the effects of shocks to the dollar (measured by the variations of its nominal effective exchange rate) on the exchange rates of the other currencies, we use daily data on the following twelve currencies, in addition to the dollar and the DM: the Dutch guilder, the Belgian franc, the Danish krone, the French franc, the Irish punt, the Italian lira, the Spanish peseta, the British pound, the Swedish krone, the Swiss franc, the Japanese yen and the Canadian dollar, and we examine four periods:[7] 1 June, 1973-11

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[4] The indexes compiled by the Bank of Italy and various international organisations, including the Bank for International Settlements and the International Monetary Fund, are of this type. Alternatively, the weights could be based on capital transactions; the data available for most currencies, however, do not allow this index to be calculated for total capital flows, but only for those intermediated by banks.

[5] The synthetic measure of the dollar value which we compared with the nominal effective exchange rate is given by the first principal component of the log-variations of the 14 bilateral rates of the dollar vis-à-vis the currencies which are included in the effective exchange rate.

[6] The results obtained do not change significantly excluding the variations in the DM/dollar rate from the calculation of the effective rate of the dollar.

[7] The first two periods basically coincide with those previously analysed by Giavazzi and Giovannini (1989).

March, 1979 ("Monetary Snake");[8] 13 March, 1979-13 January, 1987 (EMS "with realignments"); 14 January, 1987-31 July, 1992 (EMS "without realignments");[9] 1 November, 1992-23 November, 1996 (after the ERM crisis).[10]

Exchange rates are well known to be non-stationary variables. This also applies for the nominal effective exchange rate used in this work, as is clear from the results reported in Tables A1-A4. We also tested the hypothesis that the effective exchange rate of the dollar was cointegrated with each of the bilateral exchange rates of the main European currencies, the yen and the Canadian dollar vis-à-vis the DM; we used the univariate method suggested by Pesaran, Shin and Smith (1996).[11] The null hypothesis of no cointegration can be accepted in almost all cases. In order to verify the existence of a high frequency relationship, we ran regressions of the bilateral exchange rates vis-à-vis the DM on the nominal effective exchange rate of the dollar using first logarithmic differences of the data. For each currency we estimated the

[8] Among the currencies considered, the DM, the Dutch guilder, the French franc, the Belgian franc, the Danish krone and the Swedish krone were members of the "Snake" during the period considered.

[9] The period excludes the phase of greatest tension during the summer which led to the crisis of the System in September 1992. Furthermore, during this period there are discontinuities in the exchange-rate regime for the Spanish peseta and the British pound (which joined the ERM respectively on 19 June, 1989 and 8 October, 1990) and for the Italian lira (which moved from the wide to the narrow band on 8 January, 1990); for these currencies we also ran regressions for the sub-periods following these events.

[10] The period excludes the sharp adjustment after the crisis of autumn 1992 and ends before the re-entry of the lira in the ERM. Regressions estimated for a shorter sub-period (between the widening of the ERM fluctuation band and November 1996), which can be considered more homogeneous for the currencies that did not suspend their participation in the System, provide similar results.

[11] The Engle-Granger two-step procedure, which Pesaran, Shin and Smith (1996) proved to be less efficient than univariate testing procedures, gives similar results.

following equation, using the generalised method of moments, in the four periods considered:[12]

(1) $$\Delta \log(DMCUR_t) = \alpha + \beta \Delta \log(EFFUSA_t) + \gamma INT_t + \varepsilon_t$$

where $DMCUR_t$ is the DM bilateral exchange rate vis-à-vis the selected currency, $EFFUSA_t$ is the nominal effective rate of the dollar, INT_t are the net purchases of DMs against the selected currency carried out by the respective central banks and ε_t is a random variable with zero mean.[13]

Table 1 presents the main results.[14] They show that:

- The tendency of the EMS currencies to appreciate against the DM, although to a varying extent, when the dollar strengthens (already noted by several authors for the 1970s and the first part of the 1980s) is confirmed for the last decade.[15]

- As expected, between 1987 and 1992, the period of greatest stability in the EMS, the responsiveness to dollar changes of the bilateral rates vis-à-vis the DM was significantly

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[12] The coefficients estimated coincide with those of OLS. Standard errors are corrected for heteroschedasticity and serial correlation up to the second order.

[13] We also ran regressions including the first lag of the change in the dollar's effective exchange rate and the spot/next interest rate differential between Germany and the country considered, to control for disturbances to the bilateral exchange rate independent from the dollar's behaviour. It turned out that in the majority of cases these variables are not significant. Moreover, in all cases the coefficient of the change in the dollar's effective exchange rate was not significantly different from that in the original regression. This suggests that the estimates obtained with equation (1) are quite robust.

[14] Detailed results for each regression are given in Tables A5-A8 of the Appendix.

[15] For the previous period the results substantially confirm those of Giavazzi and Giovannini (1989); minor differences may be explained by the different time of the day in which data on exchange rates were gathered.

lower than in the previous EMS period, although it remained higher for the currencies in the wide fluctuation band.[16]

- Since the 1992 currency crisis, the responsiveness has risen again for all the currencies in the EMS area, with the exception of the Dutch guilder. The increase, however, has not been homogeneous: it has been smaller for three of the currencies in the narrow band whose participation to the ERM was not interrupted (the Belgian franc, the Danish krone and the French franc); larger for the two currencies which suspended their participation (the Italian lira and the British pound) and for the Irish punt.

- The coefficient of the Swiss franc is always negative, suggesting that it tends to depreciate against the DM when the dollar strengthens. This is consistent with its "safe haven" role, played in competition with the American currency. The yen coefficient, positive in the first three sub-periods, becomes negative in the most recent one, possibly reflecting its increased role as a reserve currency.

A possible objection to our analysis is that it determines a priori the structural breaks in the relationship, choosing the "critical" dates, rather than determining them endogenously. This objection has been raised with regard to previous works by Haldane and Hall (1991) and Malliaropulos (1994), who show that in some cases changes have occurred gradually and cannot be appropriately captured by the division

[16] The coefficients for the peseta and the pound in the sub-periods 19 June, 1989-31 July, 1992 and 8 October, 1990-31 July, 1992, after the respective entries in the ERM, and those for the lira in the period 8 January, 1990-31 July, 1992, after the move into the narrow fluctuation band, are reported in the footnotes of Table 1. They show that the change in the lira's and in the British pound's regimes coincided with a decrease in the strength of the relationship.

into sub-periods. We thus completed our analysis by estimating the following time-varying model:

$$\Delta \log(DMCUR_t) = \alpha_t + \beta_t \Delta \log(EFFUSA_t) + \gamma_t INT_t + \eta_t \quad (2)$$

$$\Gamma_t = \Gamma_{t-1} + \Omega_t$$

where $\eta_t \sim N(0, v_t)$ is a random noise, $\Gamma'_t = [\alpha_t, \beta_t, \gamma_t]$ and $\Omega_t \sim N(\underline{0}, \Sigma_t)$. The system has been estimated by minimising the prediction errors obtained by applying the Kalman filter with respect to Ω_t.

Figure 1, which shows the time-varying estimate of β_t, gives some additional information on the most recent period and, in particular, on the effects of the lira's re-entering the ERM.[17] After the currency crisis in autumn 1992, only the coefficient of the Dutch guilder remained stable (virtually at zero); those of the other currencies of the EMS area[18] increased, especially since the second half of 1993 and, further, since the first quarter of 1995. This suggests that the widening of the EMS fluctuation band in August 1993 was a regime change for the currencies involved. The coefficients of all these currencies fell again during 1996 and during the early months of 1997. The sharp reduction of the lira's coefficient in 1997 may have partly resulted from the lira's re-entering the ERM in the second half of November.

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[17] The charts report the results only for the 1987-1997 period. For the preceding years the analysis confirms that in the countries which adhered to the EMS from the beginning the coefficient started to decrease well in advance of the inception of the System, in most cases recording a large part of the reduction during 1978. This suggests that the marked anticipated the effects of the new regime or, as suggested by Malliaropulos (1994), that the change in the relationship reflected the process of financial integration and monetary policy convergence more than the institutional change per se. After the decline, the coefficients stabilised in the first half of the 1980s.

[18] We define this area as comprising the ERM currencies, including the Italian lira, the British pound, and the Swedish krone.

So far we have measured the effects of the dollar's variations on the bilateral exchange rates vis-à-vis the DM. Monetary authorities, however, could be interested in the effective exchange rates of their respective currencies as a global measure of their external value, rather than in the bilateral exchange rates. Thus, we also ran regressions of the daily percentage changes of the effective exchange rates of the selected currencies on changes in the dollar effective rate (the results are given in Table 2[19]). The estimated coefficients reflect both the reaction of the bilateral rates and their different weights in the effective exchange rate of each country, providing information complementary to that obtained above. In particular, we can observe that, as for the bilateral rates, the reactions of the effective exchange rates to the dollar shocks differ significantly across EMS currencies. The differences concern not only the size but also the sign, as the differing effect on the bilateral exchange rates vis-à-vis the DM is amplified by the large weight of this currency in the effective exchange rates of the European currencies. The effective rates of the Dutch guilder, the Belgian franc, the Danish krone and the French franc all tend to fall, on average, in periods of dollar strengthening, over the entire sample period considered. Those of the lira and the pound, on the contrary, tend to appreciate in all the sub-periods with the exception of 1987-1992. Those of the punt and the peseta tend to appreciate in the periods preceding their respective entries in the ERM, vice versa in the following periods.

4. Two explanations proposed in the literature

The existence of a systematic relationship between the dollar and the exchange rates between the European currencies

[19] Detailed results for each regression are reported in Tables A9-A12.

implies that a shock which is expected to determine a dollar variation, e.g. an increase in US interest rates, induces investors to sell assets denominated in marks more than assets denominated in other European currencies, in order to buy assets denominated in dollars. The explanations of this empirical regularity put forward in the literature concentrate on two main aspects: the degree of substitutability between assets denominated in different currencies, reflecting the correlation between their expected yields, and the segmentation and different depths of the markets for the various currencies, in particular owing to capital controls.

The first aspect has been analysed by Giavazzi and Giovannini (1985) and Frankel (1985a, 1985b) within the theoretical framework of capital asset pricing models. These authors test the explanatory power of the International Capital Asset Pricing Model (ICAPM) for the relationship between the external value of the dollar and the exchange rate of other currencies vis-à-vis the DM. According to this class of models, the different degree of substitutability[20] between assets denominated in different currencies is a function of the covariance between the expected yields of the financial assets in the market, under the hypothesis that investors maximise a static function of the mean and the variance of the expected yield of their portfolio.[21] Table 3 reports the correlation between the real yield differentials[22] (including the change in the exchange rate) of assets denominated in the main European currencies, in yen and in Canadian dollars and

[20] We define two assets as highly substitutable if their yields are highly correlated, so that holding both assets does not allow the investment risk to be diversified; in this case small changes in expected yields determine, *ceteris paribus*, large movements of capital from one asset to the other.

[21] See, for instance, Dornbusch (1983).

[22] Similar results are obtained for nominal differentials.

those denominated in US dollars, calculated for the same periods as considered in Section 3. The results, although not directly comparable with those obtained by the authors mentioned above, confirm their conclusions for the last decade: in the two periods between January 14, 1987 and July 31, 1992 and between November 1, 1992 and November 23, 1996 the sample correlation between the yields on dollar assets and those in DM (and thus their substitutability) is generally lower than between the former and assets denominated in other European currencies.[23] The total value of assets denominated in DM that should be sold to buy assets denominated in dollars when the latter strengthens is thus smaller than that of assets denominated in other European currencies. These currencies should therefore depreciate vis-à-vis the DM, rather than appreciate, the opposite of what we observed in Section 3.

