BANCA D'ITALIA

# Temi di discussione

**del Servizio Studi**

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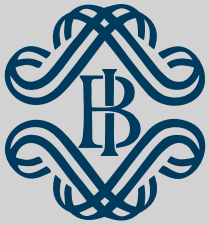
**by Paola Giucca and Aviram Levy**



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# MONETARY AGGREGATES AND MONETARY POLICY COORDINATION ON THE WAY TO ECONOMIC AND MONETARY UNION: THE ROLE OF CROSS-BORDER DEPOSITS

Paola Giucca and Aviram Levy (*)

## ABSTRACT

After analysing the pattern of cross-border deposits (CBDs) in the EEC countries in the eighties, the paper constructs and compares three hypothetical national monetary aggregates which include CBDs in a consistent fashion, for Germany, France and Italy, and some measures of the EEC-wide money supply; it then carries out an empirical comparison, for Germany and France, between traditional and hypothetical "extended" monetary aggregates in terms of their relationship with nominal income. Reflecting a number of structural and regulatory factors, CBDs have grown very fast in most countries but at an uneven pace so that the "extended" and traditional aggregates have evolved differently. The empirical analysis suggests that in the case of France over the 1979-1990 period all the definitions of money "help" to predict the future evolution of nominal income to roughly the same extent. In the case of Germany, over the 1979-1989 period the "extended" definitions did not perform better than the traditional one; when 1990 is included in the sample, no definition of money is found to Granger-cause nominal income.

## INDEX



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## Introduction[1]

In the last few years financial integration and liberalization in Europe have given a strong impetus to cross-border deposits (henceforth CBDs), i.e. bank liabilities which involve foreign currencies, non-resident holders or intermediaries domiciled abroad. An important consequence of the growth of these international banking flows is the prospective loss of significance of national monetary aggregates, since these currently include only the liquid assets held by residents in home sited intermediaries.

The 1990 ex-ante procedures of monetary policy coordination within stage one of Economic and Monetary Union (EMU), based on the announcement of growth targets for broad monetary aggregates, have marked the beginning of the transition towards a single monetary policy for the area. The Committee of Governors of the EEC Central Banks has stressed that differences in the definitions of broad national monetary aggregates need to be progressively removed in order to improve the coordination exercise. The Committee has also concluded that, for the time being, CBDs should not be included in the harmonized aggregates but in an extended measure playing the role of auxiliary aggregate. In

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1. The authors wish to thank F. Papadia, L. Bini Smaghi, E. Gaiotti, C. Monticelli, G. Parigi and S. Siviero for their precious comments and suggestions; G. Gomel, J.C. Martinez Oliva, R. Rinaldi and other colleagues of the Research Department of Banca d'Italia for useful exchanges of views; M.A. Antonicelli, S. Matteucci and A. Toscanelli for valuable editorial assistance. The authors remain the sole responsible for the opinions expressed and the errors. Although the paper is fruit of a joint effort, P. Giucca is responsible for Sections 1.2, 3, 4.2, 5.1, 5.2 and Appendix A; A. Levy for Sections 1.1, 2, 4.1, 5.3, 5.4 and Appendix B.

perspective, the explicit inclusion of these cross-border holdings in national definitions represents a prerequisite for the determination of the overall money stock of the area without omissions or double-counting.

For the sake of international consistency it could become necessary to choose a definition of money based on one of three alternative criteria: the residence of the holder, the residence of the issuing intermediary and the currency of denomination.

In order to assess the size of CBDs and analyze their pattern in the last decade, a major effort has been made in this paper to classify the different categories of CBDs and construct the related statistical series for the countries participating in the exchange rate mechanism (ERM).

Section 1 offers a brief overview of the evolution of monetary targeting procedures in the EEC countries and the problems relating to the definition and the choice of monetary aggregates in stage one of EMU. In Section 2 a taxonomy of CBDs is proposed and their evolution and magnitude are compared across countries. For Germany, France and Italy we then construct and analyze three hypothetical national monetary aggregates based on the three aforementioned criteria that include CBDs, currently excluded from monetary definitions in most countries (Section 3). In Section 4 we estimate the aggregate money supply in the group of countries adhering to the narrow ERM fluctuation band. For this purpose we have constructed four alternative measures of the area-wide money stock, on the basis of national monetary aggregates and of the three "extended" definitions mentioned above. Lastly, in Section 5 we develop an empirical comparison over the last decade, for Germany and France, between traditional and hypothetical "extended" monetary aggregates from the standpoint of their relationship with nominal income. Appendix A presents a description of the data

used, while Appendix B reports some stationarity tests.

## 1 - The role of monetary aggregates in the coordination of monetary policies in stage one of EMU

### 1.1 What role for money?

Beginning in the second half of the seventies, the seven leading industrial countries separately adopted the practice of announcing their targets for monetary growth, albeit in different periods and in varying ways.[2]

Through the early eighties compliance with targets was quite stringent, primarily in order to reduce countries' high inflation rates. Since then their application has become more flexible; the authorities of some countries now refer to non-binding forecasts for monetary growth and in some cases targeting has been substantially abandoned.

