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Currency Substitution and the Stability of the German Demand for Money Function Before and After the Fall of the Berlin Wall

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Introduction

Monetary policy in United Germany continued to be based on the broader monetary aggregate M3 in the years after the German Economic and Monetary Union (GEMU), which began on July 1st 1990. This aggegate was always above target in the years after GEMU, making it difficult for the Bundesbank to reduce interest rates at a time when the German and the European economies were depressed; this was true particularly for 1992 and 1993. In the first half of 1994 the growth of M3 greatly exceeded the target range set for 1994 (4-6%), reaching peaks of 15-22% on an annual basis. Naturally, a high variability of a monetary aggregate does not necessarily imply instability of the underlying demand function: it may just be the result of a high variability of the variables included as arguments in the function. The issue of the stability of a demand function is a relative one, as stablility depends also on the number of variables included in the function.

In setting M3 targets for the year ahead the Bundesbank considers implicitly a demand function which has only the price level and potential output as arguments, but also takes secular changes in velocity into account. Assuming homogeneity of degree one in prices, it fixes the main objective of its policy -the "unavoidable" part of inflation- at 2% (even when reasonable inflation forecasts for the year ahead are much higher), taking into account the growth of German potential output (the growth of which is normally set at 2-2.5%) and a trend annual decline in velocity of 0.5%. It calculates the desired growth of M3, around which a band of +/- 1% is applied. Other explanatory variables like short or long term German interest rates, those reflecting currency substitution with the dollar or with European currencies or the own rate of return on M3 play no role in this exercise (or it is implicitly assumed that they remain constant during the year ahead). If either as a result of increased credibility of the Exchange Rate Mechanism (ERM) of the European Monetary System (EMS), or of increased international financial integration, currency substitution is an important determinant of the demand for real M3, the demand function used by the Bundesbank will be unstable. The neglect of other possibly significant variables besides currency substitution leads to the same conclusion.

However, the Bundesbank may still be pursuing the very best policy conceivable, if the net effect of all neglected variables in the year ahead can be assumed to be zero. But the oveshooting of the growth of M3 above the upper margin of the target band of the last years, and especially that of the first half of 1994, justify a strong presumption that the demand function used by the Bundesbank may be unstable.

In a recent empirical paper on the demand for money in the ERM and in the main member countries Tullio, de Souza and Giucca (1996) show, using the error correction model, that the German demand for real M3 was relatively well behaved from 1979(2) to 1989(2), provided one includes among the explanatory variables the short term interest rate and a term reflecting currency substitution with the US dollar.[2] The only caveat is that the regression for broad money does not pass the functional form mis-specification F-test. Second, they show that if one excludes the term reflecting substitution with the US dollar the regression breaks down completely. Third, when extending the sample period to 1992(3) to include the period after the fall of the Berlin wall, the demand functions for both M1 and M3 become highly unstable even when the terms reflecting currency substitution are included. The fit and the residuals of the demand for real M1 worsen somewhat less, suggesting that the latter function may have withstood better the reunification shock.

This suggests that currency substitution with the US dollar is very important as an argument of the German demand functions for narrow and broad money and more important than for France and Italy, while substitution with the ERM currencies is in general less significant. This may have to do with the fact that capital controls played an important role in Europe for most of the sample period, that the dollar is more heavily traded than other currencies and that during the EMS period nominal and real exchange rate changes within Europe were held in check much more than DM-US dollar changes, at least between realignments.

This chapter extends the analysis of the previous paper in three directions. First, the significance and the implications for stability and for the role of currency substitution of the inclusion of a number of additional explanatory variables is explored. The additional variables are: the own rate of return on M3, the differential between the long and the short term interest rate and a measure of the volatility of the DM-dollar rate. In addition, an attempt has been made to express the real money stocks and GDP in per capita terms and to check whether the interest rate differential between Germany and the US provides a better measure of currency substitution than deviations of the DM-US dollar rate from PPP. Second, in the first study no dummies were added for the quarters around July 1st 1990 in the regressions covering the period up to 1992(3); this may strongly bias the results in favour of the hypothesis of increased instability of the demand functions after GEMU. In this study we include quarterly dummies for the reunification shock to check the robustness of the conclusion that the demand functions have become more unstable. Third the sample period for the

[2] This is measured by the deviations of the DM-dollar rate from purchasing power parity as has become customary in the literature on the ERM-wide real money demand function.

regressions covering the post-reunification period has been extended from 1992(3) to 1993(4), the last available observation at the time the data bank for this study was set up. This is particularly relevant for the analysis of the role played by intra-ERM currency substitution in the German demand functions, as the degree of financial market integration among ERM countries has increased significantly only in the second half of the 1980's, and particularly, after France and Italy abolished all capital controls by 1990. This may be one of the reasons why in this chapter intra-ERM currency substitution turns out to be much more significant than in Tullio, de Souza and Giucca (1995).

The remainder of the chapter is structured as follows: Section 1 presents a brief review of the previous results by Tullio, de Souza and Giucca. Section 2 presents the new estimates of the real demand functions for German M1 and M3 with the three additional explanatory variables (the own rate of return on M3, the differential between the long and the short term interest rate and a measure of the volatility of the DM-dollar exchange rate) for the period 1979(2) to 1989(2). Section 3 extends the estimates to 1993(4) with the reunification dummies added along with the three new explanatory variables. Section 4 concludes. Two appendices are added: Appendix 1 presents the results with an alternative measure of currency substitution with the US dollar (the long term interest rate differential between the two countries) and Appendix 2 shows the results with money and GDP expressed per capita.

1- Review of previous results

Table 1 contains the demand functions for real M1 and M3 estimated for Germany by Tullio, de Souza and Giucca (1995). The sample period is 1979(2), the initial quarter of the EMS , to 1989(2), when expectations of big political changes in Eastern Europe became widespread. The model used is the errror correction model as it was thought to be the most appropriate to superimpose a short run dynamics on a long run function. In the long run the demand for real money is assumed to depend on real GDP, the short term interest rate and the percentage deviation of the DM-dollar exchange rate from purchasing power parity, a term reflecting currency substitution between DM and dollar deposits. The long run demand for money function is given by equation (1):

$$LMP = \alpha_0 + \alpha_1 LY + \alpha_2 RS + \alpha_3 dPPP + u \qquad (1)$$

where: the letter L always stands for the natural logarithm, MP is the real money stock, Y is real GDP, RS the short term interest rate, dPPP the percentage deviation of the dollar exchange rate from purchasing power parity

and u is the error term. The letter "d" always stands for a percentage deviation or a difference between two interest rates. Thus all variables, except interest rates or differences of interest rates and dPPP, are expressed in natural logarithms[3].

The variables in equation (1) are cointegrated, but the DF and the ADF tests are not shown here to save space (see Table 5 of Tullio, de Souza and Giucca (1996)). In accordance with the error correction model, the dependent variable in Table 1 is the rate of change of the real money stock; in symbols DLMP, where the letter "D" stands for a first difference. The rate of growth of the real money stock is assumed to be influenced by two sets of variables: a) the lagged levels of the explanatory variables in equation (1), reflecting the long run factors influencing money demand and b) the rate of change of real GDP (DLY), the first difference of the short term interest rate (DRS) and the first difference of the forward discount of the DM with the currencies that were participating in the ERM (DFD), reflecting intra ERM currency substitution. The variables listed under b) reflect short run influences.