In the ICAPM the equilibrium exchange rate is a function of the expected yields of the assets available in the market, which in the model are exogenously given. Alternatively, Giavazzi and Giovannini (1989) also tried to use a model where yields are endogenously determined and the equilibrium exchange rate depends on the money supply, on the production level and on the average intertemporal rate of substitution of consumption in each country (Lucas, 1982). The empirical test presented by the authors shows that this model is also unable to explain the empirical regularity described in Section 3.

The second explanation proposed in the literature focuses on the segmentation and the different depth of the

[23] The correlation is in fact negative both between the dollar and the DM yields and between the former and the yields of the other European currencies; in the first case it is larger in absolute value. These results should be interpreted with caution, given the high sensitivity of the coefficients to the choice of the estimation period.

markets for the various currencies. In particular, Giavazzi and Giovannini (1989) suggested that, owing to the existence of capital controls, currency markets in France, Italy, Spain and, until the end of the 1970s, the United Kingdom, were thinner. As a consequence, assets denominated in the currencies of these countries were less substitutable with those denominated in dollars than assets denominated in DM, independently of the correlation between their yields. This explanation, however, cannot be applied to the recent period, as capital controls had been eliminated in all the European markets by the end of the 1980s. Nor does it seem plausible that the observed relationships reflect the markets' fear that capital controls might be re-introduced (a possibility that even in the 1992-93 crisis occurred only in Ireland and in Spain, exclusively for some types of financial transactions and for a limited period).

Another possibility is that factors other than capital controls - such as differing costs of acquiring information on the evolution of variables affecting different currencies[24] - determine the markets' depth, which in turn concurs in explaining the observed empirical regularity.[25] To verify this hypothesis, albeit indirectly, Table 4 presents the amounts of dollar transactions vis-à-vis other currencies on the main markets, both in absolute terms and as a ratio to the stock of international assets denominated in the selected currencies. These data, which can be interpreted as a proxy of the various market depths, only partially support the above hypothesis: the share of the transactions against DM is larger than those of transactions against the other European currencies (the ratio of spot transactions to the stock of international assets is 6.3 per cent for the DM, compared with between 1.3

[24] See, for instance, Mayshar (1983).

[25] An explanation of this type is mentioned in BIS (1996a).

and 4.1 for the other major European currencies[26]), but the ranking of the latter on the basis of this measure does not correspond to the ranking of the coefficients estimated in Section 3. As shown by the four quadrants in Figure 2 (based on spot transactions) there are both currencies with a relatively thin market and a low coefficient (the Dutch guilder, the Belgian franc, the Danish krone and the French franc) and currencies with a thin market and a high coefficient (the Italian lira, the Spanish peseta and the Swedish krone). Moreover, the British pound's market is deep but its coefficient is high.

These observations suggest that the depth of the market may have a partial role in determining a different substitutability between assets denominated in different currencies: it may in fact help to explain the relationship between the DM and the other European currencies as a whole, but not the large differences observed across the latter.

5. Another explanation: a role for monetary policies and exchange-rate targets

The differences observed in Section 3 in the reactions of bilateral exchange rates to the dollar changes - both across currencies and across periods - suggest that the different orientation of monetary and exchange-rate policies over time and between countries may be an important factor underlying the observed relationship, together with the different ways in which policies are perceived and anticipated by the markets. Changes over time affect all the EMS currencies in the same way: as seen in Section 3, they all tend to appreciate against the DM when the dollar strengthens and the intensity of this effect diminishes for all of them

[26] The higher values of the ratio observed for the Scandinavian currencies reflect the small stock of assets denominated in these currencies.

when the exchange-rate regime becomes more stringent. Here we concentrate on cross-country differences, which are large and persistent over time (the ranking of the effects of the dollar shock on the various currencies is constant across the various sub-periods).

In checking whether the ICAPM model is capable of explaining the reactions of bilateral exchange rates with respect to the DM to dollar changes, it has been assumed that the shock to the dollar has no effects on the yields of investments denominated in other currencies; any change in the composition of investors' portfolios is thus made dependent on the change of the revenues on dollar assets. However, if we assumed that a shock to the dollar could induce a change in the monetary policy stance of the other countries, then the reallocation of investors' portfolio would also depend on the effects of these changes on the yields of assets denominated in the respective currencies. The relationship between the value of the dollar and the bilateral exchange rates between the European currencies could therefore depend on the different reaction function of each country's monetary authority.

Assume, for instance, that interest rates are fixed by central banks which also react to the bilateral exchange rates vis-à-vis the dollar and the DM. In this case a positive shock to the dollar determines a larger interest-rate increase in countries where the central bank puts more weight on the bilateral rate vis-à-vis this currency; if the reaction is larger than in Germany, the interest rate differential between these countries and Germany widens, determining an appreciation of the respective currencies vis-à-vis the DM.

This effect can be captured by a simple three-country model. Consider the following interest rate parities between the dollar, the DM and a third currency, allowing for

deviations from the uncovered interest rate parity due to exogenous factors that can be attributed to any currency:

(3) $$s_t^{CUR/\$} = E\left(s_{t+1}^{CUR/\$}|t\right) + i_t^{USA} - i_t^{CUR} + \varepsilon_t^{\$} - \varepsilon_t^{CUR}$$

(4) $$s_t^{CUR/DM} = E\left(s_{t+1}^{CUR/DM}|t\right) + i_t^{GER} - i_t^{CUR} + \varepsilon_t^{DM} - \varepsilon_t^{CUR}$$

(5) $$s_t^{\$/DM} = E\left(s_{t+1}^{\$/DM}|t\right) + i_t^{GER} - i_t^{USA} + \varepsilon_t^{DM} - \varepsilon_t^{\$}$$

where $s_{t+1}^{CUR/\$}$ is the expected log-variation between *t* and *t*+1 of the exchange rate of the third currency vis-à-vis the dollar; $E(.|t)$ is the expectation operator based on information available at time *t*; i_t^{USA} is the interest rate on assets denominated in dollars; $\varepsilon_t^{\$}$ captures any positive idiosyncratic shock affecting the value of the dollar in a way that alters the interest rate parity; the variables for the other two currencies are defined analogously. Moreover, assume that the central bank of the third country fixes the policy interest rate taking into account, among other things, the level of the bilateral exchange rate both vis-à-vis the DM and the dollar, and that the market interest rate is a function of the policy rate, thus reacting to a change in the exchange rate according to the following reaction function:[27]

(6) $$i_t^{CUR} = f\left(s_t^{CUR/DM}, s_t^{CUR/\$}, \eta_t^{CUR}\right); \quad \text{with } f_1', f_2' \geq 0$$

where η_t^{CUR} is a parameter capturing other variables affecting the interest rates. Finally, assume that the German authorities have no target for the bilateral exchange rates.[28]

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[27] A similar reaction function has been assumed by McCallum (1994) in a two-country model.

[28] The implications of the model do not change under the hypothesis that the reaction of the German authorities is not necessarily null, but lower than those of the third country considered. This hypothesis is consistent with the idea that the US and German policies are the two

Totally differentiating equations (4) and (6), substituting one into the other and substituting for $ds_t^{\$/DM}$ using equation (5) and the fact that $ds_t^{CUR/\$} = ds_t^{CUR/DM} - ds_t^{\$/DM}$, we obtain the following expression for a change of the exchange rate of the third currency vis-à-vis the DM:

(7)
$$ds_t^{CUR/DM} = \left(\frac{1}{1 + f_{DM}^{'} + f_{\$}^{'}}\right) \times$$

$$\times \left\{ E\left(ds_{t+1}^{CUR/DM} \middle| t\right) + f_{\$}^{'}\left[E\left(ds_{t+1}^{\$/DM} \middle| t\right) - di_t^{USA} - d\varepsilon_t^{\$}\right] + \left(1 + f_{\$}^{'}\right)\left(di_t^{GER} + d\varepsilon_t^{DM}\right) - f_{\eta}^{'} d\eta_t - d\varepsilon_t^{CUR} \right\}$$

where $f_{\$}^{'}$ is the partial derivative of the f function with respect to its second argument and the other two derivatives are defined analogously. Rewriting equation (7) at time $t+1$ and applying the expectation operator based on information available at time t to both sides of this expression and iterating the substitution, we obtain an expression where the exchange rate of the third currency vis-à-vis the DM is a function of the expectations on the bilateral exchange rates of the same currency and the dollar vis-à-vis the DM and of the expectations on interest rates in Germany and in the US:

(8)
$$ds_t^{CUR/DM} = \left(\frac{1}{1 + f_{DM}^{'} + f_{\$}^{'}}\right)^T E\left(ds_{t+T}^{CUR/DM} \middle| t\right) +$$

$$+ \sum_{i=1}^{T} \left(\frac{1}{1 + f_{DM}^{'} + f_{\$}^{'}}\right)^i E\left[f_{\$}^{'}\left(ds_{t+i}^{\$/DM} - di_{t+i-1}^{USA} - d\varepsilon_{t+i-1}^{\$}\right) + \left(1 + f_{\$}^{'}\right)\left(di_{t+i-1}^{GER} + d\varepsilon_{t+i-1}^{DM}\right) - f_{\eta}^{'} d\eta_{t+i-1} - d\varepsilon_{t+i-1}^{CUR} \middle| t \right]$$

"poles of attraction" for the policies of other countries and that the latter tend to settle in an intermediate position. This seems a sensible hypothesis and is actually supported by the empirical evidence on the correlation between the policy rates of the various countries.

where $T>t$ is a generic future period. From this relationship, assuming $E\left(ds_{t+T}^{CUR/DM}|t\right)=0$ (i.e. that the long-term expectations on the exchange rate of the third currency vis-à-vis the DM do not change), it appears that an idiosyncratic shock on the external value of the dollar determines, for $f_{\$}^{'}>0$, an appreciation of the exchange rate of the third currency:

(9) $$\frac{ds_t^{CUR/DM}}{d\varepsilon_t^{\$}}=-\frac{ds_t^{CUR/DM}}{ds_t^{\$/DM}}=-\frac{f_{\$}^{'}}{1+f_{DM}^{'}+f_{\$}^{'}}$$

where the first equality reflects equation (5). This result indicates that the variation of the bilateral exchange rates vis-à-vis the DM triggered by a shock to the dollar varies depending on the relative size of $f_{\$}^{'}$ and $f_{DM}^{'}$, that is on the relative weights assigned to the two main currencies in the exchange rate policy of each country.

The same model could be applied to other third currencies. In this case we would obtain variations of the respective exchange rates vis-à-vis the DM which depend on the relative size of the parameters $f_{\$}^{'}$ and $f_{DM}^{'}$ for each of them. From this model it is thus possible to obtain a ranking of the reactions of the exchange rates of the European currencies vis-à-vis the DM after a shock to the external value of the dollar comparable to that implicit in the results of Section 3.

Furthermore, equation (8) shows that the reaction of the bilateral exchange rate of the third currency against the DM in the case of a dollar shock also depends on the expectations about the evolution of the DM/dollar exchange rate and of each country’s interest rates (the term in the sum). For instance, if the markets interpreted an increase of US interest rates as part of a monetary tightening that was

expected to continue, the third currency's appreciation against the DM at time *t* would be bigger than indicated by equation (9).

According to the implications of the model, we should expect a cross-country relationship between the coefficients estimated in Section 3, which measure the effect of dollar shocks on the bilateral rates vis-à-vis the DM, and indexes of the relative position of the national exchange rate and monetary policy between the two poles of attraction provided by Germany and US.

