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# Using An EC-Wide Monetary Aggregate in Stage Two of EMU

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## Abstract

This paper looks at whether the aggregate ERM money supply has been a useful predictor of short-term changes in inflation and growth, and long-term trends in price levels among the core ERM countries. The evidence suggests that over the period since 1987, when there have been no realignments, the ERM money supply performs at least as well, and arguably better, than the individual national aggregates in predicting nominal aggregates such as inflation and the price level, while neither money supply is a good predictor of real activity.

JEL Classification Numbers

E42, E52, F36

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1/ The work was carried out while both authors were visiting the Bank of England. Our particular thanks go to David Barr, who participated in all of the initial discussions of the project, as well as providing the data. The paper does not necessarily represent the views of either the Bank of England or the IMF.

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## Summary

The agreement on Economic and Monetary Union (EMU) adopted at the Maastricht summit in December 1991 calls upon the central banks of the European Community (EC) to coordinate their monetary policies more closely. The agreement, however, says nothing about the way in which this policy coordination should be carried out, apart from stressing the importance of maintaining stable exchange rates within the exchange rate mechanism (ERM) of the European Monetary System.

This paper assesses how useful the aggregate ERM money supply might be as an intermediate monetary target in stage two of EMU. First, Granger causality tests are used to investigate the degree to which both the domestic and the ERM-wide money supply are useful in predicting real growth and inflation in the different countries within the ERM. The ERM-wide money supply is found to be a generally useful predictor of future inflation--indeed a better predictor than the national money supply in several cases. In particular, it is significant for the three largest economies in the ERM, namely Germany, France, and Italy. Next, the paper examines the ERM money supply to determine whether it is a useful predictor of trends in the price level. Here, again, the ERM money supply appears to be an important influence on the price level trends of member countries.

The results reported in this paper are not decisive and more work should be carried out. However, they do suggest that it may be useful to use an EC-wide monetary aggregate when coordinating national money supplies in stage two of EMU. An EC-wide monetary aggregate promises to provide more information than national monetary aggregates about the impact of monetary policies on national inflation rates.

## I. Introduction

The agreement on Economic and Monetary Union (EMU) adopted by the Maastricht Summit in December 1991 calls upon the central banks of the European Community to coordinate their monetary policies more closely. That will be one of the principal tasks of the European Monetary Institute, which will be established at the start of the second stage of EMU in January 1994, to facilitate the transition to full monetary union at the start of the third stage.

The agreement on EMU, however, says nothing about the way in which this policy coordination should be carried out, apart from stressing the importance of maintaining stable exchange rates within the Exchange Rate Mechanism (ERM) of the European Monetary System (EMS). This paper suggests that the central banks should pay some attention to the evolution of a monetary aggregate for the member countries as a group.

## II. Two Models of Monetary Coordination

The ERM has frequently been described as a Deutsche Mark zone--or something very close to one. The Bundesbank chooses a monetary policy aimed at achieving price stability in Germany, and the other member countries follow the Bundesbank with a view to achieving two objectives--price stability within their own countries and exchange-rate stability within the ERM. The validity of this characterization has not gone unchallenged. There is some evidence, for example, that German monetary policy has been influenced by the policies of other ERM countries and that the other ERM countries have enjoyed some independence in conducting their own monetary policies; see the survey of recent research in Haldane (1991). Furthermore, the viability of the arrangement may be called into question by recent events in Germany. The intensification of inflationary pressures in Germany has produced a strong policy response by the Bundesbank. It was comparatively easy for other countries to adapt to German monetary policy when inflation rates and interest rates were low in Germany, and even easier to justify that adaptation. It may be somewhat harder now. As the deadline for the third stage of EMU approaches, moreover, the EC central banks will be expected to provide a common rationale for the conduct of national monetary policies.

Is there a viable alternative to German leadership? One possibility was suggested by McKinnon (1984) in a different context, namely to stabilize exchange rates among the major industrial countries. Under his proposal, the participating countries would agree on an appropriate growth rate for the sum of their national money supplies, achieve it by conducting open-market operations in their own national financial markets, but allow their individual money supplies to be determined endogenously by conducting non-sterilized intervention in the foreign-exchange markets to keep their exchange rates fixed.