Despite the growing difficulty of interpreting the aggregates, the authorities in the main industrial countries appear to intend to continue formulating and announcing monetary growth targets in the nineties. Moreover, in the EEC, the setting of targets is viewed as the linchpin for

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2. The other countries did not follow suit, except Australia and Switzerland: for most of them (Belgium, Austria, Ireland, Denmark) the policy of maintaining a fixed exchange rate vis-à-vis a strong currency was inconsistent with control over the money stock; moreover, evidence of the instability of the demand for money made monetary targeting inappropriate (see Argy et al. (1990)). For an international survey of monetary targeting, see Foot (1981), Goodhart (1989), Johnson (1983), OECD (1979), OECD (1989), Summer (1980), Isard and Rojas-Suarez (1985).

implementing and monitoring monetary policies in stage one of EMU, underlining the determination to stabilize inflationary expectations and keep monetary expansion in the medium term consistent with price stability, which is the primary objective of coordinating monetary policy.[3]

Along the lines proposed by the Committee of Governors of the EEC Central Banks, coordination will be based on a set of commonly agreed and internationally consistent key variables referring to final objectives, both nominal and real, intermediate targets and monetary policy indicators. In Autumn 1990 a preliminary ex-ante exercise of monetary policy coordination started with the evaluation of the intermediate objectives for 1991 proposed by each country on the basis of broad and sufficiently homogeneous aggregates.[4] The Committee also stressed that the

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3. See the Committee for the Study of Economic and Monetary Union (1989). This principle is also made explicit in Article 3.3 of the Decision (90/142/EEC) on the cooperation between EEC central banks, which have agreed that the tasks of the Commission shall be "to promote the coordination of the monetary policies of the Member States with the aim of achieving price stability as a necessary condition for the functioning of the European Monetary System and the realization of its monetary stability". Price stability is also the primary objective of the future European System of Central Banks and European Central Bank, as laid down in Article 2 of the Draft Statute: "The primary objective of the System shall be to maintain price stability" (Art. 2.1) and "Without prejudice to the objective of price stability, the System shall support the general economic policy of the Community" (Art. 2.2); see Committee of Governors (1990).

4. A similar aggregate is already used as an intermediate objective in three of the major countries participating in the ERM. The openness of the economy and the exchange rate constraint do not allow the smaller countries participating in the ERM to control broad monetary aggregates in the short run through interest rates changes, whose sole purpose is exchange rate stabilization. However, the Report underlined that such monetary aggregates are useful as monetary policy

methodological differences in the definition of national monetary aggregates, mainly reflecting the heterogeneity of financial structures as well as the different criteria for assigning the financial instruments to the aggregates, must be steadily removed with a view to improving the coordination exercise. Recommendations in this direction and a number of operative proposals have been put forward by the Economic Unit of the Committee of Governors.[5]

This paper analyzes the problem of the choice of monetary aggregates with regard to their role of information variables concerning final economic objectives, for which no other reliable and timely indicators are available, rather than their role of intermediate objectives in the strict sense of the word, as proposed by Friedman (1990). This choice reflects the eclectic approach that has prevailed in most industrial countries in recent years owing to financial innovation and the increasing importance attributed to exchange rate stability.

Growing financial integration and the associated increasing substitutability between alternative assets in the EEC countries, could produce higher volatility in aggregates, possibly affecting their usefulness as monetary policy indicators. For this reason, in the revision of national monetary definitions, attention has also been called to the need to supplement monetary targets with forecasts of cross-border flows in order to ensure the international consistency of aggregates.

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indicators; their growth should be monitored with a view to determining the overall monetary stance of the Community.

5. To this end, the monetary aggregates have been revised in Italy (see Banca d'Italia (1991)), Spain, the United Kingdom and France.

Cross-border flows are monetary assets (or liabilities) involving foreign currencies, non-resident holders or intermediaries domiciled abroad, and they are generally excluded (in full or in part) from the aggregates now in use. The inclusion of these deposits in the definition of the money supply will prevent some of the items from being double-counted or excluded when the national aggregates are added up and is thus a prerequisite for determining the total money stock of the area. The stock of cross-border assets is still small for most countries, but it is expected to grow as a result of the liberalization of capital flows and the process of financial integration.[6]

Finally, this paper will not deal with the problem of control of monetary aggregates related to the conflict that may emerge in a system of virtually fixed exchange rates, such as that prevailing in the EEC. As stressed in a recent work,[7] the consistency of the targeting procedure in such a context is preserved only if monetary control is exercised exclusively over the domestic component of money creation.

## 1.2 What concept of money?

In order to achieve Community-wide consistency of national monetary aggregates, all the countries will have to refer to the same definition, based on one of the following

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6. For an analysis of currency substitution in Europe and its implications for monetary policy, see Bini Smaghi and Vori (1990).