The most direct way to test this would be to estimate $f_{\$}^{'}$ and $f_{DM}^{'}$. This is a difficult task, however, as the move of the monetary authorities may reflect important factors other than the variations of the two exchange rates.[29] Alternatively, the implications of the model can be tested by examining the relationship between each country's interest rate and the German and American ones. In fact substituting equation (8) and the equivalent expression for $ds_t^{CUR/\$}$ into the expression for di_t^{CUR} obtained by totally differentiating equation (6), we obtain a relationship between the interest rates of the third country and those in the US and in Germany:

[29] In fact, we were able to detect a statistically significant reaction to the variation of the bilateral rate vis-à-vis the DM, while in most cases the reaction to the exchange rate vis-à-vis the dollar was not statistically significant.

(10) $$di_t^{CUR} =$$

$$= \left[\frac{1}{1+ f_{DM}^{'} + f_{\$}^{'}}\right]^T \left[f_{DM}^{'} E\left(ds_{t+T}^{CUR/DM} | t\right) + f_{\$}^{'} E\left(ds_{t+T}^{CUR/\$} | t\right)\right] + \sum_{i=1}^{T}\left(\frac{1}{1+ f_{DM}^{'} + f_{\$}^{'}}\right)^i \times$$

$$\times E\left[f_{\$}^{'}\left(di_{t+i}^{USA} + d\varepsilon_{t+i-1}^{\$}\right) + f_{DM}^{'}\left(di_{t+i}^{DM} + d\varepsilon_{t+i-1}^{DM}\right) - \left(f_{DM}^{'} + f_{\$}^{'}\right)\left(d\eta_{t+i-1} + d_{t+i-1}^{CUR} + d\varepsilon_{t+i-1}^{CUR}\right) | t\right] + f_{\eta}^{'} d\eta$$

Equation (10) shows that the partial correlation between the third country's interest rate and the American one coincides with the reaction to a dollar shock of the bilateral exchange rate vis-à-vis the DM, shown in equation (9). Moreover, the partial correlation with the German interest rate also reflects the relative weights of the currency in the reaction function of the monetary authorities:

(11) $$\frac{di_t^{CUR}}{di_t^{USA}} = \frac{f_{\$}^{'}}{1+ f_{\$}^{'} + f_{DM}^{'}}$$

and

(12) $$\frac{di_t^{CUR}}{di_t^{DM}} = \frac{f_{DM}^{'}}{1+ f_{\$}^{'} + f_{DM}^{'}}$$

In order to test the implications of equation (10) of our model we have estimated, using daily data, the partial correlations between the one-month euro-market interest rates of each of the countries considered and those of Germany and the US. To avoid the problems of spurious regressions, we have corrected for first order autocorrelation of the error term as suggested by Blough (1992) and Hamilton (1994). We first examine the correlation with the US rate only (captured by equation (11)), which is more directly related to the empirical analysis of Section 3 (as can be seen by comparing equations (8) and (11)). Coherently with the prediction of our theoretical analysis, Figure 3 shows the existence of a

positive relationship, in a pooled sample of the two sub-periods 1987-1992 and 1992-1996, between the estimated correlations between each country's rate and the US rate and the corresponding βs from regression (1). If the reaction of the bilateral exchange rates vis-a-vis the DM to a dollar shock had not been a function of actual or expected monetary policy actions, but depended on a correlation between shocks to the dollar and shocks to the DM (namely if $Cor\left(\varepsilon_t^{DM}, \varepsilon_t^{\$}\right) \neq 0$), we would not have found a relationship between the reaction coefficients and the partial correlation of the interest rates.

However, the relationship is not very strong; this could be due to the role of the other factors affecting the choice of the policy interest rates by the central banks (which we have included in the variable η of equation (6)) and to the unequal transmission of changes in policy rates into markets rates in the various countries. To overcome this second problem, we have estimated, using end-of-the week data, the partial correlations between the policy interest rates of each of the countries considered and those of Germany and the US.[30] As is clear from Figure 4, in this case the relationship of the partial correlations between each country's interest rates and those of the US with the βs is more clearly defined.

[30] The correlations are calculated with respect to the mean of the discount rate and the Lombard rate for Germany and with respect to the target for the Fed funds rate for the US. The policy rates used for the other countries are the following: the central rate for Belgium, the rate on banks' current account deposits with the central bank for Denmark; the repo rate for Italy; the overnight rate for France; the rate on special loans for the Netherlands, the auction rate for Spain, the base rate for the UK, and the Riksbank lending rate for Sweden. In the case of Belgium we had to tackle discontinuities in the series. Data are from the BIS data base, with the exception of the target for the Fed funds rate, which is from Rudebusch (1995).

Although the test just used is the most consistent with our model, it may be worth considering another which takes into account an important factor, not explicitly captured by the model, i.e. the asymmetric position of the EMS currencies between the two poles of attraction. As mentioned earlier, the reaction of the national monetary policies to the variation of the bilateral exchange rate vis-à-vis the DM is more easy to detect statistically. This is not surprising as almost all the countries considered in the test were members of an exchange rate regime centred on the DM, although they interpreted the relationship more or less rigidly. These results suggest that considering the relationship with the German interest rate as well (captured in the model by equation (12)) is likely to improve the explanatory content of the variable considered. Figure 5 shows that when consideration is given to the difference between the correlation of each country's policy rates with both the American and the German ones, this is indeed the case: the relationship with the corresponding βs from regression (1) is stronger than that shown in Figure 4.

On the whole, Figures 3 to 5 suggest that the differences in the exchange-rate and monetary policies play an important role in explaining the differences in the estimated βs: the less a country's monetary policy aims at maintaining a strict exchange-rate target vis-à-vis the DM, or the less close is the link with German monetary policy (or the closer that with the American one), the stronger is the reaction to a dollar shock of the bilateral exchange rates vis-à-vis the DM.[31]

[31] A similar result is obtained by BIS (1997), where it is also shown that the differences in the estimated βs are correlated with measures of trade links, the comovement of cyclical fluctuations and the international use of the currency.

From these results it is clear that the monetary authorities of the various countries behave differently. This could reflect different monetary policy objectives or perhaps different ways of pursuing the same objective. Indeed, in particular for the period following the 1992 currency crisis, it seems reasonable to hypothesise that an inflation target was the main reference for the monetary authorities of the EMS area, independently of whether intermediate targets were also maintained. If this is the case, it is likely that each country reacted differently to changes in the value of its currency vis-à-vis the dollar and the DM depending on the relative inflationary effects of the changes.

A possible test of this hypothesis could be based on the composition of trade flows by currency of denomination, in particular dollars and marks. This information, however, is available only for some of the countries considered. Moreover, the use of such data can be misleading when prices are fixed in one currency and settlements are made in a different one or when there are pricing-to-market phenomena, absorbing part of the exchange-rate variations. One possible proxy of the effect of the variations of the exchange rate vis-à-vis the dollar on the respective countries' inflation is provided by measures of their dependence on imports of raw materials, in particular energy. However, the relationship between the behaviour of the monetary authorities and this measure, although suggesting that this variable may have an explanatory content, was not significant for the countries considered taken as a whole.[32]

[32] The results, not presented here, suggest that there is a link between the behaviour of the monetary authorities of most of the European countries considered and their dependence on energy imports; on the whole, however, the relationship is very weak owing to the presence of two outliers: the UK, which has a high β coefficient although it is a net exporter of energy materials, and Belgium, whose monetary policy does not seem to reflect the possible inflationary effects resulting from a high dependence on energy imports. Even weaker results are obtained considering the net imports of total raw materials (this may be explained by the fact that for some non-energy

We therefore preferred to run simulations with the NIESR Global econometric model (GEM):[33] we observed deviations from the baseline of the consumption deflator in response to a permanent 10 per cent appreciation of the DM (or the dollar) vis-à-vis all the other currencies; the deviations are measured in the period of the shock (with the exception of Spain, where a significant effect shows up only in the second quarter of the simulation) and in the last quarter of the simulation horizon (80 periods after the shock). This allowed us to determine two measures of the relative inflationary effects of changes in the value of the two main currencies: the ratio of the impact effect on the inflation rate of each country of a DM shock to that of a dollar shock and the same ratio for the long-run effect. The upper part of Figure 6 shows the relationship between the impact ratio and the index of the relative correlation between each country's monetary policy and the German and US ones. The lower part of the figure shows the same relationship for the long run-effect. The results seem consistent with the hypothesis that the monetary authorities' behaviour reflects the expected inflationary effects of exchange-rates variations.[34] The attention paid to the DM has been in fact lower in countries where the dollar has a relatively bigger effect on inflation, possibly reflecting the above-mentioned factors related to the composition of trade flows.

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goods the markets are likely to be less efficient and the payments are not necessarily made in dollars).

[33] GEM is the quarterly model of the world economy of the National Institute for Economic and Social Research (NIESR, 1997); it has been used in various research papers and is used regularly by the NIESR to prepare forecasts for the world economy.

[34] The results, however, should be interpreted with caution, as the observed relationship is not confirmed for all the intermediate horizons of the simulations.

6. Conclusions

Our empirical analysis shows that the relationship between the dollar and the bilateral exchange rates of a group of major currencies - in particular the tendency of the EMS currencies to appreciate vis-à-vis the DM when the dollar strengthens - is confirmed for the last decade. The responsiveness of the EMS currencies to changes in the dollar's value varies significantly, however, both across countries and across periods. After decreasing in the 1987-1992 period, it rose again after the currency crisis, to a larger extent for the lira, the pound and the punt. The effect appears to have diminished during 1996, possibly reflecting the progressive convergence of the European economic policies and the expectations on the unification process, as well as Italy's re-entering the ERM in the case of the lira.

The explanations put forward in the literature, which are based on the degree of substitutability between assets denominated in the various currencies (related to the correlation between their expected yields or to the presence of capital controls), are not supported by the empirical evidence. The different depth of the markets for the various currencies may have a partial role, and help to explain the behaviour of the European currencies as a whole vis-à-vis the DM, but not the remarkable differences between them.

This paper suggests an alternative explanation, consisting in the orientation of monetary and exchange-rate policies in the various countries, or in the different ways they are perceived and anticipated by the markets. This explanation is supported by the existence of a significant relationship between the estimated effects of dollar shocks on the bilateral exchange rates vis-à-vis the DM and the link between the monetary policies in the respective countries and the American and German ones. It is also consistent with the

hypothesis that in the period considered all the monetary authorities of the EMS area pursued an anti-inflationary strategy, and that in doing so they took into account the different effects of changes in the value of the DM and the dollar on domestic inflation.

Table 1

EFFECTS OF VARIATIONS IN THE NOMINAL EFFECTIVE EXCHANGE RATE OF THE DOLLAR ON THE BILATERAL EXCHANGE RATES VIS-À-VIS THE DEUTSCHEMARK

(regression coefficients of the log-differences and standard errors[1])

Period 1.6.1973-11.3.1979 - "Monetary Snake"

Dutch Guilder	Belgian Franc	Danish Krone	French Franc	Irish Punt	Italian Lira	Spanish Peseta	British Pound	Swedish Krone	Swiss Franc	Japanese Yen	Canadian Dollar
0.12	0.13	0.33	0.14	0.68	0.77	0.99	0.68	0.51	-0.23*	0.03*	1.41
(0.029)	(0.028)	(0.011)	(0.059)	(0.069)	(0.060)	(0.079)	(0.059)	(0.088)	(0.012)	(0.14)	(0.079)

Period 13.3.1979-13.1.1987 - "EMS with realignments"

Dutch Guilder	Belgian Franc	Danish Krone	French Franc	Irish Punt	Italian Lira	Spanish Peseta	British Pound	Swedish Krone	Swiss Franc	Japanese Yen	Canadian Dollar
0.07*	0.05*	0.09	0.07*	0.08	0.24	0.27	0.39	0.40	-0.07	0.14	0.82
(0.042)	(0.028)	(0.036)	(0.050)	(0.036)	(0.073)	(0.00)	(0.083)	(0.062)	(0.026)	(0.047)	(0.00)

Period 14.1.1987-31.7.1992 - "EMS without realignments"

Dutch Guilder	Belgian Franc	Danish Krone	French Franc	Irish Punt	Italian Lira[2]	Spanish Peseta[3]	British Pound[4]	Swedish Krone	Swiss Franc	Japanese Yen	Canadian Dollar
0.01	0.01*	0.04	0.05	0.05	0.10	0.12	0.14	0.26	-0.08	0.10	1.08
(0.003)	(0.011)	(0.006)	(0.006)	(0.006)	(0.009)	(0.017)	(0.024)	(0.018)	(0.022)	(0.045)	(0.038)

Period 1.11.1992-23.11.1996 - "After the EMS crisis"

Dutch Guilder	Belgian Franc	Danish Krone	French Franc	Irish Punt	Italian Lira	Spanish Peseta	British Pound	Swedish Krone	Swiss Franc	Japanese Yen	Canadian Dollar
0.01	0.03	0.09	0.14	0.36	0.44	0.27	0.47	0.38	-0.19	-0.15	1.28
(0.003)	(0.012)	(0.023)	(0.027)	(0.059)	(0.061)	(0.046)	(0.047)	(0.071)	(0.022)	(0.03)	(0.060)

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[1] GMM estimates. The asterisk indicates that the coefficient is not statistically different from zero at a significance level of 95%.