McKinnon's rationale for this plan was his finding that national inflation rates were influenced more strongly by the growth rate of the

global money supply than by the growth rates of national money supplies, a phenomenon which he attributed to currency substitution. Other studies, however, failed to confirm his finding (see Spinelli, 1983, and Goldstein and Haynes, 1984).

The currencies of the ERM countries, however, may be closer substitutes for one another than those of the larger group of industrial countries in which McKinnon was interested. Their economies are more closely integrated, and the exchange rates connecting their currencies have been very stable for the last years. There have been no realignments in the ERM since 1987. 1/

It is therefore worth asking whether a monetary aggregate for the EC countries as a group could be used for coordinating national monetary policies in the second stage of EMU. This paper does not answer that question decisively, but it takes a first important step. It asks whether an ERM monetary aggregate can be shown to influence inflation rates and growth rates in the individual ERM countries and whether its influence is separate and more powerful than that of the countries' own national aggregates.

An affirmative answer to this question would, of course, be consistent with the hypothesis that the ERM currencies are close substitutes and with the strong form of that hypothesis advanced by Kremers and Lane (1990), Monticelli and Strauss-Khan (1991) and Artis (1991) that there is a stable demand for an ERM monetary aggregate. 2/ But it would also be consistent with a weaker hypothesis. The economic linkages among EC countries may now be so tight that the monetary policy of each EC country influences events in other EC countries by way of its effects at home, on the national inflation rate and national growth rate. We will not attempt to discriminate between these two hypothesis. It may be important to do so, however, before trying to decide whether the results reported in this paper provide an adequate justification for using an EC monetary aggregate to coordinate monetary policies in the second stage of EMU.

## III. Methods and Results

Monthly data for the period from January 1983 to December 1990 were collected on narrow money, industrial production and the CPI for each of the seven long-term members of the ERM (Germany, France, Italy, Holland, Belgium, Denmark, and Ireland), plus Spain and the U.K., which joined the ERM in 1989 and 1990, respectively. 3/ The data came from IMF

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1/ The central rate for the lire was adjusted slightly in January 1990, when Italy moved from a wide to a narrow band, but the lower floor was not altered.

2/ See, however, the comment on Kremers and Lane by Barr (1990).

3/ The estimation period for Germany ends in May 1990 to avoid the effects of Germany unification.

International Financial Statistics, with the exception of the Belgian money supply (which was obtained from the BIS) and the Irish price index (where wholesale prices were used and obtained from OECD Main Economic Indicators). In addition, the last nine months of the data on the Belgian money supply were interpolated from quarterly data. All data were seasonally adjusted, except the price series since these have no seasonal pattern.

## 1. The ERM money supply

A series was then calculated for the ERM-wide money supply. Earlier studies, focusing on the demand for ERM-wide monetary aggregates, have used different methods of aggregation (while generally concluding that their results are robust to alternative approaches). 1/ The issues involved in aggregation can be neatly be divided into two: do the data measure the same concept; and how should they be added together. To the extent that the individual country series use wider or narrower definitions of the money supply, no sum of such money supplies will be an accurate gauge of countries' contributions to the aggregate money supply. In addition, even if the money supplies are correctly and comparably measured, differences in regulations and behavior may cause members of the ERM to use money at different intensities. Both caveats imply that the approach followed by earlier authors--calculating the ERM wide money supply by summing the levels of national money supplies converted into a common currency--runs the risk of mismeasurement.

For this reason, this paper adopts a different approach to calculating the aggregate ERM money supply. Instead of forming a weighted sum of the levels of the individual money supplies, we sum the weighted rates of change (calculated as the change in the logarithm of the money supply). Mathematically, the ERM money supply was calculated as

$$\Delta \log(M_{ERM}) = \sum_i X_i \, \Delta \log(M_i) \qquad (1)$$

where i represents different countries and $X_i$ is the weight given to that particular country in the aggregate. These weight were based on the relative weight of individual countries in the GDP of the Community in 1987. The aggregate ERM series can then be calculated from the sum of its first differences.