7. See Angeloni and Giucca (1991).

three criteria,[8] which take account of cross-border monetary holdings:

a) residents' and non-residents' worldwide holdings in national currency;

b) residents' worldwide holdings of liquid assets in any currency;

c) liquid assets held by residents and non-residents with domestic-sited banks in any currency.

Table 1

| Holders / Currency | Deposits held by non-bank private sector | | | |
|---|---|---|---|---|
| | RESIDENTS with domestic banks | RESIDENTS with foreign-sited banks | NON-RESIDENTS with domestic banks | NON-RESIDENTS with foreign-sited banks |
| National | 1 | 2 | 3 | 4 |
| Foreign | 5 | 6 | 7 | 8 |

Table 1 encompasses all the possible categories of deposit according to the currency of denomination (domestic/foreign), the holder's residence (resident/non-resident) and the location of the bank (domestic-sited/foreign-sited).[9]

8. See Sannucci (1985) and Goodhart (1990).

9. Since it is not possible to ascertain with sufficient accuracy who actually holds currency in circulation, the item is customarily assumed to be held only by residents.

The definition of money based on the currency of denomination (resulting from the sum of cells 1, 2, 3, and 4) is of greater significance in terms of potential pressure on the exchange rate; the second definition, based on the residence of the holder (cells 1, 2, 5 and 6), primarily expresses residents' spending capacity, while the third, based on the bank's location (cells 1, 3, 5 and 7), chiefly relates to the expansion of bank credit.

In monetary theory it is customary to assume the "national specificity" of money, which means that in most models residents of a country are assumed to hold (and use) only the currency issued by domestic banks. This is true in particular for the EEC countries (essentially for statistical reasons), where national aggregates generally include monetary assets in any currency held by residents with domestic-sited banks (i.e. components of cells 1 and 2 of Table 1).

Conversely, deposits held by non-bank residents with foreign-sited banks in domestic currency (cell 2) and in foreign currency (cell 6) are excluded from the monetary aggregates currently in use. The only exception is Germany, where these deposits are partly included in the broader definition "M3 extended"[10] in view of their growing importance in recent years, especially in the case of those denominated in Deutsche marks.

Given the need to consider "horizontally" extended

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10. "M3 extended" comprises all the items included in traditional M3 as well as deposits held by residents with foreign-sited branches of German banks (that is, a subgroup of cells 2 and 6) denominated in both Deutsche Marks and other currencies, and short-term securities issued by banks.

aggregates for the sake of area-wide consistency, the question is which of the three criteria is capable of ensuring a reasonably stable relationship with final objectives, particularly with the price level via its relationship with nominal output growth. An important question concerns the function CBDs perform for the holders: whether, that is, they are primarily transaction balances (with a relatively stable velocity) or saving instruments. In any case, the need to avoid leakage or double-counting effects arises if monetary policy is to be consistent throughout the area. Although the problem of currency substitution has been dealt with in large number of studies and, more recently, the debate has focused on the EEC countries' measures for the liberalization of capital flows, empirical evaluations have been rare, particularly as regards the EEC countries where capital flows were subject to administrative restrictions until recently. However, in both the international fora and the most recent studies on this subject[11] a consensus is emerging that currency substitution is bound to have important implications for the conduct of monetary policy as a result of the short-term instability in the demand for money that could arise from the freedom to hold foreign currency monetary stocks for international transactions. The implications could be appreciable, even if, as Goodhart (1990) claims, such holdings basically comprise savings, with a significant financial component, owing to the effects on the composition of broad monetary aggregates (M2 or M3).[12]

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11. See BIS (1990), Bini Smaghi and Vori (1990) and Monticelli, Papi and Vaciago (1990).

12. As Goodhart (1990) points out, most Eurodeposits -- held by residents in foreign currency and by non-residents in national currency -- are held in the form of time deposits and certificates of deposit that are generally included in the definition of broad aggregates.

As regards the choice of the most significant concept of money, it has recently been argued that aggregates defined "by domestic-sited banks" and "by currency" are not relevant. Concerning the classification by home banks, it has been noted[13] that while this option is statistically the easiest to pursue, it is the least significant from an economic viewpoint, particularly for countries, such as the United Kingdom, with off-shore financial centres in which non-residents' deposits with home banks in domestic and foreign currency (cells 3 and 7) may actually be larger than those of residents. With respect to the classification based on the currency denomination, it has been pointed out[14] that in a fixed exchange rate regime the significance of this criterion should rapidly diminish. As a consequence, the EEC central banks appear to be oriented in favour of adopting the definition of money based on the concept of the residence of the holder.

Each criterion actually gives a different measure of the global money stock of the area, due to the different treatment of transactions with EEC non-residents and of non-EEC currencies.

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13. See Goodhart (1990).

14. See Angeloni et al. (1990).

## 2 - The evolution of "cross-border" deposits in the countries participating in the EMS exchange rate mechanism

In order to assess CBDs and analyze their development, we have constructed time series for the different kinds of asset, as defined in cells 2 to 7 of Table 1, held by non-bank agents with BIS-reporting banks; the data used in this and in the following Sections are described in Appendix A.[15] The analysis concerns the countries participating in the ERM, except for Spain, Ireland and Denmark.[16]

Table 2 shows a strong and widespread growth of cross-border holdings between 1977[17] and 1990. Over the period the total amount of such deposits, aggregated by the three criteria mentioned above, increased more than thirteen-fold on average[18] for the countries as a group, excluding the United Kingdom.