The dynamic error correction version of the demand function can be estimated in one stage or in two stages, the latter implying the substitution into the ECM of the residuals of the OLS estimates of the cointegrating equation. All the equations in Tullio, de Souza and Giucca (1996) and those in the current chapter are estimated with the one stage procedure, following recent theoretical work which suggests its superiority with respect to the two-stage procedure. All the variables which enter in level form a cointegrated set, so that standard t-, F- and normal critical values can be used for inference. The latter is a necessary condition for the error correction models to hold.[4]

FD never turned out to be significant in the cointegrating equation. Currency substitution with the US dollar (dPPP) is instead very significant in the cointegrating equation for both aggregates, but more so for M1. As to short run dynamics the intra-ERM currency substitution term (DFD) is never significant; however, the coefficient of the forward discount itself (FD) is close to the 5% significance level only for M1. Why did we use two different measures of currency substitution, dPPP for DM-US dollar substitution and FD or DFD for the intra-ERM one, and why is the first one influencing in a very significant way the long run demand function, while the second is barely influencing the short run dynamics? The answers to these questions may be connected. It was mentioned in the introduction that capital controls played an important role in

[3] The precise definition of the variables and the sources of the data are indicated in Appendix 3.

[4] For a detailed description of cointegration and ECM see A. Banerjee, J. Dolado, J. W. Galbraith and D.F. Hendry (1993), Chapter 6.

Europe for most of the sample period, that the dollar is more heavily traded than other currencies and that during the EMS period nominal and real exchange rate changes within Europe were held in check much more than DM-US dollar changes. Capital controls and the heavy trading in dollars explain the different importance of the two types of currency substitution, while the different exchange rate system (almost free floating for the dollar and the ERM for European currencies) explains the difference in the way currency substitution was measured. Intra-ERM currency substitution had to do mostly with expectations of realignments and deposits shifted within Europe before realignments have evidently tended to be repatriated after they were decided, leaving negligible effects beyond the very short run. Therefore we tend to consider FD and DFD more as dummy variables for realignments than as normal explanatory variables.

The series for M1 is seasonally unadjusted, while the one for M3 available from our source is seasonally adjusted. All the equations for M1 presented in this chapter include three quarterly dummies. The presence of the dummies among the explanatory variables increases the R^2 by 10-15%. This extra explanatory power of the regressions for M1 should be kept in mind when one compares it with the adjusted R^2 of the regressions for M3.

Overall the regression for M1 is the more satisfactory (regression 1). The residuals are extremely well behaved (although it should be noticed that a dummy variable has been added for the fourth quarter of 1987), the explanatory power is very high and the parameters are all significantly different from zero at the 1% level, except for the intra-ERM currency substitution term FD. For real M3 the results are not equally satisfactory: the null hypothesis of no functional form mis-specification is rejected at the 5% confidence level (Reset-F test); the explanatory power of the regression is substantially lower[5] and the parameters are less precisely estimated; this holds in particular for the intra-ERM currency substitution term.

In order to further investigate the importance of the two currency substitution terms in the German demand for money functions, Tullio et alia presented first Wald-F tests for the exclusion of the terms, then they reestimated the equations by excluding the terms. We report their results in Tables 2 and 3 below (their Tables 7 and 8, respectively). The first column of Table 2 suggests that the hypothesis of a zero restriction on the coefficient of the DM-US dollar substitution term in the demand function for real M1 is rejected at the 1% confidence level. The same holds for the hypothesis of a joint zero restriction on the coefficients of the two terms. The hypothesis of a zero restriction on the

[5] This holds even after correcting for the fact that the regressions for M1 contain three quarterly dummies.

coefficient of the intra-ERM currency substitution term is rejected only at the 10% confidence level. As to the demand for real M3 the hypothesis of a zero restriction on the coefficient of the DM-dollar term is rejected at the 5% confidence level and the joint restriction is rejected at the 10% level. These results indicate that currency substitution cannot be neglected in the German demand for money function, especially as far as M1 is concerned. Of the two forms of substitution, the one with the US dollar is much more relevant.

Table 3 contains the dynamic demand functions for real M1 and M3 estimated by Tullio et al. in which the currency substitution terms have been eliminated in two successive steps: first the less important intra-ERM term, then the more important DM-dollar term. Regressions (1) and (2) of Table 1 have been reported again in Table 3 in order to facilitate the comparison of the coefficients, the t-statistics and the standard tests on the residuals. Taking the demand for real M1 first, the elimination of the intra-ERM term causes little change in the coefficients and t-statistics (regression 3). However, the normality test on the residuals (N-CHI2(2)) indicates that the hypothesis of normality is rejected at the 5% confidence level. When we remove the DM-dollar term the regression breaks down, as all variables except the interest rate become insignificantly different from zero.

As to the real demand for M3, it should be recalled that regression 2 has already shown evidence of functional form mis-specification when all currency substitution terms were included. When one removes the intra-ERM term, the RESET-F test rejects the hypothesis of no functional form mis-specification at the 1% significance level (regression (5)) and when both currency substitution terms are excluded, all explanatory variables loose most of their significance and the error correction model breaks down.

So far we have only summarized the results obtained by Tullio et al. which constitute the starting point for the present chapter. In the next section we reestimate the demand functions for real M1 and M3 for the same period 1979(2) to 1989(2) with the inclusion of three additional exlanatory variables. In section 3 we extend the estimation period to 1993(4) using the larger set of explanatory variables and including dummy variables for the reunification shock of 1990 and beyond. The effect of the inclusion of the new variables, of the reunification dummies and of the extension of the sample period on the significance of the currency substitution terms and on the stability of the functions is then analysed.

2-The stability of M1 and M3 and the role of currency substitution revisited: 1979(2)-1989(2)

Table 4 contains the estimates of the demand function for real M1 for the period 1979(2) to 1989(2). Regression 1 is the re-estimation of the same regression of the previous section (also reported in Tables 1 and 3 above); the slight differences are due to the revision in the data of real GDP in the latest estimates. Regression 7 includes two new explanatory variables: the variability of the nominal DM-dollar exchange rate measured by the variance of the exchange rate from quarter t-3 to t (VARER) and the differential beetween the long and the short term interest rate (dRLS). The best results are obtained when VARER in assumed to influence the cointegrating (long run) relationship and the interest rates differential (dRLS) the dynamics; hence a "D" appears in front of dRLS implying that it is entered as a first difference. The variability of the nominal exchange rate has a positive coefficient and is significant at the 1% level implying an increase in the demand for DM deposits when dollar exchange rate uncertainty increases. This result is not that surprising considering the history of the DM, of the US dollar and of inflation in the two countries. The differential between the long and the short term interest rate has the expected negative sign, but its coefficient is not significantly different from zero. With the inclusion of these two additional variables the significance of both currency substitution terms increases sharply and, in the case of the intra-ERM term, the absolute value of the coefficient increases by about 50%. The other parameters also change, but the changes are all within two standard errors. In particular, the coefficient on lagged real money balances (LMP), which indicates the rate at which the real money stock returns towards its initial equilibrium after a disturbance, with no change in any variable in the demand function, falls from 49 to 42% per quarter. This implies a reduction of the speed of adjustment toward equilibrium from about 6 to 7 months, which is, however, still relatively rapid. The standard error of the regression falls by about 11%. The residuals are less well behaved when the new variables are included as there is now some evidence of autocorrelated residuals. The Chow forecast F-test performed with regression (7) from 1988(1) to 1989(2) does not show structural breaks in the relationship. The same holds if the initial quarter for the test is moved foreward until 1989(1). The Cusum Square test indicates instead a structural break at the beginning of 1989. The recursive parameter estimates on the coefficients of the currency substitution terms do not show significant changes through time (graphs not shown here). Finally, Table 5 shows the Wald F-tests for the exclusion of the currency substitution terms in regression (7). To conclude, the analysis of Tables 4 and 5 indicates that, with the inclusion of the new variables (VARER and dRLS), currency substitution, especially the intra-ERM one, becomes more

important in the demand for real M1. As before, without the currency substitution terms the EC-model breaks down (cf. regression (8) of Table 4 with regression (1)).