[2] For the period 8.1.1990-31.7.1992, after the lira's move to the narrow band, the coefficient is equal to 0.11 (0.014).

[3] For the period 9.6.1989-31.7.1992, after the peseta's entry in the ERM, the coefficient is equal to 0.10 (0.016).

[4] For the period 8.10.1990-31.7.1992, after the pound's entry in the ERM, the coefficient is equal to 0.18 (0.036).

EFFECTS OF VARIATIONS IN THE NOMINAL EFFECTIVE RATE OF THE DOLLAR ON OTHER CURRENCIES' EFFECTIVE EXCHANGE RATES

(regression coefficients of the log-differences and standard errors[5])

Period 1.6.1973-11.3.1979 - "Monetary Snake"

Dutch Guilder	Belgian Franc	Danish Krone	French Franc	Irish Punt	Italian Lira	Spanish Peseta	British Pound	Swedish Krone	Swiss Franc	Japanese Yen	Canadian Dollar
-0.30	-0.27	-0.07*	-0.29	0.08	0.46	0.57	0.17	0.08*	-0.63	-0.74	-0.16
(0.029)	(0.028)	(0.011)	(0.053)	(0.030)	(0.056)	(0.015)	(0.050)	(0.094)	(0.013)	(0.155)	(0.028)

Period 13.3.1979-13.1.1987 - "EMS with realignments"

Dutch Guilder	Belgian Franc	Danish Krone	French Franc	Irish Punt	Italian Lira	Spanish Peseta	British Pound	Swedish Krone	Swiss Franc	Japanese Yen	Canadian Dollar
-0.22	-0.21	-0.19	-0.18	-0.32	0.02*	-0.02*	0.04*	0.10*	-0.34	-0.10	-0.25*
(0.031)	(0.013)	(0.031)	(0.035)	(0.158)	(0.060)	(0.020)	(0.084)	(0.073)	(0.017)	(0.330)	(0.000)

Period 14.1.1987-31.7.1992 - "EMS without realignments"

Dutch Guilder	Belgian Franc	Danish Krone	French Franc	Irish Punt	Italian Lira[6]	Spanish Peseta[7]	British Pound[8]	Swedish Krone	Swiss Franc	Japanese Yen	Canadian Dollar
-0.23	-0.20	-0.18	-0.15	-0.23	-0.09	-0.12	-0.19	0.01	-0.31	-0.00*	-0.01*
(0.000)	(0.013)	(0.01)	(0.025)	(0.013)	(9.324)	(0.016)	(0.022)	(0.017)	(0.021)	(0.045)	(0.84)

Period 1.111992-23.11.1996 - "After the EMS crisis"

Dutch Guilder	Belgian Franc	Danish Krone	French Franc	Irish Punt	Italian Lira	Spanish Peseta	British Pound	Swedish Krone	Swiss Franc	Japanese Yen	Canadian Dollar
-0.31	-0.26	-0.20	-0.14	-0.09*	0.21	-0.04*	0.09	0.06	-0.48	0.62	1.18
(0.019)	(0.019)	(0.022)	(0.026)	(0.047)	(0.053)	(0.038)	(0.037)	(0.064)	(0.034)	(0.000)	(0.038)

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[5] GMM estimates. The asterisk indicates that the coefficient is not statistically different from zero at a significance level of 95%.

[6] For the period 1.8.1990-7.31.1992, after the lira's move to the narrow band, the coefficient is equal to -0.06 (0.015).

[7] For the period 6.9.1989-7.31.1992, after the peseta's entry in the ERM, the coefficient is equal to -0.14 (0.016).

[8] For the period 10.8.1990-7.31.1992, after the pound's entry in the ERM, the coefficient is equal to -0.17 (0.037).

CORRELATION VIS-À-VIS US INTEREST RATES,
CALCULATED ON REAL ONE-MONTH EUROMARKET RATES[1]
(percentages)

Countries	1.4.1979-13.1.1987	14.1.1987-31.7.1992	1.11.1992-23.11.1996
Germany	-0.50	-0.65	-0.59
Netherlands	-0.48	-0.65	-0.60
Belgium	-0.49	-0.63	-0.57
Denmark	-0.48	-0.62	-0.50
French	-0.47	-0.62	-0.47
Ireland		-0.64	-0.02
Italy	-0.34	-0.56	0.19
Spain		-0.57	-0.18
United Kingdom	-0.19	-0.59	0.04
Sweden	-0.00	-0.46	0.07
Swiss	-0.51	-0.61	-0.63
Japan	-0.46	-0.59	-0.65
Canada	0.83	0.84	0.73

[1] Includes the monthly realised variation of the exchange rate vis-à-vis the dollar. Nominal interest rates have been deflationed using a unique index obtained by weighting the inflation rates of each country considered on the basis of the average proportions in the 1980-1994 period. All values are different from zero at the 95 per cent significance level, with the exception of those for Sweden in the first period and for the UK and Ireland in the third one.

TRANSACTIONS VIS-À-VIS THE DOLLAR

a)Percentages of the total transactions in dollars (1)

Dollars against:	DM	GBP	FF	ITL	PTA	FB	DK	NLG	Other SME	SK	ECU	SWF	Yen	CAN$	Other	Tot.
Total of international markets (2)	40.6 26.8	7.4 8.2	2.5 5.4	*1.6* *3.3*	*0.8* *2.0*	*0.8* *1.5*	*0.7* *1.3*	*0.9* *1.7*	*0.7* *1.3*	*0.5* *1.0*	0.6 1.9	6.3 6.4	24.9 25.6	3.5 4.0	8.2 9.6	100.0
London market (2)	42.9 25.2	13.2 15.4	3.0 6.1	1.4 3.9	0.7 2.4	*0.7* *1.8*	*0.6* *1.5*	*0.8* *2.0*	*0.6* *1.5*	*0.5* *1.2*	1.3 4.1	5.9 6.1	21.3 20.2	2.0 2.9	5.1 5.7	100.0
US market (2)	34.7	9.2	5.8	*1.4*	*0.9*	*1.0*	*0.8*	*1.1*	*0.8*	*0.7*	0.6	8.1	23.1	4.6	*7.2*	100.0

b) Transactions as a percentage of international assets denominated in the respective currencies (3)

Total of international markets	6.3	4.1	1.3	1.6	3.6	2.0	9.1	1.2	-	15.6	0.5	3.2	5.1	0.6	-	-

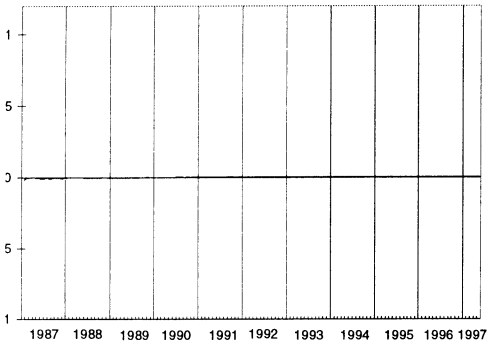
Sources: BIS; Bank of England; Federal Reserve of New York.

(1)Data in Italics are estimated on the basis of those directly available from the surveys.
(2)For the total of international markets and for the London market the first row reports spot transactions; the second row total transactions (sum of spot, outright forward and foreign exchange swap transactions); data for the US market refer to total transactions. All data are adjusted to avoid double counting.
(3)Data are based on spot transactions on the total of international markets, surveyed by the BIS; international assets are the sum of the following items, also of BIS source: banks' cross-border positions, euronotes and international bonds.

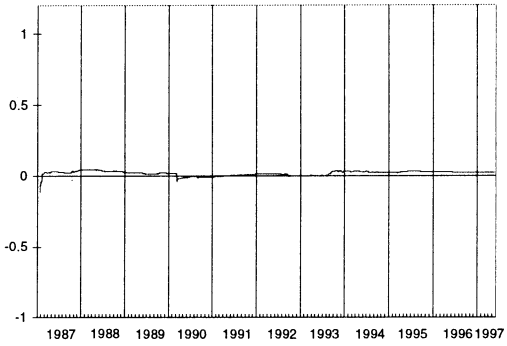
Figure 1

TIME VARYING COEFFICIENTS OF THE REGRESSION BETWEEN THE EFFECTIVE EXCHANGE RATE OF THE DOLLAR AND THE BILATERAL EXCHANGE RATES OF OTHER CURRENCIES VIS-A-VIS THE DEUTSCHEMARK
(daily data)