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15. Reporting banks belong to the following countries: Austria, Belgium, Luxembourg, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, Canada, Japan, the United Kingdom, and the United States.

16. For these countries data are not available on all the items considered.

17. This is the first year for which data are available for all cells and all countries, except for the United Kingdom; for the UK the series relating to sterling deposits held with home banks or by non-residents (cell 3) and in foreign currency (cell 7) and by non-residents in foreign currency (cell 5) are available only from 1983 onwards.

18. The overall amount of deposits rose from 24.6 to 295.6 billion dollars in terms of the currency denomination criterion, from 18.3 to 331.3 billion in terms of resident holders and from 38.5 to 388.5 billion in terms of home banks.

Table 2

**Deposits held by non-bank private sector**
**(end-of-period data; billions of dollars)**

| CURRENCY | | DOMESTIC | | | FOREIGN | | |
|---|---|---|---|---|---|---|---|
| | | RESIDENTS | NON-RESIDENTS | | RESIDENTS | | NON-RESIDENTS |
| COUNTRY | PERIOD | foreign sited banks [2] | domestic sited banks [3] | foreign sited banks [4] | domestic sited banks [5] | foreign sited banks [6] | domestic sited banks [7] |
| Belgium-Luxembourg | 1977 | 0.0 | - | 0.4 | - | 2.1 | - |
| | 1979 | 0.9 | - | 0.5 | - | 3.6 | - |
| | 1984 | 2.7 | - | 1.0 | - | 6.1 | - |
| | 1989 | 6.6 | - | 1.6 | - | 17.4 | - |
| | 1990 | 9.3 | - | 2.5 | - | 23.8 | - |
| Belgium | 1977 | - | 1.5 | - | 1.5 | - | 2.4 |
| | 1979 | - | 2.1 | - | 2.0 | - | 4.4 |
| | 1984 | - | 1.6 | - | 2.5 | - | 7.9 |
| | 1989 | - | 6.8 | - | 9.0 | - | 20.3 |
| | 1990 | - | 8.3 | - | 9.1 | - | 28.1 |
| Luxembourg | 1977 | - | 0.4 | - | 1.4 | - | 5.5 |
| | 1979 | - | 0.6 | - | 1.9 | - | 9.6 |
| | 1984 | - | 0.5 | - | 4.0 | - | 13.1 |
| | 1989 | - | 2.3 | - | 22.4 | - | 74.9 |
| | 1990 | - | 3.4 | - | 30.9 | - | 104.3 |
| France | 1977 | 0.3 | 1.9 | 0.8 | 1.2 | 2.1 | 4.3 |
| | 1979 | 0.5 | 2.8 | 1.8 | 1.8 | 3.3 | 7.5 |
| | 1984 | 0.5 | 2.1 | 2.4 | 2.9 | 6.0 | 13.5 |
| | 1989 | 4.6 | 10.7 | 10.6 | 18.1 | 13.5 | 21.3 |
| | 1990 | 13.3 | 18.0 | 15.8 | 12.3 | 17.3 | 28.9 |
| Germany | 1977 | 1.4 | 7.8 | 7.0 | 0.9 | 1.2 | 1.9 |
| | 1979 | 2.1 | 15.7 | 11.8 | 1.3 | 2.4 | 2.0 |
| | 1984 | 3.7 | 9.6 | 13.1 | 1.4 | 5.5 | 6.0 |
| | 1989 | 57.3 | 27.5 | 49.5 | 5.1 | 17.6 | 11.7 |
| | 1990 | 90.2 | 34.2 | 61.7 | 7.4 | 22.5 | 18.6 |
| Italy | 1977 | 0.0 | 0.4 | 0.1 | 0.6 | 1.8 | 0.6 |
| | 1979 | 0.1 | 0.8 | 0.4 | 1.1 | 2.6 | 0.8 |
| | 1984 | 0.1 | 0.7 | 0.9 | 1.1 | 4.0 | 1.4 |
| | 1989 | 0.8 | 2.8 | 5.2 | 3.5 | 7.2 | 6.3 |
| | 1990 | 3.4 | 2.8 | 10.4 | 4.7 | 11.0 | 8.6 |
| Netherlands | 1977 | 0.1 | 1.6 | 0.9 | 1.8 | 1.9 | 2.8 |
| | 1979 | 0.3 | 3.5 | 1.2 | 2.3 | 3.0 | 5.5 |
| | 1984 | 0.6 | 2.9 | 1.1 | 5.3 | 10.6 | 10.9 |
| | 1989 | 3.9 | 7.1 | 5.5 | 18.6 | 40.0 | 24.5 |
| | 1990 | 5.6 | 9.9 | 6.8 | 26.1 | 44.4 | 32.9 |
| United Kingdom | 1977 | 0.3 | - | 0.9 | - | 1.8 | - |
| | 1979 | 1.1 | - | 2.3 | - | 3.6 | - |
| | 1984 | 1.6 | 16.4 | 2.5 | 24.3 | 12.1 | 129.7 |
| | 1989 | 9.0 | 48.4 | 16.8 | 71.2 | 28.6 | 218.0 |
| | 1990 | 13.3 | 66.9 | 23.7 | 94.6 | 37.2 | 260.4 |

Source: Own calculations based on data from BIS, International Banking and Financial Market Developments. Square brackets indicate corresponding cells of Table 1.