The estimates of the demand function for real M3 are presented in Table 6. Regression (9), which does not include the new explanatory variables, is the same as regression (2) of Table 1; the small differences in the parameter estimates are all due to slight revisions in the series of real GDP. The new variables in regression (10) now include also the differential between the own rate of return on M3 and the short term interest rate (dROS); for M1 the inclusion of this variable was not necessary since no interest is paid on M1 in Germany. While in regression (10) the coefficients of the exchange rate variability (VARER) and of the differential between the long and the short term interest rate (dRLS) are significantly different from zero and have the right sign, the coefficient of DdROS has the right sign but is not significant. The inclusion of the new variables has three main consequences: a) the intra-ERM currency substitution term becomes significant, b) the absolute values of the coefficient on lagged money (LMP) and lagged real GDP fall to about one half of the previous values, which implies that the adjustment speed falls from about 12 to 30 months and c) the hypothesis of no functional form mis-specification now cannot be rejected, while for regression (9) it was rejected at the 5% significance level (Reset F-test; cf. the bottom line of regression (9) and (10) in Table 6). Thus, although with the inclusion of the new variables, the rate of adjustment becomes somewhat low (from 24 to 10% per quarter), regression (10) is overall more satisfactory. Table 7 reports the Wald F-tests for the deletion of the currency substitution terms; the tests indicate that the terms cannot be deleted at the 5% level of significance both individually and jointly. This differs from the previous results, for which only the DM-dollar term appeared significant at the 5% level (cf. Table 7 with Table 2). Again, if one removes the currency substitution terms from regression (10), the EC-model breaks down (regression (11)).

As for M1, the Chow Forecast F-test for regression (10) indicates no structural break during the last years of the estimation period at the 1% significance level (results not shown here). The Cusum Square test also suggests that the relationship is stable (Fig 1). The recursive parameter estimates on the coefficients of the currency substitution terms suggest instead a significant increase in the absolute value of both coefficients in the course of 1985 (Fig. 2 and 3). This finding lends itself to an interesting interpretation: after the French U-turn of 1983, the ERM became more credible, capital mobility increased gradually and had already reached a high level well before France and Italy completely abolished capital controls in the late 1980's; in addition, inflation convergence was proceeding in a satisfactory way at the time the White Book

on the internal market was approved by the Heads of State in 1985. As a result, the influence of both types of currency substitution on the German demand for money increased sharply. For a similar conclusion, that between 1983 and 1986 the EMS changed significantly several behavioural relationships in some countries of the ERM, including Germany, see Artus and Salomon (1995), De Jong (1995) and Tullio and Ronci (1994). In particular, De Jong (1995) shows that expectations of German producer prices were influenced more than before by foreign variables starting in 1985, while Artus and Salomon (1995) show that the weight of French wages relative to German wages fell rapidly in the equation determining the French GDP-delator after 1985, and that the influence of the FF-DM exchange rate on the French-German interest rate differential fell sharply in the 1983-87 period. Finally Tullio and Ronci (1994) show in a paper analyzing the determinants of Italian inflation in the 1970's and 1980's that, after 1983, the influence of the Italian money stock on Italian inflation fell significantly at the expense of German inflation.

In sum the inclusion of the new explanatory variables strengthens considerably the role of currency substitution both in the demand for real M1 and real M3. This is particularly the case for intra-ERM currency substitution. In addition the inclusion of the new explanatory variables makes the demand for real M3 considerably more well behaved than before, while some worsening in the behaviour of the residuals of the M1 function is observed. Currency substitution is not only extremely important; in the demand for real M3 it becomes incresingly important after 1985, especially as far as the DM-dollar substitution is concerned (Fig.3). In the next section we extend the sample period to 1993(4).

3-The stability of M1 and M3 and the role of currency substitution after the fall of the Berlin wall revisited; 1979(2)-1993(4)

The estimates of the demand function for real M1 for the extended period are contained in Table 8. Regression (12), which includes the new explanatory variables but not the dummies for the unification shock, is not well behaved since the residuals are heteroscedastic and not normally distributed. In addition, there is a significant change in several coefficients; in particular the absolute values of the coefficient of the lagged money stock and of lagged real GDP increase by about 50% (cf. regression (12) of Table 8 with regression (7) of Table 4). With the unification dummies (one for each of the first 3 quarters of 1990) the residuals become homoscedasitc and most of the coefficients show robustness with those of the equation estimated for the pre-unification period (cf. regression (13) with regression (7)). However, the residuals remain highly non-

normal and only by removing the last observation or by adding a dummy for the last quarter of 1993, do the residuals pass the normality test (regression (14) of Table 8).

The coefficients of the currency substitution terms in regression (14) have exactly the same values as in regression (7) with a further increase in the already very high significance of the DM-dollar substitution (t-statistics of dPPP increases from 6.81 in regression (7) to 7.79 in regression (14)). The Chow Forecast F-test, the Cusum Square test and the recursive parameter estimates cannot be performed on regression (14) because of the presence of the dummies. In order to get more information on the stability of the function and on the parameter values we fall back on regression (13) or (12). The Chow Forecast-F tests performed with regression (13) for the periods 1991(1) to 1993(4), 1992(1) to 1993(4) and 1993(1) to 1993(4) all indicate a structural break at the 1% level of significance, despite the inclusion of three unification dummies. The Cusum Square test performed on the residuals of regression (12) indicates one large structural break at the beginning of 1990 and two smaller ones in the first quarter of 1991 and in the last quarter of 1993 (fig. 4). Fig. 5 contains the recursive parameter esimates for regression (12) on the coefficient of dPPP. The figure shows a significant increase in the weight of the DM-dollar substitution in the first half of 1990 which continues until the end of 1991 when there were reunification fears on the part of financial markets and laxer German monetary policy followed by a partial recovery in 1992 and 1993 due to a very restrictive stance of German monetary policy despite the recession. Considering the significance of the DM-dollar substitution and its increasing importance, it is not surprising that, if one removes the term from regression (14), the EC-model breaks down.