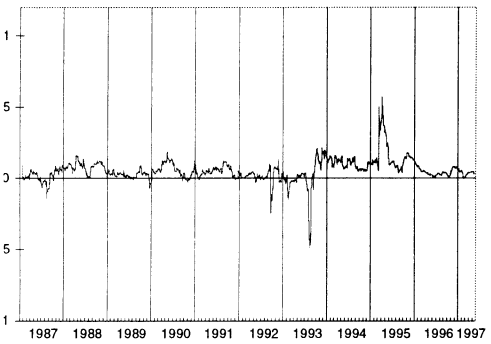
Dutch guilder



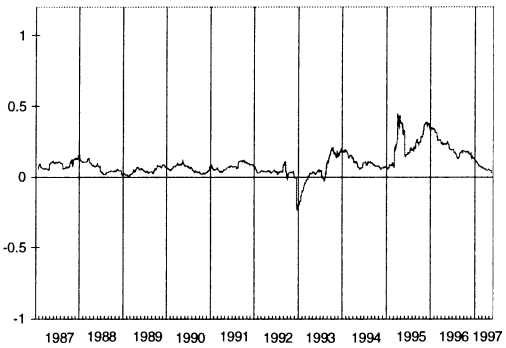
Belgian franc



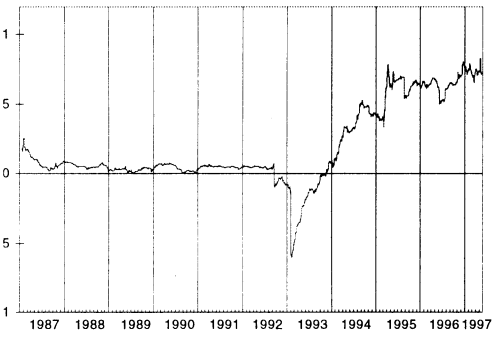
Danish krone



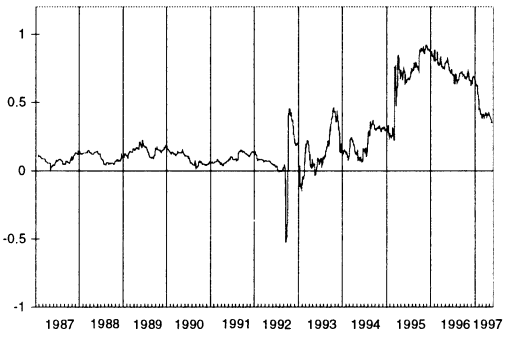
French franc



Irish punt

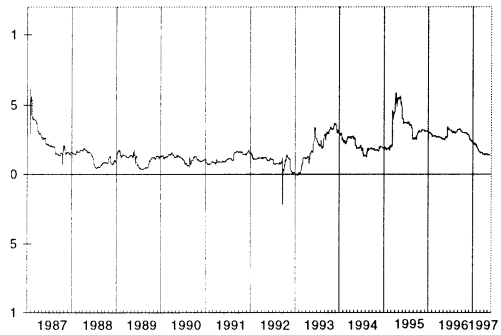


Italian lira

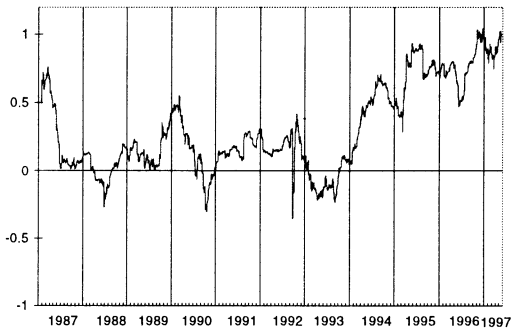


Continues Figure 1

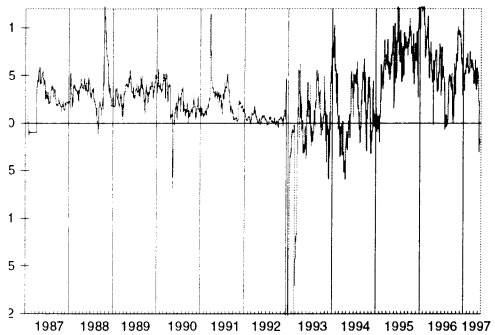
Spanish peseta



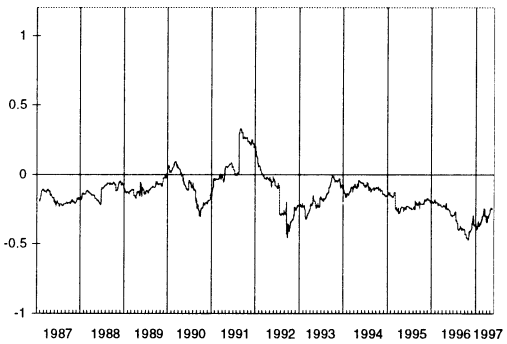
British pound



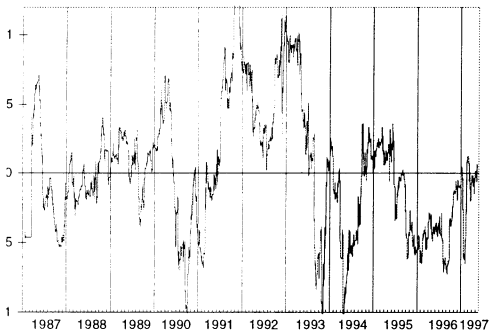
Swedish krone



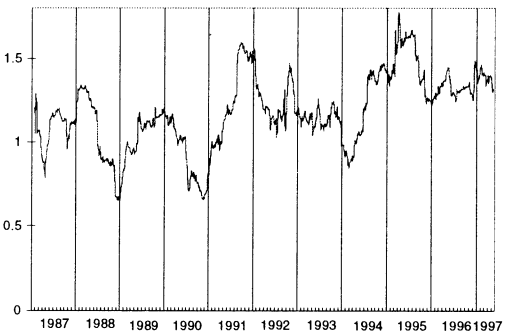
Swiss franc



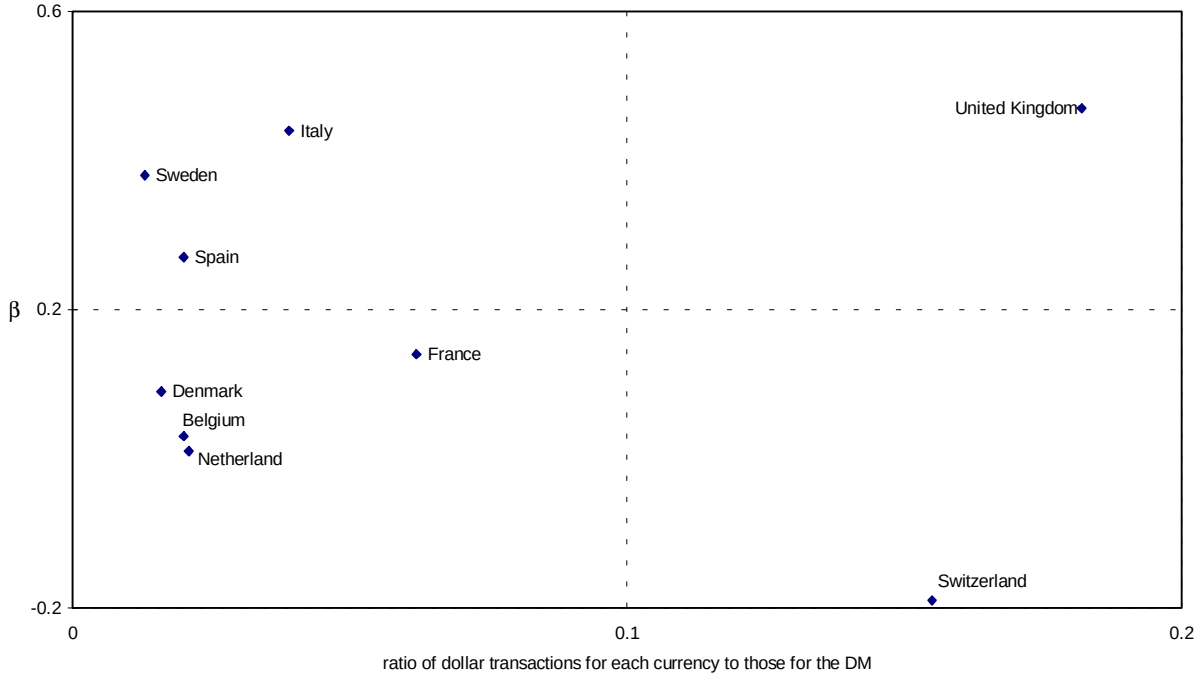
Japanese yen



Canadian dollar

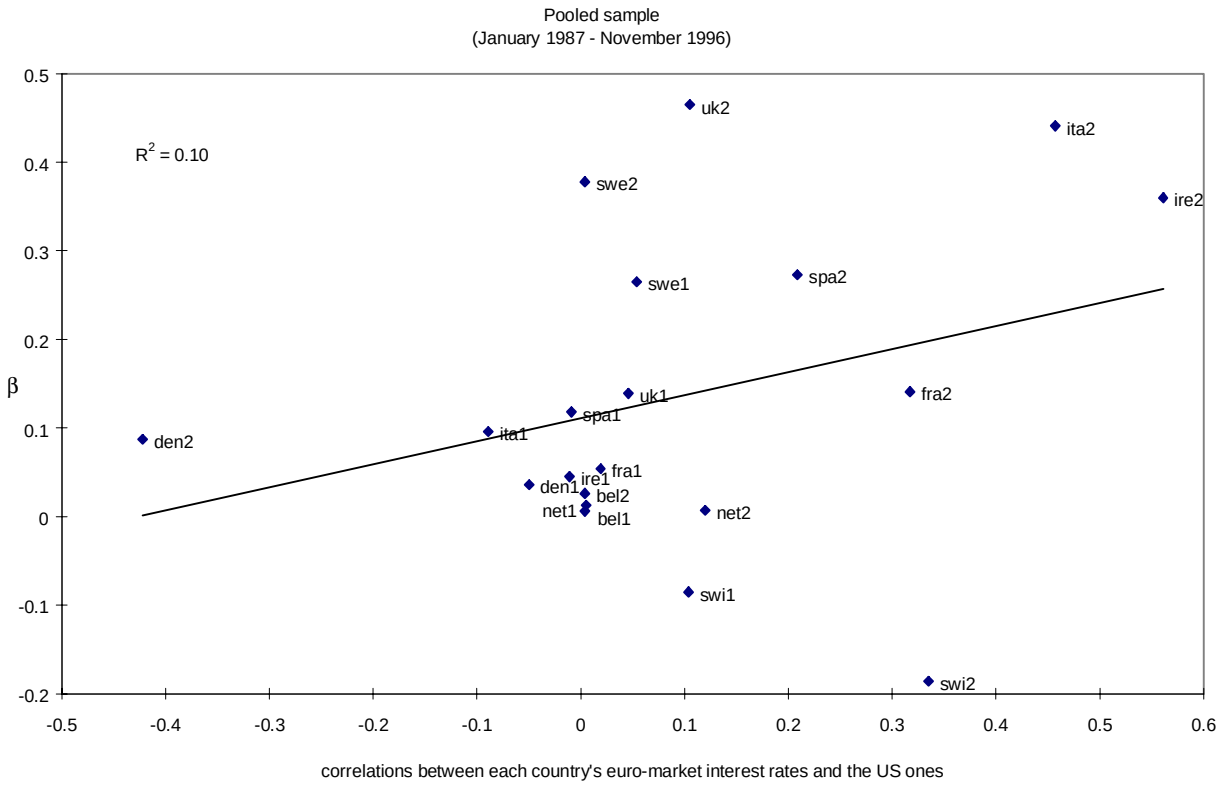


EFFECTS OF DOLLAR VARIATIONS ON BILATERAL EXCHANGE RATES AGAINST THE DM (βS) VIS-À-VIS DOLLAR TRANSACTIONS AGAINST EACH CURRENCY (1)



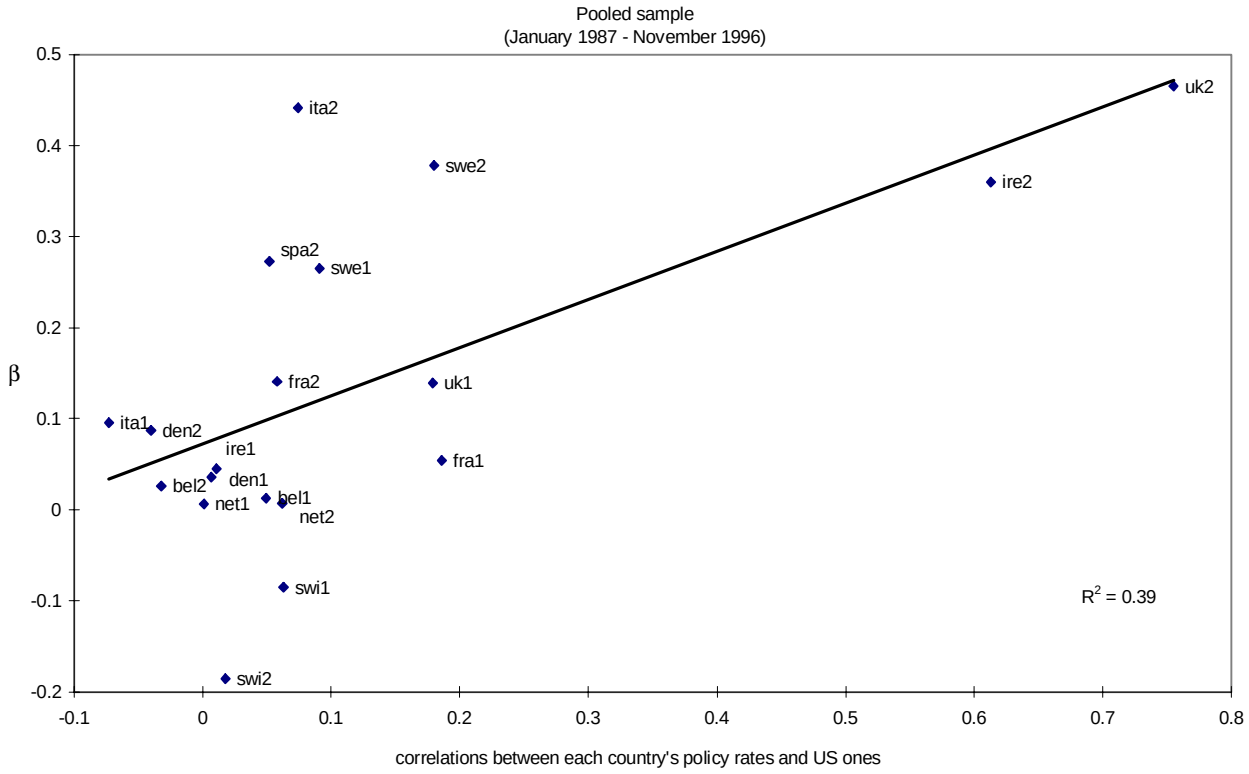
(1) On the vertical axis effects of the dollar variations estimated in the period November 1992-November 1996 (see Table 1); on the horizontal axis ratios of spot transactions against dollars for the respective currencies to those for the DM (data are partly estimated; see footnote 1 of Table 4).