The process was not uniform, however: the large increase recorded during the years 1977-79 was followed by a marked deceleration in the following five years, while in the period 1985-1990 there was a noticeable acceleration. According to the BIS (1990), the deceleration recorded in the first half of the eighties mainly reflected banks' financial disintermediation and, for some countries, problems affecting domestic banking systems. The development of CBDs was also influenced by the evolution of the exchange rate of the dollar, the currency in which statistics are denominated.

The different kinds of deposit have been expressed as percentages of countries' monetary aggregates and income for the period under review (Tables 3 and 4), in order to assess more accurately the importance of cross-border assets held by residents in the various countries and to compare their relative size.

Ratios for the different countries differ markedly, showing that there are large disparities within the EEC depending on the financial openness of the economy (which is considerable for all the Community countries except, until 1990, for France and Italy), the different compulsory reserve regimes in national banking systems, the role of some currencies as reserve currencies (chiefly the Deutsche Mark and the pound sterling) and the relative efficiency of national financial systems which influences not only the extent but also the rate of change of currency substitution.

Substitution in favour of foreign currency assets held with home banks (cell 5) appears to be particularly significant in the countries where currency deregulation has already been completed: in 1990 the ratio of such deposits to monetary aggregates and income (Tables 3 and 4) was very high

Table 3

**Deposits held by non-bank private sector**
**(in percent of national monetary aggregates (1))**

| CURRENCY / COUNTRY | PERIOD | DOMESTIC | | | FOREIGN | | |
|---|---|---|---|---|---|---|---|
| | | RESIDENTS | NON-RESIDENTS | | RESIDENTS | | NON-RESIDENTS |
| | | foreign sited banks [2] | domestic banks [3] | foreign sited banks [4] | domestic banks [5] | foreign sited banks [6] | domestic banks [7] |
| Belgium-Luxembourg | 1977 | 0.05 | - | 0.59 | - | 3.14 | - |
| | 1979 | 1.00 | - | 0.50 | - | 3.88 | - |
| | 1984 | 4.54 | - | 1.72 | - | 10.39 | - |
| | 1989 | 4.06 | - | 0.98 | - | 10.69 | - |
| | 1990 | 4.72 | - | 1.26 | - | 12.05 | - |
| Belgium | 1977 | - | 2.26 | - | 2.26 | - | 3.60 |
| | 1979 | - | 2.28 | - | 2.21 | - | 4.73 |
| | 1984 | - | 2.68 | - | 4.32 | - | 13.35 |
| | 1989 | - | 4.16 | - | 5.51 | - | 12.48 |
| | 1990 | - | 4.22 | - | 4.59 | - | 14.21 |
| Luxembourg | 1977 | - | 0.56 | - | 2.09 | - | 8.30 |
| | 1979 | - | 0.66 | - | 2.09 | - | 10.39 |
| | 1984 | - | 0.91 | - | 6.80 | - | 22.25 |
| | 1989 | - | 1.42 | - | 13.78 | - | 45.99 |
| | 1990 | - | 1.71 | - | 15.65 | - | 52.78 |
| France | 1977 | - | - | - | - | - | - |
| | 1979 | 0.10 | 0.63 | 0.41 | 0.39 | 0.73 | 1.68 |
| | 1984 | 0.14 | 0.66 | 0.74 | 0.90 | 1.86 | 4.18 |
| | 1989 | 0.58 | 1.35 | 1.33 | 2.27 | 1.70 | 2.68 |
| | 1990 | 1.36 | 1.84 | 1.62 | 1.26 | 1.77 | 2.96 |
| Germany | 1977 | 0.49 | 2.76 | 2.51 | 0.32 | 0.43 | 0.67 |
| | 1979 | 0.53 | 3.91 | 2.92 | 0.33 | 0.60 | 0.50 |
| | 1984 | 1.27 | 3.31 | 4.50 | 0.48 | 1.88 | 2.05 |
| | 1989 | 7.75 | 3.71 | 6.69 | 0.68 | 2.39 | 1.58 |
| | 1990 | 8.97 | 3.40 | 6.13 | 0.74 | 2.24 | 1.85 |
| Italy | 1977 | 0.02 | 0.20 | 0.06 | 0.30 | 0.85 | 0.27 |
| | 1979 | 0.01 | 0.23 | 0.11 | 0.32 | 0.78 | 0.23 |
| | 1984 | 0.04 | 0.25 | 0.34 | 0.42 | 1.54 | 0.55 |
| | 1989 | 0.12 | 0.44 | 0.81 | 0.56 | 1.13 | 1.00 |
| | 1990 | 0.43 | 0.35 | 1.33 | 0.60 | 1.41 | 1.10 |
| Netherlands | 1977 | 0.35 | 4.06 | 2.12 | 4.55 | 4.60 | 6.84 |
| | 1979 | 0.55 | 6.39 | 2.20 | 4.27 | 5.52 | 10.19 |
| | 1984 | 1.41 | 7.18 | 2.61 | 13.03 | 25.96 | 26.79 |
| | 1989 | 3.37 | 6.15 | 4.75 | 16.17 | 34.72 | 21.28 |
| | 1990 | 3.93 | 7.05 | 4.80 | 18.46 | 31.45 | 23.31 |
| United Kingdom | 1977 | 0.22 | - | 0.63 | - | 1.25 | - |
| | 1979 | 0.49 | - | 1.03 | - | 1.63 | - |
| | 1984 | 0.69 | 7.11 | 1.08 | 10.58 | 5.24 | 56.37 |
| | 1989 | 1.32 | 7.13 | 2.47 | 10.48 | 4.21 | 32.09 |
| | 1990 | 1.46 | 7.32 | 2.59 | 10.35 | 4.07 | 28.49 |