Moving on to the demand function for real M3, regression (15) of Table 9 shows that without unification dummies the extension of the estimation period produces enormous problems in the residuals. While with the inclusion of the new variables the residuals were very well behaved until 1989(2) (regression (10) of Table 6) now they are autocorrelated, heteroscedastic and not normally distributed (regression (15) of Table 9). In addition the functional form is mis-specified according to the Reset-F test. The inclusion of three dummies around the unification shock (the third and fourth quarter of 1990 and the first of 1991) a six month lag with respect to real M1 removes all the problems with the residuals and the coefficients of lagged M3 and dPPP assume their previous values (cf. regression (16) of Table 9 with regression (10) of Table 6). Although the coefficient of the intra-ERM currency substitution term becomes insignificant, the deletion of dPPP is rejected at the 5% significance level. If one removes the currency substitution terms, the EC-model breaks down as usual (regression (17) of Table 9). As to the stability of the estimated relationship, Fig

6 shows the Cusum Square test performed with regression (16): it shows a structural break in 1992 and then again in 1993. These breaks are confirmed by the Chow tests for the periods 1992(1) to 1993(4) and 1993(1) and 1993(4) which indicate structural breaks at the 1% level of significance.

Because of the presence of the reunification dummies, the recursive parameter estimates have been performed with regression (15). Fig. 7 shows the time profile of the coefficient of dPPP. In addition to the significant 1985 jump in the absolute value of the coefficient recorded already in the estimation for the shorter period (Fig. 3), one observes, as with M1, a further significant increase in 1990 and 1991. For both changes in the value of this coefficient an interpretation has been already offered above: as to the 1985 jump, the ERM became more credible and capital controls in France and Italy stopped being binding around that time and as to the 1990-91 jump there was a loss in confidence in the DM caused by unification fears and lax monetary policy in Germany.

4- Summary and conclusions

This chapter has analysed the stability of the demand functions for German real M1 and M3 before and after the fall of the Berlin wall up to 1993(4), with particular attention being devoted to the role played by the changing degree of international financial market integration and the increased credibility of the ERM on the significance of currency substitution for Germany. The effects of the reunification shock on the stability of the functions and on the role of currency substitution is also analysed separately for the two aggregates.

Three proxies have been used to measure the effect of currency substitution: the percentage deviation of the nominal DM-dollar exchange rate from Purchasing Power Parity, measuring substitution of assets included in the German money stocks with dollar assets; the forward discount of the DM with the currencies participating in the ERM, measuring substitution with ERM assets, and the variability of the DM-dollar exchange rate which reflects uncertainty about the value of the US dollar.

The starting point of this chapter is a study by Tullio, de Souza and Giucca (1996) covering the period 1979(2)-1992(3) on the stability of the ERM-wide and German demand for money in which it is shown that currency substitution with the US dollar is very important for the ERM-wide and for the German money stocks and that the German demand for M1 and M3 become unstable after the fall of the Berlin wall. The present chapter attempts to improve the previous specification of the German demand for real money by adding three variables to the list of explanatory variables: the variability of the

DM-dollar exchange rate which always turns out to be significant and with a positive sign, suggesting a flight into the DM when the variability of the dollar increases, the differential between the German long and short term interest rate which is generally significant and with the right (negative) sign, and the differential between the own rate of return on M3 and the short term interest rate which generally has the right (positive) sign, but is not significant.

As a result of the inclusion of these variables, M3 becomes more stable during the pre-unification period and the intra-ERM currency substitution becomes very significant both for M1 and for M3, while in the previous specification it was not. The estimates up to 1993(4) show that these currency substitution terms are very significant and suggest an increasing importance of currency substitution through time. This is particularly true for the DM-dollar currency substitution, as its removal from the regressions always causes a breakdown of the otherwise very satisfactory EC-model. In addition, both the intra-ERM and the DM-dollar substitution terms increase in weight in 1985 and in 1990-91. In 1985 the existing exchange rate parities within the ERM became more credible, the internal market was launched and progress was made towards a more integrated European financial market, with Italy and France assuming a more relaxed stance towards capital controls for their residents. In 1990-91 fears about the conseqences of German reunification superimposed on furher capital liberalization in Europe caused a second significant increase in the weight of both currency substitution terms.

Despite the inclusion of 3-4 dummies for reunification we are unable to find stable demand for money functions after the fall of the Berlin wall. Clearly the consequences of the reunification shock on the German demand for money function were not yet over in 1993 and/or one ought to try to furhter improve the specification by including West European real GDP (excluding the German one), Eastern European GDP and perhaps Russian inflation.

However, our objective was not to find a stable demand function for M3 in Germany before and after unification. Our objective was twofold. First, to show that, without taking into account rapidly increasing foreign influences (currency substitution), there was no such thing as a stable demand for real M3 in Germany before the fall of the Berlin wall. Second to show that, after the fall of the wall, the demand function for M3 which was stable before (with currency substitution terms with the dollar and with other European currencies) starts showing instability, even if one includes a battery of dummy variables for the unification shock.

February 1995

Appendix 1 - An alternative measure of DM-dollar currency substitution: the US-German long term interest rate differential (dRL)

Table A.1 contains the estimates of regression (7) and (14) (relating to M1) where the DM-dollar substitution term dPPP has been substituted with the long term interest rate differential between the two countries (dRL). The numbers of the regressions correspond to the ones in the text For the 1979(2)-1989(2) period the results are clearly inferior. Even though the residuals pass all the tests, the coefficient of lagged money becomes insignificantly differet from zero, suggesting that the EC-model breaks down. For the extended sample period the regression (14a) is quite satisfactory and would compare relatively well with regression (14) of table 8 if the coefficient of lagged money did not fall to one third of the previous value. Table A.2 presents the re-estimation of regression (10) and (16) relating to M3. The results not as satisfactory as when one uses dPPP. Although the residuals are well behaved and the DM-dollar currency substitution term is always significant, the coefficient of lagged money falls by about one third and becomes insignificantly different from zero. This is the reason why the term dPPP was preferred in this chapter.

Appendix 2 - Scale variables expressed per capita

The division of real M3 and of real GDP by population leads to a slight improvement in the estimation results for the pre-unification period. This is shown in Table A-3 where estimates for real M3 are presented for the period 1979(2) to 1989(2). Regression (10) of table 6 is duplicated here to facilitate the comparison. The t-statistics of both currency substitution terms increase slightly and the absolute value of lagged money increases by 50% implying a faster and more plausible speed of convergence towards equilibrium. However for the extended sample period the per capita correction worsens the results considerably. The results for the 1979(2)-1993(4) period are not shown here to save space. For this reason all the regressions presented in the text are not corrected for population.

Appendix 3 - Data description and sources

LM1 = logarithm of Money (M1), seasonally unadjusted. Source International Financial Statistics (IFS) of the IMF, line 34.

LM3 = logarithm of Money (M3), seasonally adjusted. Source Bundesbank

Consumer Price Index, base year 1985. Source: International Financial Statistics (IFS), line 64. For the period 1990.3-1993.4 the price index for the whole of Germany is a weighted average of West and East with a weighted of the West and of 0.16 for the East.

LY = logarithm of real GDP, base year 1985. Source: OECD Quarterly National Accounts.

RS = Short-term interest rate. Source International Financial Statistics (IFS), line 60b (Call Money Rate)

RL = Long-term interest rate. Source International Financial Statistics (IFS), line 61 (Government Bond Yield)

FD = Intra - ERM Currency subscription. It is defined as weighted average of the 3 months forward discount rates of the Belgian franc, French franc, Danish kroner, Irish pound, Italian lira and Dutch guilder with respect to the German mark.

dPPP = DM-dollar currency substituiton. It is defined as (E-PPP)/PPP, where E is the spot exchange rate of the US dollar in DM, and PPP, the purchasing power parity level, is defined as the ratio of the German consumer price index (base 1985, see above for source) to the US consumer price index (source IFS, line 64), scaled to equal the average spot exchange rate of the US dollar in DM during 1985:

dRL = DM-dollar currency substitution, calculated as the differential between US and German long term interest rates. Source for the long-term interest rates: International Financial Statistics (IFS), line 61 (Government Bond Yield).

dRLS = differential between German long-and short-term interest rates.