EFFECTS OF DOLLAR VARIATIONS ON BILATERAL EXCHANGE RATES AGAINST THE DM (βS) VIS-À-VIS CORRELATION BETWEEN EACH COUNTRY'S EURO-MARKET INTEREST RATES AND THE US ONES (1)



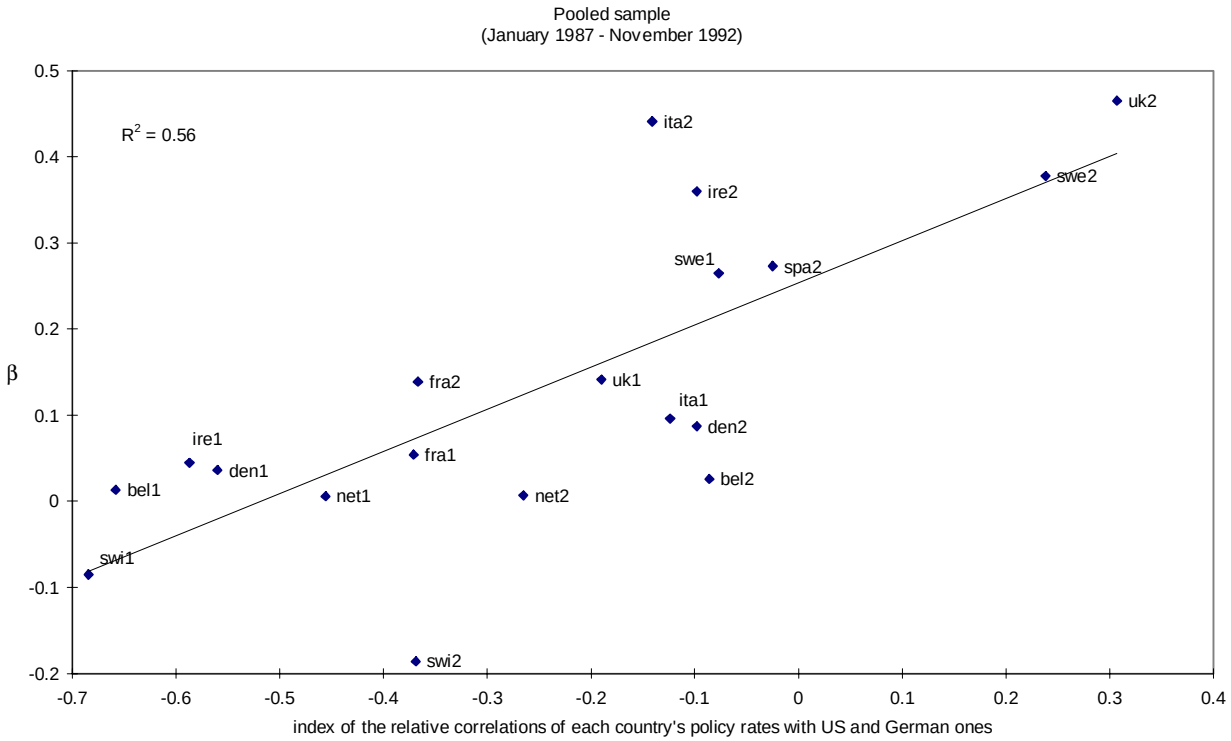
(1) The effects of dollar variations are those estimated in Section 3; interest rates coefficients are partial correlations obtained regressing the one month euro-market interest rates of each of the countries considered on the German and US ones, correcting for autocorrelation of the error term in order to avoid problems of spurious regressions as suggested by Blough (1992) and Hamilton (1994). Numbers 1 or 2 added to the country code refer to the subsample considered.

EFFECTS OF DOLLAR VARIATIONS ON BILATERAL EXCHANGE RATES AGAINST THE DM (βS) VIS-À-VIS CORRELATION BETWEEN EACH COUNTRY'S POLICY RATES AND THE US ONE (1)



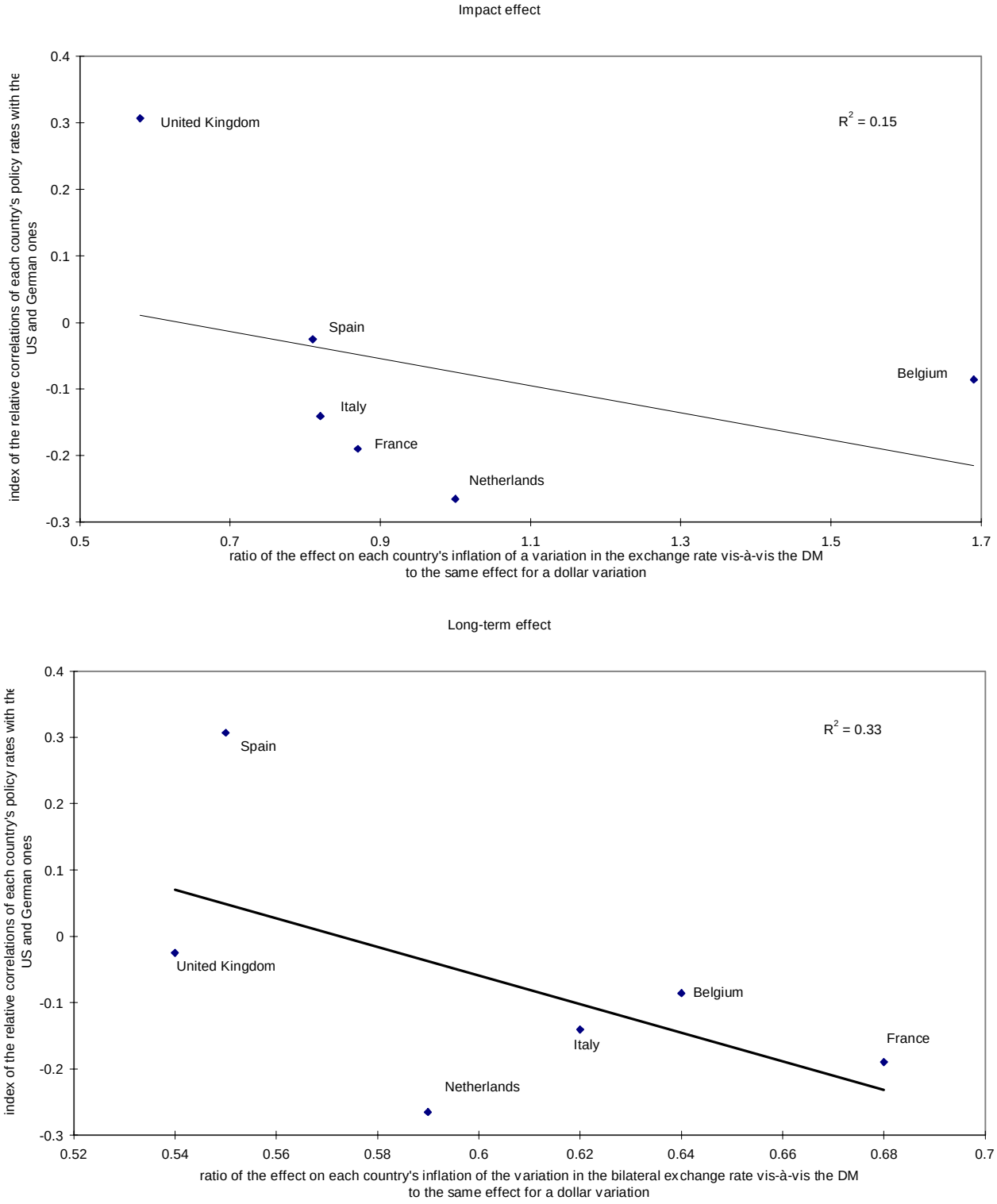
(1) The effects of dollar variations are those estimated in Section 3; monetary policy reactions are partial correlations obtained regressing the selected policy rates for the various countries on the German and US one, correcting for autocorrelation of the error term in order to avoid problems of spurious regressions as suggested by Blough (1992) and Hamilton (1994); policy rates are those reported in footnote 29. Numbers 1 or 2 added to the country code refer to the subsample considered.

EFFECTS OF DOLLAR VARIATIONS ON BILATERAL EXCHANGE RATES AGAINST THE DM (βS) VIS-À-VIS RELATIVE CORRELATION BETWEEN EACH COUNTRY'S POLICY RATES AND THE US AND GERMAN ONES (1)



(1) The effects of dollar variations are those estimated in Section 3; the index of monetary policy reactions is the difference of the partial correlations obtained regressing the selected policy rates for the various countries on the Us and German ones, correcting for autocorrelation of the error term in order to avoid problems of spurious regressions as suggested by Blough (1992) and Hamilton (1994); policy rates are those reported in footnote 29. Numbers 1 or 2 added to the country code refer to the subsample considered.

CORRELATION BETWEEN EACH COUNTRY'S POLICY RATES AND THE US AND GERMAN ONES VIS-À-VIS RELATIVE INFLATIONARY EFFECTS OF DOLLAR AND DM VARIATIONS (1)



(1) The indices of the monetary policy reaction are those of Figure 5; the inflationary effects of dollar and DM variations are estimated with the NIESR Global econometric model, as described in Section 5.

Table A1

STATIONARITY AND COINTEGRATION TESTS FOR THE PERIOD 1.6.1973-11.3.1979 (1)

	Unit root test on effective exchange rates (2)	Unit root test on bilateral exchange rates vis-à-vis the DM (2)	Engle-Granger cointegration test between bilateral exchange rate and the effective exchange rate of the US dollar (3)	Pesaran et al. cointegration test between bilateral exchange rates and the effective exchange rate of the US dollar (4)
US Dollar	-0.572	-0.204		
Dutch Guilder	-1.029	-2.026	2.838	-1.8749
Belgian Franc	-0.249	-3.092	3.784	-1.4807
Danish Krone	-2.225	-0.806	0.544	-2.9877
French Franc	-1.500	-1.164	0.733	-2.0020
Irish Punt	-1.848	-1.678	1.940	-0.8402
Italian Lira	-0.743	-0.901	0.514	-2.1202
Spanish Peseta	-0.631	-0.510	1.806	-2.1629
British Pound	-1.840	-1.678	1.937	-0.9005
Sweden Krone	-0.160	0.196	0.763	-3.7270
Swiss Franc	-0.325	-0.867	0.925	-1.2728
Japanese Yen	0.533	-2.124	1.911	-0.1434
Canadian Dollar	1.294	0.488	0.286	-3.0809

(1) The null hypothesis can never be rejected at the 5% level.