The formulation in equation (1) has several advantages. It reduces the problems associated with differences in the coverage of national series, although there remains the issue of adding together apples and pears, in the sense that differences in coverage may imply different functions. In

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1/ For example, Kremers and Lane (1990) used data on levels of the money supply adjusted by purchasing-power-parity exchange rates, while Monticelli and Strauss-Kahn (1991) concentrated on results using current exchange rates.

addition, it means that if the money supply in any one member country expanded at an unusual rate for a period, due for example to financial deregulation, the importance of this series in the overall aggregate is not increased. This formulation appears advantageous for the purpose of this paper, which is concerned with the use of the ERM money supply as an intermediate target in a future where national monetary regulations will be largely harmonized and such surges in the growth of one money stock are unlikely to occur. Finally, the use of relative GDPs as weights ensures that the weights represent relative economic importance, even if, for historical reasons which are likely to disappear with the harmonization of regulations, narrow money is used more intensively in one country than another.

## 2. Causality tests

In order to test whether the ERM money supply has value as an intermediate target, separately from the influence of the domestic money supply in that country, Granger causality tests were calculated looking at the influence of both domestic and ERM-wide money in determining real growth and inflation. Granger causality tests use vector auto-regressions (VARs) to ask whether the lagged values of one variable are useful in predicting the current value of another variable. By showing whether the ERM money stock is a useful leading indicator of future inflation and growth in individual ERM countries, over and above the information contained in domestic monetary aggregates, these tests provide a direct test of how useful the ERM-wide money supply might be as an intermediate target.

We first investigated the characteristics of the individual series. Granger causality tests are only valid when the VAR contains stationary series. Augmented Dickey Fuller tests were therefore carried out on both the levels and first differences of the logarithms of the price level, industrial production and the money supply, for the seven ERM countries plus the ERM aggregates. The tests were carried out over two data periods, one starting in April 1983 and the other in April 1987; both ended in December 1990, except in the case of Germany, where the series were ended in May 1990 to avoid the effects of German unification. The former represents the period since the "hardening" of the ERM in 1983, while the latter covers a recent period during which there were no major realignments of the ERM central parities. If the ERM money supply is a useful intermediate target for individual EC countries, this effect is likely to be strongest in the period since 1987, when nominal convergence has been strong enough to allow ERM parities to remain fixed, implying a significant coordination of monetary policy across countries. Unfortunately, this period is also relatively short, and hence the econometric estimates may be relatively inaccurate. For this reason the longer period starting in 1983 was also used.

The tests indicated that the levels of the variables were nonstationary in the overwhelming number of cases, while the first differences were stationary. For only one out of the 32 equations in the levels of the variables could the hypothesis of nonstationarity of the

underlying series be rejected at the 5 percent significance level (the oddity being the Danish money supply). By contrast, for first differences of the variables, all but one of the regressions for the longer time period accepted the hypothesis of stationarity at conventional levels (the oddity in this case being ERM prices); even over the shorter period since 1987, all but four of the difference equations accepted stationarity.

Accordingly, (VARs) were estimated with the change in the logarithm of industrial production (or the CPI) made to depend on its own lagged values plus lagged values of the change in the logs of the domestic and ERM money supplies. 1/ As with the stationarity tests, these VARs were estimated over two data periods; 1987:4-1990:12 (fixed parities) and 1983:4-1990:12 (harder ERM). There is an issue as to whether the VARs should also include the levels of the variables, since there may be cointegrating vectors in these levels terms, particularly in the VARs involving money and prices. Experimentation using the two-step procedure suggested by Engle and Granger (1987) for estimating cointegrating vectors, however, indicated that the results were robust to the inclusion or exclusion of such a variable. As a result we report the results from "conventional" VARs excluding levels terms.

Granger causality tests for the shorter data period are shown in Table 1. It reports the F-statistics produced by excluding the growth in the ERM money supply from the full VAR and then by excluding the growth in the domestic money supply, again from the full VAR. The left-hand side of the table shows the results for a VAR with inflation as the dependent variable and involving six lagged values of inflation, of the growth of the domestic money supply and of the growth of the ERM money supply. 2/ The right-hand side reports the results from a VAR with the growth in industrial production as the dependent variable, and six lagged values of growth, the domestic money supply and the ERM-wide money supply. 3/ The coefficients marked by an asterisk are significant at the ten percent level, the ten percent level being chosen because of the relatively short estimation period.