VARER = Exchange rate volatility, calculated as the variance, over four observations, of the market rate. Source for the market rate: International Financial Statistics (IFS), line rf.

dROS = differential between M3-Own rate of return (Source: Bundesbank) and short-term interest rate.

POP = population. Source: OECD.

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TABLE 1 German money demand function:- EC-model, EMS period, 1979(2)-1989(2)

No. of regression	(1)	(2)
Definition of money	M1	M3
explanatory variables:		
constant	-3.62 (-6.06)	-1.47 (-2.95)
DLY	0.82 (5.03)	0.38 (2.40)
DRS	-1.38 (-5.29)	-0.64 (-2.41)
DRS(-1)	–	-0.59 (-2.59)
FD	-0.17 (-1.95)	-0.05 (-0.62)
LMP(-1)	-0.48 (-5.81)	-0.25 (-3.02)
LY(-1)	1.05 (6.20)	0.53 (3.12)
RS(-1)	-0.83 (-7.26)	-0.27 (-2.79)
dPPP(-1)	-0.14 (-6.09)	-0.03 (-2.44)
D874	-0.03 (-2.79)	–
R^2 Adjusted	0.979	0.502
SER	0.009	0.008
DW	1.98	2.09
AR-CHI2 (4)	0.85 (0.84)	2.70 (0.44)
AR-F (4)	0.18 (0.91)	0.68 (0.67)
ARCH-CHI2 (4)	1.19 (0.76)	2.57 (0.46)
ARCH-F (4)	0.25 (0.86)	0.63 (0.60)
N-JB	1.37 (0.50)	1.54 (0.46)
RESET-F (1)	0.23 (0.64)	6.44 (0.02)*

- t-statistics or probabilities of rejection of the null hypothesis when the latter is true in parenthesis.
- * rejection of the null hypothesis at the 5% confidence level.

Table 2 Wald F-test for exclusion of currency substitution terms
(see regression (1) and (2) in Table 1 ; sample period 1979 (2)-1989 (2))

Definition of money	M1	M3
No. of regression	(1)	(2)
zero restriction on coefficient of FD (intra-ERM)	F = 3.81 (0.06)	F = 0.39 (0.54)
zero restriction on coefficient of dPPP(-1) (US $)	F = 37.03 (0.00)**	F = 5.97 (0.02)*
zero restriction on coefficients of FD and dPPP(-1)	F = 19.55 (0.00)**	F = 2.99 (0.06)

Probabilities of rejection of the null hypothesis when the latter is true in parenthesis

* Rejection of the null hypothesis at the 5 % significance level; ** at the 1%

TABLE 3 German money demand function:- EC-model with and without currency substitution terms, EMS period, 1979(2)-1989(2)

No. of regression	(1)	(2)	(3)	(4)	(5)	(6)
Definition of money	M1	M1	M1	M3	M3	M3
explanatory variables						
constant	-3.62 (-6.06)	-3.29 (5.49)	-0.59 (-1.14)	-1.47 (-2.95)	-1.33 (-3.01)	-0.70 (-1.85)
DLY	0.82 (5.03)	0.79 (4.68)	0.39 (1.80)	0.38 (2.40)	0.36 (2.34)	0.22 (1.45)
DRS	-1.38 (-5.29)	-1.62 (-6.83)	-1.53 (-4.54)	-0.64 (-2.41)	-0.70 (-2.81)	-0.39 (-1.72)
DRS(-1)	–	–	–	-0.59 (-2.59)	-0.59 (-2.61)	-0.40 (-1.78)
FD	-0.17 (-1.95)	–	–	-0.05 (–0.62)	–	–
LMP(-1)	-0.48 (-5.81)	-0.47 (-5.49)	-0.04 (-0.71)	-0.25 (-3.02)	-0.24 (-2.98)	-0.10 (-1.71)
LY(-1)	1.05 (6.20)	0.99 (5.69)	0.15 (1.14)	0.53 (3.12)	0.49 (3.11)	0.23 (1.89)
RS(-1)	-0.83 (-7.26)	-0.81 (-6.78)	-0.38 (-2.90)	-0.27 (-2.79)	-0.25 (-2.75)	-0.16 (-1.83)
dPPP(-1)	-0.14 (-6.09)	-0.14 (-5.68)	–	-0.03 (-2.44)	-0.03 (-2.39)	–
D874	-0.03 (-2.79)	-0.03 (-2.58)	-0.02 (-1.62)	–	–	–
R^2 Adjusted	0.979	0.976	0.950	0.502	0.496	0.409
SER	0.009	0.009	0.013	0.008	0.008	0.008
DW	1.98	2.01	1.75	2.09	2.15	1.99
AR-CHI2 (4)	0.85 (0.84)	0.79 (0.86)	3.36 (0.34)	2.70 (0.44)	3.35 (0.34)	3.20 (0.37)
AR-F (4)	0.18 (0.91)	0.18 (0.91)	0.83 (0.49)	0.68 (0.67)	0.89 (0.45)	0.88 (0.46)
ARCH-CHI2 (4)	1.19 (0.76)	1.63 (0.65)	2.08 (0.55)	2.57 (0.46)	5.01 (0.17)	6.70 (0.08)
ARCH-F (4)	0.25 (0.86)	0.35 (0.78)	0.48 (0.70)	0.63 (0.60)	1.37 (0.27)	2.00 (0.14)
N-JB	1.37 (0.50)	7.34 (0.03)*	0.22 (0.90)	1.54 (0.46)	1.50 (0.47)	1.40 (0.50)
RESET-F (1)	0.23 (0.64)	0.65 (0.43)	2.00 (0.17)	6.44 (0.02)*	8.71 (0.01)**	6.16 (0.02)*

- t-statistics or probabilities of rejection of the null hypothesis when the latter is true in parenthesis.
- * rejection of the null hypothesis at the 5% confidence level; ** at the 1% .

TABLE 4 German demand function for real M1 - EC-model, EMS period, 1979(2)-1989(2)

No. of regression :	(1)	(7)	(8)
explanatory variables			
constant	-3.89 (-5.68)	-2.96 (-5.29)	0.05 (0.09)
DLY	0.80 (4.56)	0.77 (4.96)	0.31 (1.36)
DRS	-1.39 (-5.11)	-1.64 (-4.45)	-2.15 (-3.99)
FD	-0.21 (-2.25)	-0.30 (-3.28)	--
LMP(-1)	-0.49 (-5.55)	-0.42 (-4.94)	0.04 (0.48)
LY(-1)	1.03 (5.86)	0.88 (5.36)	-0.03 (0.17)
RS(-1)	-0.81 (-7.00)	-0.78 (-7.46)	-0.35 (-2.57)
dPPP(-1)	-0.15 (-5.88)	-0.15 (-6.81)	--
D874	-0.03 (-2.97)	-0.03 (-3.25)	-0.02 (-1.40)
VARER(-1)	--	0.004 (3.02)	0.002 (0.97)
DdRLS	--	-0.005 (-1.23)	-0.008 (-1.36)
R^2 Adjusted	0.968	0.975	0.933
SER	0.009	0.008	0.013
DW	1.89	2.38	1.81
AR-CHI2 (4)	5.86 (0.21)	11.39 (0.023)*	4.45 (0.35)
AR-F (4)	1.04 (0.41)	2.21 (0.099)	0.76 (0.56)
ARCH-CHI2 (4)	1.46 (0.83)	1.13 (0.89)	1.82 (0.77)
ARCH-F (4)	0.33 (0.86)	0.25 (0.91)	0.41 (0.80)
N-JB	0.50 (0.78)	0.91 (0.63)	0.35 (0.84)
RESET-F (1)	0.19 (0.67)	0.27 (0.61)	1.68 (0.21)

- t-statistics or probabilities of rejection of the null hypothesis when the latter is true in parenthesis.
- * rejection of the null hypothesis at the 5% confidence level.