(2) Augmented Dickey-Fuller test based on OLS F Statistic; $H_0: \alpha = 0,\ \rho = 1$ in regression $y_t = \alpha + \rho y_{t-1} + \varepsilon_t$.

(3) Augmented Dickey-Fuller test on the residual of the following OLS regression: $\log(DMCUR_t) = \alpha + \log(EFFUSA_{t-i}) + \varepsilon_t$.

(4) Pesaran, Shin and Smith (1996) test based on OLS F Statistic; $H_0: \phi = \rho = 0$ in regression:

$$\Delta \log(DMCUR_t) = \alpha + \sum_{i=0}^{2} \beta_i \Delta \log(EFFUSA_{t-i}) + \sum_{i=1}^{2} \delta_i \Delta DMCUR_{t-i} + \varsigma INT_{t_t} + \phi \log(DMCUR_{t-1}) + \rho \log(EFFUSA_{t-1}) + \varepsilon_t$$

Table A2

STATIONARITY AND COINTEGRATION TESTS FOR THE PERIOD 21.3.1979-31.1.1987 (1)

	Unit root test on effective exchange rates (2)	Unit root test on bilateral exchange rates vis-à-vis the DM (2)	Engle-Granger cointegration test between bilateral exchange rate and the effective exchange rate of the US dollar (3)	Pesaran et al. cointegration test between bilateral exchange rates and the effective exchange rate of the US dollar (4)
US Dollar	-1.209	-1.015		
Dutch Guilder	1.063	-2.201	3.284	-0.5336
Belgian Franc	-1.697	-1.127	0.855	-2.4617
Danish Krone	-3.308	-2.584	2.639	-2.5769
French Franc	-1.292	-0.431	0.012	-1.5908
Irish Punt	-2.130	0.595	2.315	-2.2551
Italian Lira	-1.711	-0.582	1.388	-1.4464
Spanish Peseta	-1.076	-0.372	0.447	-1.2461
British Pound	-0.337	0.366	0.541	-1.7461
Sweden Krone	-0.688	-0.225	1.153	-1.6958
Swiss Franc	-0.399	-1.627	2.295	-1.5955
Japanese Yen	-0.204	-0.902	0.568	-1.4977
Canadian Dollar	-0.345	-0.515	0.965	-2.1035

(1) The null hypothesis can never be rejected at the 5% level.

(2) Augmented Dickey-Fuller test based on OLS F Statistic; $H_0: \alpha = 0,\ \rho = 1$ in regression $y_t = \alpha + \rho y_{t-1} + \varepsilon_t$.

(3) Augmented Dickey-Fuller test on the residual of the following OLS regression: $\log(DMCUR_t) = \alpha + \log(EFFUSA_{t-i}) + \varepsilon_t$.

(4) Pesaran, Shin and Smith (1996) test based on OLS F Statistic; H_0: $\phi = \rho = 0$ in regression:

$$\Delta \log(DMCUR_t) = \alpha + \sum_{i=0}^{2} \beta_i \Delta \log(EFFUSA_{t-i}) + \sum_{i=1}^{2} \delta_i \Delta DMCUR_{t-i} + \varsigma INT_{tt} + \phi \log(DMCUR_{t-1}) + \rho \log(EFFUSA_{t-1}) + \varepsilon_t$$

Table A3

STATIONARITY AND COINTEGRATION TESTS FOR THE PERIOD 14.1.1987-31.7.1992 (1)

	Unit root test on effective exchange rates (2)	Unit root test on bilateral exchange rates vis-à-vis the DM (2)	Engle-Granger cointegration test between bilateral exchange rate and the effective exchange rate of the US dollar (3)	Pesaran et al. cointegration test between bilateral exchange rates and the effective exchange rate of the US dollar (4)
US Dollar	-2.183	-1.377		
Dutch Guilder	-1.017	-3.119	5.370*	-2.0024
Belgian Franc	-0.592	-2.252	3.319	-2.3590
Danish Krone	-0.953	-2.069	2.136	-1.6588
French Franc	-0.618	-2.416	3.157	-13296
Irish Punt	-0.922	-3.569	7.837*	-2.1932
Italian Lira	-2.702	-2.075	4.242	-2.5685
Spanish Peseta	-1.457	-2.044	3.226	-2.0146
British Pound	-2.705	-1.765	2.075	-3.1676
Sweden Krone	-2.540	-1.447	1.982	-3.1443
Swiss Franc	-1.682	-1.343	2.425	-1.8529
Japanese Yen	-1.371	-1.157	0.859	-1.6271
Canadian Dollar	-2.057	-1.530	4.163	-1.2610

(1) An asterisk indicates that the null hypothesis can be rejected at the 5% level.

(2) Augmented Dickey-Fuller test based on OLS F Statistic; $H_0: \alpha = 0,\ \rho = 1$ in regression $y_t = \alpha + \rho y_{t-1} + \varepsilon_t$.

(3) Augmented Dickey-Fuller test on the residual of the following OLS regression: $\log(DMCUR_t) = \alpha + \log(EFFUSA_{t-i}) + \varepsilon_t$.

(4) Pesaran, Shin and Smith (1996) test based on OLS F Statistic; H_0: $\phi = \rho = 0$ in regression:

$$\Delta \log(DMCUR_t) = \alpha + \sum_{i=0}^{2} \beta_i \Delta \log(EFFUSA_{t-i}) + \sum_{i=1}^{2} \delta_i \Delta DMCUR_{t-i} + \varsigma INT_{tt} + \phi \log(DMCUR_{t-1}) + \rho \log(EFFUSA_{t-1}) + \varepsilon_t$$

Table A4

STATIONARITY AND COINTEGRATION TESTS FOR THE PERIOD 1.11.1992-23.11.1996 (1)

	Unit root test on effective exchange rates (2)	Unit root test on bilateral exchange rates vis-à-vis the DM (2)	Engle-Granger cointegration test between bilateral exchange rate and the effective exchange rate of the US dollar (3)	Pesaran et al. cointegration test between bilateral exchange rates and the effective exchange rate of the US dollar (4)
US Dollar	-1.702	-1.429		
Dutch Guilder	-1.462	-3.067	8.096*	-2.5134
Belgian Franc	-1.209	-1.917	20.792*	-2.2694
Danish Krone	-1.365	-2.040	2.907	-2.1833
French Franc	-1.669	-2.385	4.659*	-2.6982
Irish Punt	-2.844	-2.606	5.111*	-3.2001
Italian Lira	-2.769	-2.440	4.632*	-3.7559
Spanish Peseta	-2.423	-2.373	2.458	-2.0219
British Pound	-1.518	-1.291	3.175	-1.8305
Sweden Krone	-4.105	-4.176	2.402	-5.4320*
Swiss Franc	-1.383	-1.455	1.661	-1.9751
Japanese Yen	-2.189	-1.786	1.930	-3.2222
Canadian Dollar	-2.166	-1.441	1.471	-2.4591

(1) An asterisk indicates that the null hypothesis can be rejected at the 5% level.

(2) Augmented Dickey-Fuller test based on OLS F Statistic; $H_0: \alpha = 0,\ \rho = 1$ in regression $y_t = \alpha + \rho y_{t-1} + \varepsilon_t$.

(3) Augmented Dickey-Fuller test on the residual of the following OLS regression: $\log(DMCUR_t) = \alpha + \log(EFFUSA_{t-i}) + \varepsilon_t$.

(4) Pesaran, Shin and Smith (1996) test based on OLS F Statistic; H_0: $\phi = \rho = 0$ in regression:

$$\Delta \log(DMCUR_t) = \alpha + \sum_{i=0}^{2} \beta_i \Delta \log(EFFUSA_{t-i}) + \sum_{i=1}^{2} \delta_i \Delta DMCUR_{t-i} + \varsigma INT_{tt} + \phi \log(DMCUR_{t-1}) + \rho \log(EFFUSA_{t-1}) + \varepsilon_t$$

RESULTS AND DIAGNOSTIC TESTS OF THE REGRESSION OF BILATERAL EXCHANGE RATES VIS-À-VIS THE DM ON THE EFFECTIVE EXCHANGE RATE OF THE DOLLAR FOR THE PERIOD 1.6.1973-11.3.1979 (1)

bilateral rate	α	$\Delta \log EFFUSA_t$	INT_t x 1000	R^2	DW
Dutch Guilder	0.00 (0.72)	0.12 (4.17)	1.81 (2.22)	0.02	2.09
Belgian Franc	0.00 (1.42)	0.13 (4.54)	1.68 (1.07)	0.02	2.26
Danish Krone	0.00 (1.86)	0.33 (2.96)	2.08 (0.35)	0.07	2.31
French Franc	0.00 (2.40)	0.14 (2.31)	1.58 (0.86)	0.01	2.03
Irish Punt	0.00 (2.94)	0.68 (11.55)	0.86 (0.57)	0.16	2.10
Italian Lira	0.00 (3.40)	0.77 (12.96)	1.83 (0.92)	0.21	1.65
Spanish Peseta	0.00 (1.85)	0.99 (12.60)	6.78 (1.56)	0.16	2.03
British Pound	0.00 (2.94)	0.68 (11.55)	0.86 (0.57)	0.16	2.10
Sweden Krone	0.00 (2.68)	0.51 (5.88)	0.25 (0.06)	0.16	2.14
Swiss Franc	0.00 (1.12)	-0.23 (-1.91)	1.57 (0.43)	0.02	2.06
Japanese Yen	0.00 (0.83)	0.03 (0.23)	2.39 (0.41)	0.00	2.14
Canadian Dollar	0.00 (2.94)	1.41 (17.97)	1.34 (0.39)	0.51	2.07

(1) GMM estimates; the numbers in parenthesis are Student's *t*.

RESULTS AND DIAGNOSTIC TESTS OF THE REGRESSION OF BILATERAL EXCHANGE RATES VIS-À-VIS THE DM ON THE EFFECTIVE EXCHANGE RATE OF THE DOLLAR FOR THE PERIOD 12.3.1979-13.1.1987 (1)

bilateral rate	α	$\Delta \log EFFUSA_t$	INT_t x 1000	R^2	DW
Dutch Guilder	0.00 (0.93)	0.07 (1.61)	0.00 (0.78)	0.06	2.59
Belgian Franc	0.00 (2.54)	0.05 (1.76)	-0.00 (0.25)	0.01	2.07
Danish Krone	0.00 (3.47)	0.09 (2.37)	0.00 (1.01)	0.04	2.35
French Franc	0.00 (3.25)	0.07 (1.46)	0.00 (0.65)	0.02	2.12
Irish Punt	0.00 (3.02)	0.08 (2.25)	0.00 (3.69)	0.02	2.38
Italian Lira	0.00 (4.79)	0.24 (3.26)	0.00 (0.74)	0.23	2.11
Spanish Peseta	0.00 (3.90)	0.27 (8.72)	-	0.10	2.33
British Pound	0.00 (1.26)	0.39 (4.65)	0.01 (0.75)	0.11	1.97
Sweden Krone	0.00 (2.15)	0.40 (6.38)	0.02 (0.95)	0.19	1.83
Swiss Franc	0.00 (0.52)	-0.07 (2.77)	0.02 (1.60)	0.01	2.06
Japanese Yen	0.00 (1.03)	0.14 (2.96)	0.00 (0.03)	0.01	1.82
Canadian Dollar	0.00 (0.75)	0.82 (4.33)	-	0.34	2.42

(1) GMM estimates; the numbers in parenthesis are Student's *t*.