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1/ Industrial production and the CPI were used as dependent variables since they are available on a monthly basis. As the focus of the research is on behavior in the 1980s, and more specifically on the period since the last (significant) realignment of ERM currencies in early 1987, quarterly data would have provided relatively few degrees of freedom.

2/ Artis (1991) reports that the effects of the money supply on prices and output frequently occur with relatively long lags, but we could not examine that hypothesis given the relatively short time period under investigation.

3/ Estimates were initially carried out using VARs with 1, 3, and 6 lags, and the longer lags proved the most successful. Likelihood ratio, Aikaike and Swartz-Bayes criteria were also calculated to investigate the optimal number of lags for each VAR. The general finding was in favor of longer lags; however, the individual tests gave very different results for a number of data sets, and hence a uniform lag of six was adopted.

Table 1. Results from the Granger Causality Tests (1987-90)

| | Inflation | | Growth | |
|---|---|---|---|---|
| | ERM Money | Domestic Money | ERM Money | Domestic Money |
| Germany | 2.21* | 2.48* | 0.95 | 0.89 |
| France | 4.68* | 1.07 | 1.64 | 0.61 |
| Italy | 2.40* | 2.65* | 0.99 | 0.93 |
| Holland | 0.87 | 0.27 | 1.12 | 0.53 |
| Belgium | 2.93* | 1.19 | 3.06* | 2.87* |
| Denmark | 0.90 | 2.19* | 1.39 | 0.91 |
| Ireland | 2.80* | 0.76 | 0.50 | 1.12 |
| U.K. | 0.93 | 2.22* | 2.83* | 1.41 |
| Spain | 0.71 | 0.86 | 2.03 | 1.37 |

Notes: An asterisk indicates that the coefficient is significant at the 19 percent level. The estimation period is 1987:4-1990:12, except for Germany, where the period ends in 1990:5.

Among the seven core members of the Exchange Rate Mechanism, the ERM-wide money supply Granger causes inflation in five countries, namely Germany, France, Italy, Belgium, and Ireland, while the domestic money supply is significant in only three instances. In general, therefore, it appears that in most members of the system the ERM-wide money supply is a useful predictor of future inflation--and is indeed a better predictor than the national money supply in several cases. In particular, the ERM aggregate is significant for the three largest economies in the ERM, namely Germany, France, and Italy. The finding that the ERM-wide money supply is a significant factor in explaining inflation in Germany is of particular interest, since the ERM is often described as a asymmetric system in which Germany pursues an independent monetary policy which other members follow. Our results, while not irreconcilable with that view, indicate that the monetary policies of other countries may have had some influence on the German economy.

It should be emphasized that these results do not reflect the inclusion of the national money supply in the ERM-wide aggregate. Excluding the domestic money supply from the ERM aggregate has no effect on the significance of the ERM money supply (although it does affect the significance of the domestic aggregate). This is because the growth rate of the ERM-wide aggregate is a linear combination of the growth rates of the national aggregates, so that all independent influences of the domestic money supply are picked up by the regression coefficient for the national aggregate.

Granger causality tests are also reported for the two recent additions to the ERM, Spain, and the United Kingdom. The results indicate that the ERM-wide money supply is not a significant explanatory variable for domestic inflation in these economies. Since both countries are heavily integrated with the core ERM countries but followed independent monetary and exchange rate policies over most of the period being considered, our results suggest that the importance of the ERM money supply for inflation in the core ERM countries probably reflects the exchange rate constraint, rather than simply being a reflection of the integrated nature of the EC.

The right hand side of Table 1 shows the results of a similar exercise but using the rate of growth of industrial production as the dependent variable in the VAR. 1/ The results for the long-term ERM members indicate that the money supply is relatively unimportant in predicting real activity; in only one country does the money supply Granger cause real activity, namely Belgium, where both the domestic and ERM-wide money supplies are significant. While this may well reflect a genuine lack of causation, it is also possible that this negative result is associated with the fact that industrial production, the series we have used to measure real

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1/ It should be noted that these results use data on the growth of the nominal money supply, although the dependent variable is real. Results using growth in the real money supply, defined as the nominal money supply deflated by the price level, showed a very similar pattern.

output, is relatively volatile, or with the long lags that may characterize the relationship between monetary policy and real activity.