Table 5 Wald F-test for exclusion of currency substitution terms in M1
(see regression (7) and (8) in Table 4 ; sample period 1979 (2)-1989 (2))

zero restriction on coefficient of FD	F = 10.76 (0.003)**
zero restriction on coefficient of dPPP(-1)	F = 46.33 (0.000)**
zero restriction on coefficients of FD and dPPP(-1)	F = 24.89 (0.000)**

Probabilities of rejection of the null hypothesis when the latter is true in parenthesis

** Rejection of the null hypothesis at the 1 % significance level

TABLE 6 German demand function for real M3 - EC-model, EMS period, 1979(2)-1989(2)

No. of regression :	(9)	(10)	(11)
explanatory variables			
constant	-1.24 (-2.72)	-0.92 (-1.77)	-0.02 (-0.04)
DLY	0.31 (1.94)	0.20 (1.27)	0.005 (0.03)
DRS	-0.62 (-2.27)	-0.32 (-1.14)	-0.15 (-0.62)
DRS(-1)	-0.59 (-2.52)	-0.75 (-2.41)	-0.86 (-2.57)
FD	-0.06 (-0.74)	-0.19 (-2.16)	--
LMP(-1)	-0.24 (-2.85)	-0.10 (-1.14)	0.04 (0.49)
LY(-1)	0.47 (2.93)	0.27 (1.48)	-0.04 (-0.23)
RS(-1)	-0.25 (-2.64)	-0.18 (-2.01)	-0.09 (-1.00)
dPPP(-1)	-0.04 (-2.38)	-0.03 (-2.39)	--
VARER(-1)	--	0.004 (2.73)	0.003 (1.89)
DdRLS(-1)	--	-0.007 (-1.97)	-0.010 (-2.62)
DdROS	--	0.004 (0.96)	-0.0002 (-0.05)
R^2 adjusted	0.356	0.516	0.421
SER	0.008	0.007	0.008
DW	2.01	2.22	2.10
AR-CHI2 (4)	2.30 (0.68)	3.36 (0.50)	2.70 (0.61)
AR-F (4)	0.42 (0.80)	0.55 (0.70)	0.47 (0.75)
ARCH-CHI2 (4)	1.78 (0.78)	4.28 (0.37)	6.75 (0.15)
ARCH-F (4)	0.40 (0.80)	1.05 (0.40)	1.79 (0.16)
N-JB	1.18 (0.55)	0.29 (0.87)	0.25 (0.88)
RESET-F (1)	6.43 (0.012)*	1.09 (0.30)	1.23 (0.28)

- t-statistics or probabilities of rejection of the null hypothesis when the latter is true in parenthesis.
- * rejection of the null hypothesis at the 5% confidence level.

Table 7 Wald F-test for exclusion of currency substitution terms in M3
(see regression (10) in Table 6 ; sample period 1979 (2)-1989 (2))

zero restriction on coefficient of FD	F = 4.65 (0.04)*
zero restriction on coefficient of dPPP(-1)	F = 5.71 (0.02)*
zero restriction on coefficients of FD and dPPP(-1)	F = 3.94 (0.03)*

- Probabilities of rejection of the null hypothesis when the latter is true in parenthesis.
- * indicates rejection of the null hypothesis at the 5% significance level.

TABLE 8 German demand function for real M1 - EC-model, EMS period, 1979(2)-1993(4)

No. of regression :	(12)	(13)	(14)
explanatory variables			
constant	-4.26 (-6.34)	-3.23 (-6.10)	-3.13 (-7.54)
DLY	1.09 (7.73)	0.80 (6.65)	0.79 (8.37)
DRS	-1.95 (-2.74)	-1.61 (-3.14)	-1.35 (-3.34)
FD	-0.17 (-0.90)	-0.25 (-1.87)	-0.31 (-2.90)
LMP(-1)	-0.62 (-5.92)	-0.44 (-5.28)	-0.43 (-6.53)
LY(-1)	1.28 (6.36)	0.95 (5.91)	0.92 (7.32)
RS(-1)	-0.90 (-5.86)	-0.82 (-7.46)	-0.80 (-9.23)
dPPP(-1)	-0.19 (-5.63)	-0.15 (-5.93)	-0.15 (-7.79)
D874	-0.03 (-1.59)	-0.04 (-2.59)	-0.04 (-3.23)
VARER(-1)	0.0006 (0.21)	0.0017 (0.84)	0.004 (2.37)
DdRLS	-0.005 (-0.72)	-0.0005 (-0.09)	-0.0002 (-0.04)
D901	--	-0.04 (-2.57)	-0.04 (-3.17)
D902	--	0.07 (4.44)	0.07 (6.12)
D903	--	0.07 (4.26)	0.07 (5.66)
D934	--		0.06 (5.25)
R^2 adjusted	0.908	0.956	0.973
SER	0.018	0.013	0.010
DW	1.68	1.65	2.19
AR-CHI2 (4)	6.87 (0.14)	1.34 (0.85)	4.81 (0.31)
AR-F (4)	1.35 (0.27)	0.22 (0.93)	0.82 (0.52)
ARCH-CHI2 (4)	19.96 (0.001)**	2.17 (0.70)	6.99 (0.14)
ARCH-F (4)	7.12 (0.00)**	0.51 (0.73)	1.82 (0.14)
N-JB	14.96 (0.00)**	72.18 (0.00)**	2.57 (0.28)
RESET-F (1)	3.73 (0.06)	0.03 (0.86)	0.001 (0.97)

- t-statistics or probabilities of rejection of the null hypothesis when the latter is true in parenthesis.
- ** rejection of the null hypothesis at the 1% confidence level.