RESULTS AND DIAGNOSTIC TESTS OF THE REGRESSION OF BILATERAL EXCHANGE RATES VIS-À-VIS THE DM ON THE EFFECTIVE EXCHANGE RATE OF THE DOLLAR FOR THE PERIOD 14.1.1987-31.7.1992 (1)

bilateral rate	α	$\Delta \log EFFUSA_t$	INT_t x 1000	R^2	DW
Dutch Guilder	0.00 (0.02)	0.01 (2.56)	0.00 (1.42)	0.01	2.69
Belgian Franc	0.00 (0.03)	0.01 (1.20)	0.00 (3.85)	0.00	2.95
Danish Krone	0.00 (0.16)	0.04 (5.89)	0.00 (2.10)	0.03	2.31
French Franc	0.00 (0.49)	0.05 (9.76)	0.00 (5.03)	0.20	2.17
Irish Punt	0.00 (0.03)	0.05 (8.26)	0.00 (0.16)	0.08	2.44
Italian Lira	0.00 (0.81) 0.00 (0.58)	0.10 (10.93) 0.11 (8.24)	0.00 (6.49) 0.00 (4.19)	0.18 0.20	2.16 2.27
Spanish Peseta (2)	0.00 (0.65) 0.00 (0.70)	0.12 (6.85) 0.10 (6.55)	0.00 (3.25) 0.00 (4.53)	0.06 0.08	1.98 1.83
British Pound (2)	0.00 (0.11) 0.00 (0.41)	0.14 (5.71) 0.18 (4.89)	0.00 (2.57) 0.01 (1.91)	0.04 0.13	1.92 1.83
Sweden Krone	0.00 (0.34)	0.26 (14.56)	-0.00 (1.27)	0.21	2.35
Swiss Franc	0.00 (0.87)	-0.08 (3.92)	0.00 (4.58)	0.03	1.99
Japanese Yen	0.00 (0.29)	0.10 (2.29)	0.00 (1.56)	0.02	1.93
Canadian Dollar	0.00 (0.34)	1.08 (28.61)	0.00 (2.29)	0.53	2.12

(1) GMM estimates; the numbers in parenthesis are Student's *t*.
(2) For the Italian lira, the Spanish peseta and the British pound, the second line reports the results respectively for the following periods: 8.1.1990-31.7.1992; 9.6.1989-31.7.1992 and 8.1.1990-31.7.1992.

RESULTS AND DIAGNOSTIC TESTS OF THE REGRESSION OF BILATERAL EXCHANGE RATES VIS-À-VIS THE DM ON THE EFFECTIVE EXCHANGE RATE OF THE DOLLAR FOR THE PERIOD 11.1.1992-23.11.1996 (1)

bilateral rate	α	Δlog EFFUSA$_t$	INT$_t$ x 1000	R^2	DW
Dutch Guilder	0.00 (0.39)	0.01 (2.72)	0.00 (2.24)	0.01	1.95
Belgian Franc	0.00 (0.50)	0.03 (2.23)	0.00 (8.84)	0.12	2.25
Danish Krone	0.00 (0.47)	0.09 (3.73	0.00 (3.30)	0.03	2.12
French Franc	0.00 (0.27)	0.14 (5.15)	0.00 (2.83)	0.07	2.10
Irish Punt	0.00 (0.18)	0.36 (6.14)	0.00 (1.00)	0.11	2.04
Italian Lira	0.00 (0.77)	0.44 (7.23)	0.00 (2.89)	0.12	2.05
Spanish Peseta	0.00 (078)	0.27 (5.99)	0.00 (3.55)	0.12	1.93
British Pound	0.00 (0.24)	0.47 (9.84)	0.00 (2.82)	0.17	2.03
Sweden Krone	0.00 (0.69)	0.38 (5.29)	0.00 (-0.22)	0.04	1.89
Swiss Franc	0.00 (0.80)	-0.19 (8.32)	1.13 (2.59)	0.08	2.01
Japanese Yen	0.00 (0.35)	-0.15 (2.19)	-	0.01	2.12
Canadian Dollar	0.00 (0.03)	1.28 (21.21)	0.13 (0.90)	0.41	2.19

(1) GMM estimates; the numbers in parenthesis are Student's *t*.

RESULTS AND DIAGNOSTIC TESTS OF THE REGRESSION OF NOMINAL EFFECTIVE EXCHANGE RATES OF VARIOUS CURRENCIES ON THAT OF THE DOLLAR FOR THE PERIOD 1.6.1973-11.3.1979 (1)

Effective rate	α	$\Delta \log EFFUSA_t$	INT_t x 1000	R^2	DW
Dutch Guilder	0.00 (2.15)	-0.30 (10.25)	1.29 (1.29)	0.16	2.04
Belgian Franc	0.00 (1.61)	-0.27 (9.51)	1.07 (1.011)	0.12	2.27
Danish Krone	0.00 (0.27)	-0.07 (0.63)	1.71 (0.35)	0.01	2.31
French Franc	-0.00 (0.84)	-0.29 (5.52)	1.13 (0.86)	0.08	2.09
Irish Punt	-0.00 (2.16)	0.08 (2.54)	-1.03 (1.30)	0.01	2.15
Italian Lira	-0.00 (2.96)	0.46 (8.19)	-2.64 (1.62)	0.12	1.56
Spanish Peseta	-0.00 (0.96)	0.57 (7.64)	6.29 (1.40)	0.73	2.06
British Pound	-0.00 (2.13)	0.17 (3.35)	-1.76 (1.22)	0.02	2.15
Sweden Krone	-0.00 (0.97)	0.08 (0.84)	-0.91 (0.27)	0.00	2.09
Swiss Franc	0.00 (2.53)	-0.63 (4.86)	-2.08 (0.47)	0.14	2.09
Japanese Yen	0.00 (2.41)	-0.74 (4.77)	4.21 (0.76)	0.15	1.81
Canadian Dollar	-0.00 (2.24)	0.16 (5.78)	0.16 (0.31)	0.06	1.95

(1) GMM estimates; the numbers in parenthesis are Student's *t*.

Table A10

RESULTS AND DIAGNOSTIC TESTS OF THE REGRESSION OF NOMINAL EFFECTIVE EXCHANGE RATES OF VARIOUS CURRENCIES ON THAT OF THE DOLLAR FOR THE PERIOD 12.3.1979-13.1.1987 (1)

Effective rate	α	$\Delta \log EFFUSA_t$	INT_t x 10000	R^2	DW
Dutch Guilder	0.00 (1.44)	-0.22 (6.74)	0.00 (0.73)	0.28	2.19
Belgian Franc	0.00 (1.30)	-0.21 (15.43)	-0.00 (2.53)	0.18	1.99
Danish Krone	0.00 (1.63)	-0.19 (6.17)	-0.00 (2.15)	0.15	2.23
French Franc	0.00 (2.07)	-0.18 (5.18)	-0.00 (0.85)	0.13	2.09
Irish Punt	0.00 (0.94)	-0.32 (20.06)	0.00 (0.20)	0.20	2.08
Italian Lira	0.00 (3.67)	0.02 (0.28)	0.00 (0.70)	0.00	2.10
Spanish Peseta	0.00 (3.18)	-0.02 (0.88)	-	0.00	2.36
British Pound	0.00 (0.75)	0.04 (0.44)	0.01 (0.75)	0.00	1.99
Sweden Krone	0.00 (1.68)	0.10 (1.33)	0.05 (1.26)	0.02	1.78
Swiss Franc	0.00 (1.64)	-0.34 (19.30)	0.01 (0.77)	0.25	1.91
Japanese Yen	0.00 (2.71)	-0.10 (0.98)	-0.00 (1.03)	0.01	1.89
Canadian Dollar	0.00 (0.90)	-0.25 (1.66)	—	0.10	2.58

(1) GMM estimates; the numbers in parenthesis are Student's *t*.

RESULTS AND DIAGNOSTIC TESTS OF THE REGRESSION OF NOMINAL EFFECTIVE EXCHANGE RATES OF VARIOUS CURRENCIES ON THAT OF THE DOLLAR FOR THE PERIOD 14.1.1987-31.7.1992 (1)

Effective rate	α	$\Delta \log EFFUSA_t$	INT_t x 1000	R^2	DW
Dutch Guilder	0.00 (0.37)	-0.23 (25.09)	0.00 (4.32)	0.46	2.04
Belgian Franc	0.00 (0.06)	-0.20 (15.79)	0.00 (1.92)	0.14	2.83
Danish Krone	-0.00 (0.29)	-0.18 (17.44)	0.00 (1.37)	0.27	2.17
French Franc	0.00 (0.09)	-0.15 (20.02)	0.00 (3.13)	0.32	2.08
Irish Punt	0.00 (0.13)	-0.23 (17.29)	0.00 (1.41)	0.27	1.98
Italian Lira	0.00 (1.13)	-0.09 (9.77)	0.00 (4.03)	0.12	2.13
(2)	0.00 (1.38)	-0.06 (4.29)	0.00 (2.87)	0.07	2.25
Spanish Peseta	0.00 (0.81)	-0.12 (7.44)	0.00 (2.52)	0.06	1.99
(2)	0.00 (1.07)	-0.14 (9.01)	0.00 (2.90)	0.12	1.86
British Pound	0.00 (0.12)	-0.19 (8.79)	0.00 (2.24)	0.08	1.93
(2)	0.02 (1.00)	-0.17 (4.44)	0.00 (1.07)	0.12	2.03
Sweden Krone	0.00 (0.33)	0.01 (0.75)	0.00 (0.80)	0.00	2.45
Swiss Franc	0.00 (0.92)	-0.31 (14.76)	0.00 (2.92)	0.24	1.98
Japanese Yen	0.00 (0.06)	-0.00 (-0.06)	0.01 (1.43)_	0.01	1.97
Canadian Dollar	0.00 (0.39)	0.01 (0.21)	0.20 (2.51)	0.01	2.18

(1) GMM estimates; the numbers in parenthesis are Student's *t*.
(2) For the Italian lira, the Spanish peseta and the British pound, the second line reports the results respectively for the following periods: 8.1.1990-31.7.1992; 9.6.1989-31.7.1992 and 8.1.1990-31.7.1992.

RESULTS AND DIAGNOSTIC TESTS OF THE REGRESSION OF NOMINAL EFFECTIVE EXCHANGE RATES OF VARIOUS CURRENCIES ON THAT OF THE DOLLAR FOR THE PERIOD 1.11.1992-23.11.1996 (1)

Effective rate	α	$\Delta \log EFFUSA_t$	INT_t x 1000	R^2	DW
Dutch Guilder	0.00 (0.19)	-0.31 (15.89)	0.00 (0.20)	0.32	2.09
Belgian Franc	0.00 (0.12)	-0.26 (13.34)	0.00 (2.31)	0.21	2.24
Danish Krone	0.00 (0.11)	-0.20 (8.97)	0.00 (0.89)	0.10	2.06
French Franc	0.00 (0.60)	0.14 (5.46)	0.00 (3.16)	0.08	2.06
Irish Punt	0.00 (0.37)	-0.09 (1.85)	0.00 (1.81)	0.01	1.92
Italian Lira	0.00 (0.89)	0.21 (3.93)	0.01 (2.83)	0.06	2.06
Spanish Peseta	0.00 (0.88)	-0.04 (1.16)	0.00 (2.83)	0.05	1.93
British Pound	0.00 (0.02)	0.09 (2.36)	0.00 (2.95)	0.02	2.06
Sweden Krone	0.00 (0.76)	0.06 (0.98)	0.00 (0.44)	0.00	1.87
Swiss Franc	0.00 (0.81)	-0.48 (14.39)	1.36 (1.87)	0.27	2.04
Japanese Yen	0.00 (0.90)	0.62 (7.02)	-	0.09	2.05
Canadian Dollar	0.00 (0.69)	1.18 (4.60)	0.10 (1.65)	0.04	2.20

(1) GMM estimates; the numbers in parenthesis are Student's *t*.

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