Interestingly, the ERM monetary aggregate appears to be more important for activity in the recent ERM entrants. It is a significant factor in the United Kingdom and attracts a relatively large, though marginally insignificant, value in the case of Spain. This may well reflect the importance of the monetary stance in the ERM for the bilateral exchange rate between the U.K./Spain and the ERM countries.

One possible reason for the general lack of significance of the monetary aggregates in the real output VARs is that the wrong measure of monetary policy is being used. In particular, it is possible that changes in interest rates could be a more powerful influence on the real economy than changes in the money supply. To investigate this possibility, data on short-term interest rates were also gathered from the IFS data bank. The ERM interest rate was then calculated, using the same weights used in the money supply calculation. VARs using inflation and growth were then run using the changes in ERM and domestic interest rates in place of the changes in the money supplies. 1/

Interest rates were found to have less influence than monetary aggregates on the inflation rate. More surprisingly, they also had little influence on real activity. The ERM interest rate was insignificant in all nine regressions (including the U.K. and Spain), while the domestic interest rate was significant in only one case, that of Belgium (for the sake of brevity the tests are not reported). As with the earlier results using the monetary aggregates, these negative results could reflect the volatility of the industrial production series or the length of the lags involved. 2/

The VARs using the two monetary aggregates were also estimated over the longer data period, starting in April 1983 rather than April 1987; the results from this estimation are reported in Table 2. They show a smaller role for the ERM-wide money supply in determining inflation, as might be expected given the looser nature of the exchange rate commitment from 1983-87. For the inflation regressions, the ERM money supply and domestic money supplies are significant for an equal number of core countries, three out of seven (the ERM aggregate is also significant in the regression using Spanish data). This represents a fall in the number of countries in which the ERM aggregate is significant, while the domestic money supply is significant in the same number of countries. Overall, therefore, the importance of the ERM money supply appears to diminish with the inclusion of

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1/ First differences were used since tests indicated that the levels of interest rates were generally non-stationary, a somewhat surprising finding given that inflation was found to be stationary.

2/ Artis (1991), using data for the whole of the 1980s, finds domestic interest rates affect output only with relatively long lags. Unlike our results, however, he finds effects on prices at short lags.

Table 2. Results from the Granger Causality Tests: Longer Sample (1983-90)

| | Inflation | | Growth | |
|---|---|---|---|---|
| | ERM Money | Domestic Money | ERM Money | Domestic Money |
| Germany | 1.83 | 0.57 | 0.62 | 0.87 |
| France | 3.15* | 1.49 | 0.69 | 1.14 |
| Italy | 1.59 | 2.53* | 1.14 | 1.67 |
| Holland | 1.21 | 0.69 | 0.87 | 0.71 |
| Belgium | 2.68* | 0.67 | 1.98 | 1.70 |
| Denmark | 0.84 | 2.98* | 1.05 | 1.36 |
| Ireland | 2.41* | 2.40* | 1.37 | 1.49 |
| U.K. | 0.87 | 0.83 | 3.88* | 2.35* |
| Spain | 2.41* | 0.90 | 1.48 | 1.29 |

Notes: An asterisk indicates that the coefficient is significant at the five percent level. The estimation period is 1983:4-1990:12, except for Germany, where the period ends in 1990:5.

the mid-1980s data, as might be expected given that there were several realignments of ERM parities. 1/

The results for the VARs using data on industrial production show even fewer interactions than those for the shorter period. For the core ERM countries neither money supply turns out to be significant in any of the regressions. Only in the case of the U.K. data set is there any significant interaction; as with the shorter period, the U.K. effect may well reflect the effects of the exchange rate on U.K. activity. Limited experiments with longer lags found slightly more significant results, in particular in the regression using Irish data; however, the overall performance was still disappointing.