TABLE 9 German demand function for real M3 - EC-model, EMS period, 1979(2)-1993(4)

No. of regression :	(15)	(16)	(17)
explanatory variables			
constant	-1.37 (-4.16)	-0.53 (-2.22)	-0.19 (-0.95)
DLY	0.36 (2.99)	0.28 (3.26)	0.21 (2.43)
DRS	-0.44 (-0.81)	-0.29 (-1.04)	-0.24 (-0.94)
DRS(-1)	-1.11 (-1.69)	-0.75 (-2.27)	-0.70 (-2.07)
FD	-0.08 (-0.45)	-0.15 (-1.58)	--
LMP(-1)	-0.34 (-4.82)	-0.09 (-1.41)	-0.03 (-0.58)
LY(-1)	0.61 (4.89)	0.18 (1.82)	0.07 (0.75)
RS(-1)	-0.39 (-2.78)	-0.22 (-2.94)	-0.14 (-1.97)
dPPP(-1)	-0.06 (-2.38)	-0.03 (-2.25)	--
VARER(-1)	0.002 (0.80)	0.003 (2.37)	0.002 (1.41)
DdRLS(-1)	-0.04 (-0.65)	-0.006 (-1.85)	-0.005 (-1.64)
DdROS	-0.008 (-0.82)	0.0004 (0.09)	-0.001 (-0.24)
D903	--	0.06 (4.75)	0.07 (5.27)
D904	--	-0.02 (4.75)	0.07 (5.27)
D911	--	0.11 (9.46)	0.12 (9.94)
R^2 adjusted	0.326	0.835	0.819
SER	0.018	0.009	0.009
DW	2.86	2.17	2.03
AR-CHI2 (4)	16.33 (0.003) **	2.23 (0.69)	3.90 (0.42)
AR-F (4)	4.11 (0.007)**	0.39 (0.81)	0.74 (0.57)
ARCH-CHI2 (4)	10.38 (0.03)*	1.24 (0.87)	1.03 (0.91)
ARCH-F (4)	2.92 (0.03)*	0.29 (0.88)	0.24 (0.92)
N-JB	129.35 (0.00)**	0.31 (0.86)	0.22 (0.90)
RESET-F (1)	7.58 (0.008)**	0.16 (0.69)	0.61 (0.44)

- t-statistics or probabilities of rejection of the null hypothesis when the latter is true in parenthesis.
- * rejection of the null hypothesis at the 5% confidence level, ** at the 1%.

Table 10 Wald F-test for exclusion of currency substitution terms in M3
(see regression (15) and (17) in Table 9; sample period 1979 (2)-1993 (4))

zero restriction on coefficient of FD	F = 0.20 (0.66)
zero restriction on coefficient of dPPP(-1)	F = 5.68 (0.02)*
zero restriction on coefficients of FD and dPPP(-1)	F = 2.84 (0.07)

Probabilities of rejection of the null hypothesis when the latter is true in parenthesis

* Rejection of the null hypothesis at the 5 % significance level

Table 11 Wald F-test for exclusion of currency substitution terms in M3
(see regression (16) and (17) in Table 9; sample period 1979 (2)-1993 (4))

zero restriction on coefficient of FD	F = 2.43 (0.13)
zero restriction on coefficient of dPPP(-1)	F = 5.06 (0.03)*
zero restriction on coefficients of FD and dPPP(-1)	F = 3.15 (0.05)*

Probabilities of rejection of the null hypothesis when the latter is true in parenthesis

* Rejection of the null hypothesis at the 5 % significance level

TABLE A1 German demand function for real M1 with alternative measure of DM-dollar currency substitution (dRL)-

Sample period	**1979(2)-1989(2)**	**1979(2)-1993(4)**
No. of regression :	**(7a)**	**(14a)**
explanatory variables		
constant	-0.48 (-0.79)	-0.97 (-2.0)
DLY	0.41 (1.82)	0.57 (4.24)
DRS	-1.68 (-2.92)	-0.90 (-1.50)
FD	-0.18 (-1.31)	-0.23 (-1.47)
LMP(-1)	-0.02 (-0.22)	-0.15 (-1.91)
LY(-1)	0.11 (0.67)	0.32 ((2.25)
RS(-1)	-0.35 (-2.70)	-0.53 (4.53)
dRL(-1)	-0.005 (-1.88)	-0.006 (-2.18)
VARER(-1)	0.003 (1.43)	0.002 (0.98)
DdRLS	-0.006 (-0.95)	0.001 (0.19)
D874	-0.021 (-1.43)	-0.024 (-1.46)
D901	--	-0.04 (-2.22)
D902	--	0.10 (5.29)
D903	--	0.07 (3.73)
D934	--	0.06 (3.42)
R^2 adjusted	0.939	0.940
SER	0.012	0.015
DW	1.84	1.67
AR-CHI2 (4)	4.55 (0.34)	7.76 (0.10)
AR-F (4)	0.72 (0.59)	1.40 (0.25)
ARCH-CHI2 (4)	1.98 (0.74)	4.51 (0.34)
ARCH-F (4)	0.45 (0.77)	1.12 (0.36)
N-JB	1.08 (0.58)	0.40 (0.82)
RESET-F (1)	0.64 (0.43)	0.05 (0.82)

T-statistics or probabilities of rejection of the null hypothesis when the latter is true in parenthesis

TABLE A2 German demand function for real M3 with alternative measure of DM-dollar currency substitution (dRL)-

Sample period	**1979(2)-1989(2)**	**1979(2)-1993(4)**
No. of regression :	**(10a)**	**(16a)**
explanatory variables		
constant	-0.71 (-1.63)	-0.12 (-0.50)
DLY	0.15 (1.12)	0.21 (2.56)
DRS	-0.10 (-0.41)	-0.12 (-0.46)
DRS(-1)	-0.97 (-3.24)	-0.75 (-2.22)
FD	-0.16 (-1.97)	-0.11 (-1.18)
LMP(-1)	-0.06 (-0.81)	-0.03 (-0.58)
LY(-1)	0.19 (1.27)	0.06 (0.66)
RS(-1)	-0.05 (-0.71)	-0.18 (-2.53)
dRL(-1)	-0.005 (-3.02)	-0.003 (-1.85)
VARER(-1)	0.003 (2.39)	0.003 (2.07)
DdRLS(-1)	-0.008 (-2.51)	-0.006 (-1.79)
DdROS	0.005 (1.19)	0.001 (0.14)
D903		0.07 (5.24)
D904		-0.009 (-0.74)
D911		0.12 (10.14)
R^2 adjusted	0.684	0.829
SER	0.007	0.009
DW	2.15	2.04
AR-CHI2 (4)	3.26 (0.51)	1.72 (0.79)
AR-F (4)	0.53 (0.71)	0.30 (0.88)
ARCH-CHI2 (4)	0.95 (0.92)	1.32 (0.86)
ARCH-F (4)	0.21 (0.93)	0.31 (0.87)
N-JB	0.08 (0.96)	0.67 (0.72)
RESET-F (1)	0.003 (0.95)	0.09 (0.76)

T-statistics or probabilities of rejection of the null hypothesis when the latter is true in parenthesis

TABLE A3 Scale variables expressed per capita, real M3 per capita, 1979(2)-1989(2)

No. of regression :	**(10)**	**(10p)**
explanatory variables		
constant	-0.92 (-1.77)	-0.29 (-1.96)
DLY	0.20 (1.27)	0.30 (1.94)
DRS	-0.32 (-1.14)	-0.37 (-1.30)
DRS(-1)	-0.75 (-2.41)	-0.73 (-2.27)
FD	-0.19 (-2.16)	-0.23 (-2.48)
LMP(-1)	-0.10 (-1.14)	-0.15 (-1.58)
LY(-1)	0.27 (1.48)	0.36 (1.88)
RS(-1)	-0.18 (-2.01)	-0.16 (-1.71)
dRL(-1)	-0.03 (-2.39)	-0.04 (-2.52)
VARER(-1)	0.004 (2.73)	0.003 (2.37)
DdRLS(-1)	-0.007 (-1.97)	-0.006 (-1.70)
DdROS	0.004 (0.96)	0.006 (1.22)
R^2 adjusted	0.516	0.517
SER	0.007	0.007
DW	2.22	2.30
AR-CHI2 (4)	3.36 (0.50)	2.09 (0.72)
AR-F (4)	0.55 (0.70)	0.33 (0.85)
ARCH-CHI2 (4)	4.28 (0.37)	0.80 (0.95)
ARCH-F (4)	1.05 (0.40)	0.18 (0.95)
N-JB	0.29 (0.87)	1.01 (0.60)
RESET-F (1)	1.09 (0.30)	0.78 (0.39)