Source: For cross-border deposits, own calculations based on data from BIS, International Banking and Financial Market Developments. Square brackets indicate corresponding cells of Table 1.

(1) M2 for Belgium, Luxembourg, Italy and the Netherlands; M3 for Germany and France; M4 for the United Kingdom.

Table 4

**Deposits held by non-bank private sector**
**(in percent of GDP/GNP)**

| CURRENCY | | DOMESTIC | | | FOREIGN | | |
|---|---|---|---|---|---|---|---|
| | | RESIDENTS | NON-RESIDENTS | | RESIDENTS | | NON-RESIDENTS |
| COUNTRY | PERIOD | foreign sited banks [2] | domestic sited banks [3] | foreign sited banks [4] | domestic sited banks [5] | foreign sited banks [6] | domestic sited banks [7] |
| Belgium-Luxembourg | 1977 | 0.04 | - | 0.43 | - | 2.30 | - |
| | 1979 | 0.76 | - | 0.38 | - | 2.95 | - |
| | 1984 | 3.54 | - | 1.34 | - | 8.12 | - |
| | 1989 | 3.65 | - | 0.88 | - | 9.59 | - |
| | 1990 | 4.16 | - | 1.11 | - | 10.61 | - |
| Belgium | 1977 | - | 1.73 | - | 1.72 | - | 2.75 |
| | 1979 | - | 1.81 | - | 1.75 | - | 3.75 |
| | 1984 | - | 2.19 | - | 3.54 | - | 10.93 |
| | 1989 | - | 3.92 | - | 5.19 | - | 11.76 |
| | 1990 | - | 3.90 | - | 4.24 | - | 13.14 |
| Luxembourg | 1977 | - | 10.69 | - | 39.72 | - | 157.58 |
| | 1979 | - | 12.34 | - | 39.29 | - | 195.48 |
| | 1984 | - | 15.21 | - | 114.11 | - | 373.44 |
| | 1989 | - | 26.38 | - | 256.65 | - | 856.34 |
| | 1990 | - | 31.61 | - | 288.73 | - | 973.49 |
| France | 1977 | 0.06 | 0.44 | 0.20 | 0.28 | 0.48 | 1.01 |
| | 1979 | 0.07 | 0.43 | 0.28 | 0.27 | 0.50 | 1.16 |
| | 1984 | 0.10 | 0.45 | 0.51 | 0.62 | 1.28 | 2.89 |
| | 1989 | 0.42 | 0.99 | 0.97 | 1.66 | 1.24 | 1.96 |
| | 1990 | 1.04 | 1.41 | 1.23 | 0.96 | 1.35 | 2.26 |
| Germany | 1977 | 0.23 | 1.32 | 1.20 | 0.15 | 0.21 | 0.32 |
| | 1979 | 0.26 | 1.90 | 1.42 | 0.16 | 0.29 | 0.24 |
| | 1984 | 0.65 | 1.68 | 2.29 | 0.25 | 0.96 | 1.04 |
| | 1989 | 4.25 | 2.04 | 3.67 | 0.38 | 1.31 | 0.87 |
| | 1990 | 5.42 | 2.06 | 3.71 | 0.45 | 1.35 | 1.12 |
| Italy | 1977 | 0.01 | 0.16 | 0.05 | 0.24 | 0.68 | 0.22 |
| | 1979 | 0.01 | 0.18 | 0.09 | 0.25 | 0.62 | 0.18 |
| | 1984 | 0.03 | 0.17 | 0.23 | 0.28 | 1.00 | 0.37 |
| | 1989 | 0.08 | 0.29 | 0.53 | 0.36 | 0.74 | 0.65 |
| | 1990 | 0.29 | 0.24 | 0.90 | 0.41 | 0.96 | 0.75 |
| Netherlands | 1977 | 0.12 | 1.32 | 0.69 | 1.48 | 1.50 | 2.23 |
| | 1979 | 0.17 | 1.99 | 0.68 | 1.33 | 1.72 | 3.17 |
| | 1984 | 0.51 | 2.58 | 0.94 | 4.68 | 9.32 | 9.62 |
| | 1989 | 1.54 | 2.81 | 2.17 | 7.40 | 15.88 | 9.73 |
| | 1990 | 1.81 | 3.25 | 2.21 | 8.50 | 14.48 | 10.74 |
| United Kingdom | 1977 | 0.10 | - | 0.30 | - | 0.60 | - |
| | 1979 | 0.23 | - | 0.47 | - | 0.75 | - |
| | 1984 | 0.41 | 4.24 | 0.64 | 6.30 | 3.12 | 33.60 |
| | 1989 | 1.07 | 5.76 | 2.00 | 8.47 | 3.40 | 25.92 |
| | 1990 | 1.25 | 6.27 | 2.22 | 8.86 | 3.48 | 24.40 |