Taken together, our results indicate that, far from being irrelevant for domestic policy, the ERM-wide money supply may well be a useful intermediate target for inflation. Indeed, it performs at least as well, and in some cases better, than domestic monetary aggregates. By contrast, one of the indicators of monetary policy, ERM-wide or domestic, money supply or interest rates, appears to be particularly useful in predicting real activity, at least over the relatively short time periods used in this investigation.

## 3. The ERM money supply and price trends

In addition to looking at whether a measure of the ERM-wide money supply is a useful predictor of short-term changes in prices and output, it is also interesting to investigate whether it has a significant influence on long-term trends. To the extent that currencies within the ERM are substitutable, the price level in individual countries may well reflect the behavior of the overall aggregate more than that of the domestic money supply. 2/

The relative importance of the domestic and ERM-wide money supplies in determining trends in national price levels is investigated by estimating cointegrating vectors. The results from the augmented Dickey Fuller tests reported above indicate that price levels, domestic money supplies, the ERM money supply and industrial production are all integrated of order one. In these circumstances, it may be possible to find one or more cointegrating vectors between these variables. Such vectors, which represent the long-run relationship between the variables, will indicate the relative importance of the domestic and ERM money supplies in determining long-run price trends.

The existence of cointegrating vectors can be tested using the maximum likelihood approach suggested by Johansen (1988). The results from using

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1/ See Frankel and Phillips (1992) for a detailed chronology of the ERM.

2/ In the United States, CPIs for individual cities show a very high degree of correlation over long periods of time, implying that in a currency union aggregate monetary policy may be the dominant factor in determining price trends.

the Johansen procedure to test the number of cointegrating vectors in a system involving the domestic price level, the domestic money supply, the ERM money supply and domestic industrial production for the short data period are shown in Table 3. 1/ The Table reports the tests of the null hypothesis that the number of vectors is zero, one or less, two or less, and three or less, with the critical values given in the bottom row. There results indicate that there is a unique cointegrating vector in most cases. For three countries (Germany, Belgium and Ireland) the hypothesis of no cointegrating vectors is rejected at the 5 percent level, while for another three the tests statistics are close to this critical value; the statistics vary from 49-52 compared to a critical value of 53.3. Only in the case of Denmark is there little evidence of a long-run relationship. On the other hand, the tests for higher numbers of cointegrating vectors are never significant at conventional levels, indicating no evidence for multiple relationships.

The Johansen procedure also reports the cointegrating vectors implied by the procedure. These results, however, were difficult to interpret, with the coefficients frequently being either extremely large, incorrectly signed, or both. Since the first part of the Johansen procedure implied the existence of a unique cointegrating vector in most cases, the alternative three-step procedure for estimating this vector, suggested by Engle and Yoo (1988) and described by Cuthbertson, Hall and Taylor (1992), was used to estimate this cointegrating vector for each equation. As well as providing more easily interpretable results, this procedure also has the advantage that it calculates standard errors for the individual coefficients in the cointegrating vector, allowing standard t-tests to be applied.

The coefficients from the Engle-Yoo procedure for the 1987:4-1990:12 period are reported in Table 4 and show a striking pattern. The coefficient for the ERM money supply has the expected positive sign for six of the seven countries (the exception being Ireland) and are significant in all but one of the regressions (the exception in this case being Denmark). Hence for the five largest countries in the ERM the results indicate that the ERM money supply is a significant determinant of the underlying trend in the price level. By contrast, the domestic monetary aggregate has a positive coefficient for only two of these five countries, France and Italy, which are also the large countries which maintained capital controls over the data period. In the German, Dutch, and Belgian regressions the coefficients on the domestic money supply are incorrectly signed, while they are correctly signed in the cases of Denmark and Ireland. In short, the ERM money supply appears to be a significant factor in determining underlying price trends in most ERM countries, while the domestic money supply appears to matter only for large countries with capital controls (where the ERM money supply also matters) or the very small members of the ERM.

The Engle-Yoo procedure was also carried out for the longer 1983-90 data period, and the results are reported in Table 5. In this case, the

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1/ Results excluding output were broadly similar.