T-statistics or probabilities of rejection of the null hypothesis when the latter is true in parenthesis

FIG. 1 - CUSUM OF SQUARES TEST ON THE RESIDUALS OF REGRESSION 10 TABLE 6
(real M3 with new explanatory variables): 1979 (2) - 1989 (2)

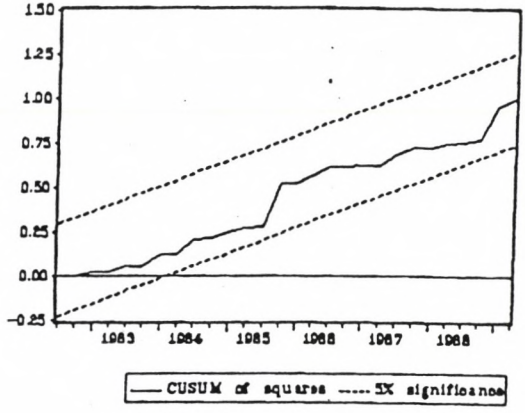


FIG. 2 - RECURSIVE PARAMETER ESTIMATES ON THE COEFFICIENT OF FD IN REGRESSION 10 OF TABLE 6 (REAL M3) : 1979 (2) - 1989 (2)

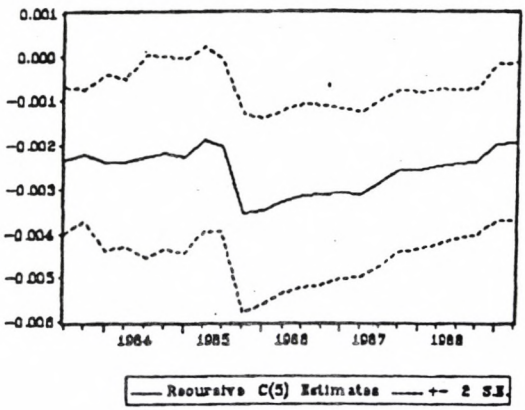


FIG. 3 - Recursive parameter estimates on the coefficient of dPPP-1 in regression 10 of table 6 (real M3): 1979 (2) - 1989 (2)

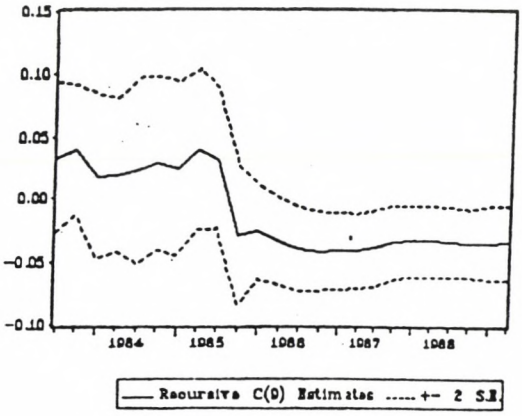


FIG. 4 - CUSUM OF SQUARES STABILITY TEST - REGR. (12) of table 8 - REAL M1 - 1979 (2) - 1993 (4)

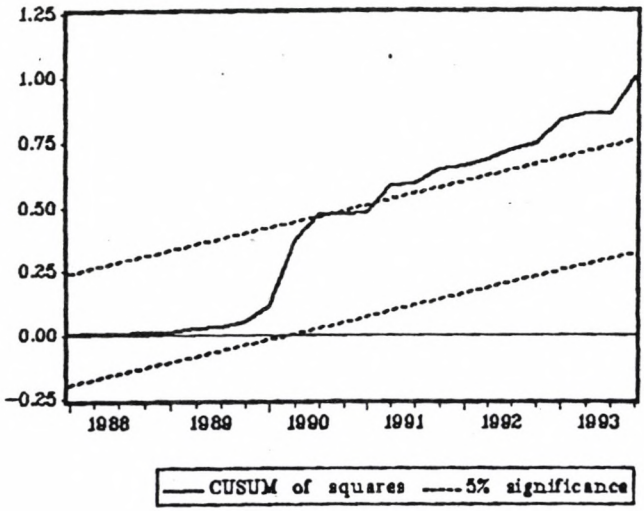


FIG. 5 - RECURSIVE PARAMETER ESTIMATES - COEFFICIENT OF dPPP - REGRESSION (12) OF TABLE 8 - REAL M1 - 1979 (2) - 1993 (4)

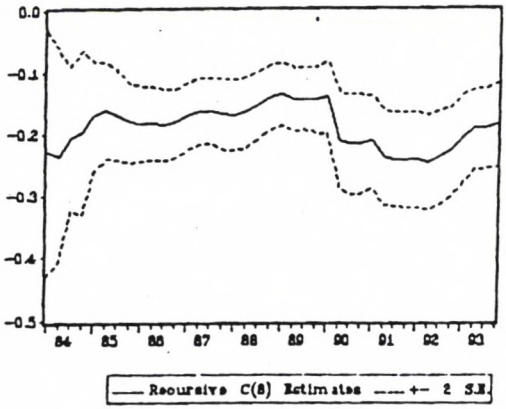


FIG. 6 - CUSUM OF SQUARES STABILITY TEST - REGR. (16) OF TABLE 9 - REAL M3 - 1979 (2) - 1993 (4)

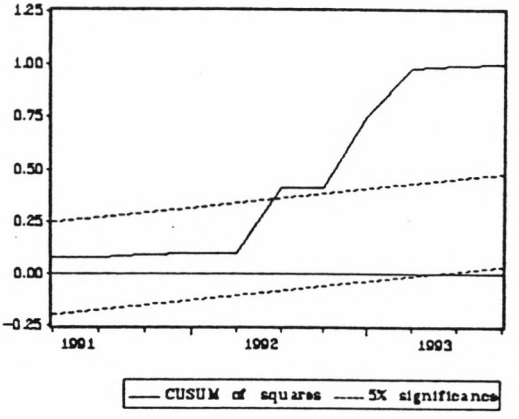
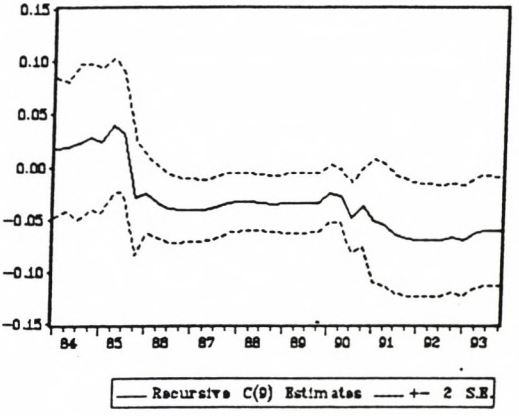


FIG. 7 - RECURSIVE PARAMETER ESTIMATES - COEFFICIENT OF dPPP - REGRESSION (15) of table 9 - REAL M3 - 1979 (2) - 1993 (4)



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