Sources: OECD, Main Economic Indicators and IMF, International Financial Statistics for GDP/GNP; own calculations based on data from BIS, International Banking and Financial Market Developments, for cross-border deposits. Square brackets indicate corresponding cells of Table 1.

in Luxembourg (16 and 289 per cent respectively),[19] the Netherlands (18 and 9 per cent), the United Kingdom (10 and 9 per cent) and Belgium (5 and 4 per cent). Moreover, residents' foreign currency deposits held with foreign-sited banks (cell 6) were larger in the smaller countries, such as the Netherlands[20] (where such deposits were 32 per cent of M2 and 15 per cent of income) and, to a lesser extent, Belgium and Luxembourg (12 percent of M2 and 11 percent of income), owing to the importance of foreign trade in those countries.

In the United Kingdom and Luxembourg, which are traditionally international banking centres, deposits held by non-residents with home banks in domestic currency (cell 3) and especially in foreign currency (cell 7) are very large; in 1990 the latter amounted to 260 billion dollars in the United Kingdom (29 percent of M4 and 24 percent of income) and to 104 billion dollars in Luxembourg (53.4 percent of M2 and almost ten times national income).

As regards Germany, residents' deposits with foreign sited banks (cells 2 and 6) are very large, especially those denominated in Deutsche Marks, which rose from 1.4 billion dollars in 1977 to 90 billion in 1990 (9 percent of M3 and 5 per cent of income); the parallel increase in Deutsche Mark assets held by non-residents with German banks was smaller (from 8 to 34 billion dollars) (cell 3). According to the Bundesbank,[21] these results were due in

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19. For Luxembourg we have used Belgium's M2, due to lack of national monetary statistics in the BIS Data-bank.

20. In the Netherlands these deposits have nearly doubled since the third quarter of 1988, partly as a result of the tightening of tax treatment of interest on deposits held with home banks.

21. See Deutsche Bundesbank (1989).

part to the higher interest rates earned on Deutsche Mark-denominated Eurodeposits, to which no reserve requirement is applied. Euro-Deutsche Mark deposits held by non-residents (cell 4) are also significant: their sustained growth in the period considered (from 7 billion dollars in 1977 to 62 billion in 1990, equal to 6 per cent of M3 and 4 per cent of income) mirrored the growing importance of the Deutsche Mark as a reserve currency.

In France, non-residents' holdings with home banks, especially in foreign currency (cell 7), are quite significant: in 1990 they amounted to about 29 billion dollars (equal to 3 per cent of M3 and 2 per cent of income), compared with 18 billion dollars denominated in francs (cell 3). The liberalization of capital flows in January 1990 has also stimulated the shift of deposits to the Euro-market, as a consequence of the relatively more burdensome compulsory reserve requirements for domestic banks. A marked decrease was recorded in residents' domestic and foreign currency deposits with home banks, while franc-denominated assets held by residents with foreign banks rose from 4.6 billion dollars at end-1989 to 17.4 billion in the third quarter of 1990, increasing from 0.6 to 1.9 per cent of M3 and from 0.4 to 1.4 per cent of income).[22] This trend was reversed after the reduction of reserve ratios adopted in October, with deposits declining to 13 billion dollars in the fourth quarter of 1990.

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22. In response to these portfolio shifts, in October 1990 the French monetary authorities reduced the minimum reserve ratios from 3 to 0.5 per cent on the franc-denominated assets held by residents with home banks that are included in M3-M2 (certificates of deposit, time deposits, securities, repurchase agreements and advances) and from 3 to 2 per cent on savings deposits included in M2; the 5 per cent minimum reserve ratio on sight deposits remained unchanged.