Table 3. Tests for Number of Cointegrating Vectors (r)

| | r=0 | r<1 | r<2 | r<3 |
|---|---|---|---|---|
| Germany | 64.3* | 24.8 | 9.2 | 0.2 |
| France | 51.2 | 20.5 | 3.3 | 0.2 |
| Italy | 49.6 | 24.4 | 7.1 | 2.6 |
| Holland | 49.5 | 27.7 | 10.2 | 1.1 |
| Belgium | 75.0* | 27.1 | 11.6 | 2.4 |
| Denmark | 36.4 | 13.5 | 5.2 | 0.5 |
| Ireland | 72.0* | 31.9 | 5.8 | 1.7 |
| Critical value (5 percent) | 53.3 | 35.1 | 20.2 | 9.1 |

Notes: The table reports the trace test with critical values given in Johansen (1989). The estimation period is 1987:4-1990:12, except for Germany, where the period ends in 1990:5.

Table 4. Domestic Prices: Cointegration Results for 1987-90

| | ERM Money Supply | Domestic Money Supply | Domestic Output |
|---|---|---|---|
| Germany | 0.22 (0.03)** | -0.22 (0.05)** | 0.24 (0.02)** |
| France | 0.25 (0.05)** | 0.20 (0.04)** | 0.26 (0.07)** |
| Italy | 0.26 (0.02)** | 0.47 (0.02)** | 0.29 (0.18) |
| Holland | 0.77 (0.27)* | -0.83 (0.41)* | 0.13 (0.29) |
| Belgium | 0.45 (0.07)** | -0.18 (0.15) | 0.29 (0.12)* |
| Denmark | 0.16 (0.14) | 0.26 (0.09)* | 0.17 (0.14) |
| Ireland | -0.39 (0.10)** | 0.31 (0.10)** | 0.27 (0.05)** |

Notes: The table reports the coefficient estimates derived from the Engle and Yoo (1988) three step estimation procedure. The estimation period is 1987:4-1990:12, except for Germany, where the period ends in 1990:5.

Table 5. Domestic Prices: Cointegration Results for 1983-90

| | ERM Money Supply | Domestic Money Supply | Domestic Output |
|---|---|---|---|
| Germany | 0.21 (0.03)** | -0.22 (0.05)** | 0.24 (0.02)** |
| France | 0.06 (0.01)** | 0.48 (0.01)** | 0.18 (0.07)** |
| Italy | -0.07 (0.02)** | 0.74 (0.01)** | -0.13 (0.19) |
| Holland | 0.37 (0.02)* | -0.35 (0.03)* | 0.06 (0.08) |
| Belgium | 0.55 (0.01)** | -0.34 (0.02) | 10.6 (16.0) |
| Denmark | 0.40 (0.81) | 0.30 (0.63) | -0.32 (0.30) |
| Ireland | -0.22 (0.05)** | 0.38 (0.05)** | 0.07 (0.06) |

Notes: The table reports the coefficient estimates derived from the Engle and Yoo (1988) three step estimation procedure. The estimation period is 1983:4-1990:12, except for Germany, where the period ends in 1990:5.

countries can be characterized as falling into two types. Germany and her smaller neighbors (Holland, Belgium, and Denmark) have large coefficients on the ERM money supply and small, often incorrectly signed, coefficients on the domestic money supply. France, Italy, and Ireland have the opposite characteristics, with large coefficients on their domestic money supplies and small, often incorrectly signed, coefficients on the ERM money supply. This grouping corresponds precisely to the division between countries which changed their central parities frequently in the 1983-87 period and those that did not. Taking the evidence from Table 4 and 5 together, it appears reasonable to infer, despite the short data period, that for countries with fixed ERM parities and relatively free capital markets, the ERM-wide money supply is a better indicator of future trends in the price level than are the national money supplies.

## IV. Conclusions

The results reported in this paper are not decisive, and more work should be done on this subject. The use of longer lags should be investigated when additional data become available, and alternative definitions of the money supply should be studied. Even at this juncture, however, the results suggest that it may useful to use a Community-wide monetary aggregate when coordinating national money supplies in Stage Two of EMU--more so perhaps than using an interest-rate average or focusing primarily on the structure of interest-rate differentials. A Community-wide monetary aggregate gives promise of providing more information than national monetary aggregates about the impact of monetary policies on national inflation rates.

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