In Italy, residents' deposits in foreign currency and in lire with foreign-sited banks (cells 2 and 6) remained quite small, owing to the existence of foreign exchange controls until May 1990. The removal of exchange controls exerted upward pressures on both kinds of deposit: those denominated in domestic currency increased from less than 1 billion dollars at the end of 1989 to 3.4 billion at end-1990, while foreign currency deposits rose from 7 to 11 billion dollars in the same period.

## 3 - The evolution of "extended" monetary aggregates in Germany, France and Italy. A re-examination in the light of the process of relocation of deposits

Table 5 gives data on "extended" monetary aggregates for Germany, France and Italy, referring respectively to the residence of the holder, location of the issuer and currency of denomination. In line with the above remarks on the size of the different types of deposit, the broadest aggregate for Germany is based on national currency, while the broadest definition for France includes domestic banks' liabilities; in Italy the definition of the broadest aggregate is based on the concept of the residence of the holder. At the end of 1990 the difference between the largest "extended" aggregates and the national broad monetary aggregate amounted to 20 per cent in Germany, 5 per cent in France and 2 per cent in Italy.[23] Analysis of "extended" monetary aggregates over the last twelve years brings out the differences between the three countries and enables us to determine the long-term trends of monetary aggregate components for each.

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23. In the Netherlands the broadest aggregate exceeded the traditional aggregate by 53 per cent.

Table 5

"Extended" aggregate: total assets held by residents
(in any currency, worldwide; cells 1+2+5+6 of Table 1)

| Country | Period | "Extended" aggregate (billions of domestic currency) | of which (in %) | | | |
|---|---|---|---|---|---|---|
| | | | domestic currency | | foreign currency | |
| | | | domestic sited banks (*) | foreign sited banks | domestic sited banks | foreign sited banks |
| | | [col. a] | [col. b] | [col. c] | [col. d] | [col. e] |
| France | 1979: 12 | 1815.8 | 98.8 | 0.1 | 0.4 | 0.7 |
| | 1984: 12 | 3153.1 | 97.2 | 0.1 | 0.9 | 1.8 |
| | 1989: 12 | 4703.8 | 95.6 | 0.6 | 2.2 | 1.6 |
| | 1990: 12 | 5163.4 | 97.0 | 1.3 | 1.2 | 1.7 |
| Germany | 1979: 12 | 704.1 | 98.6 | 0.5 | 0.3 | 0.6 |
| | 1984: 12 | 944.9 | 96.5 | 1.2 | 0.5 | 1.8 |
| | 1989: 12 | 1380.8 | 90.3 | 7.0 | 0.6 | 2.0 |
| | 1990: 12 | 1497.5 | 88.7 | 9.0 | 0.7 | 2.3 |
| Italy | 1979: 12 | 274010.3 | 98.9 | 0.0 | 0.3 | 0.8 |
| | 1984: 12 | 510283.1 | 98.1 | 0.0 | 0.4 | 1.5 |
| | 1989: 12 | 814623.1 | 98.3 | 0.1 | 0.5 | 1.1 |
| | 1990: 12 | 901317.7 | 98.2 | 0.4 | 0.6 | 1.4 |

"Extended" aggregate: total assets in domestic currency
(all holders, worldwide; cells 1+2+3+4 of Table 1)

| Country | Period | "Extended" aggregate (billions of domestic currency) | of which (in %) | | | |
|---|---|---|---|---|---|---|
| | | | Residents | | Non-residents | |
| | | | domestic banks (*) | foreign sited banks | domestic banks | foreign sited banks |
| | | [col. a] | [col. b] | [col. c] | [col. d] | [col. e] |
| France | 1979: 12 | 1814.2 | 98.9 | 0.1 | 0.6 | 0.4 |
| | 1984: 12 | 3112.2 | 98.5 | 0.1 | 0.7 | 0.7 |
| | 1989: 12 | 4647.2 | 96.8 | 0.6 | 1.3 | 1.3 |
| | 1990: 12 | 5184.6 | 96.6 | 1.3 | 1.8 | 1.6 |
| Germany | 1979: 12 | 745.2 | 93.1 | 0.5 | 3.7 | 2.7 |
| | 1984: 12 | 994.9 | 91.7 | 1.2 | 3.0 | 4.1 |
| | 1989: 12 | 1475.7 | 84.6 | 6.6 | 3.1 | 5.7 |
| | 1990: 12 | 1596.0 | 83.3 | 8.4 | 3.2 | 5.8 |
| Italy | 1979: 12 | 271876.5 | 99.7 | 0.0 | 0.2 | 0.1 |
| | 1984: 12 | 503641.4 | 99.4 | 0.0 | 0.3 | 0.3 |
| | 1989: 12 | 811837.3 | 98.6 | 0.1 | 0.4 | 0.8 |
| | 1990: 12 | 898492.8 | 98.5 | 0.4 | 0.3 | 1.3 |

"Extended" aggregate: total monetary liabilities held by domestic banks
(in any currency, to all holders; cells 1+3+5+7 of Table 1)

| Country | Period | "Extended" aggregate (billions of domestic currency) | of which (in %) | | | |
|---|---|---|---|---|---|---|
| | | | Residents | | Non-residents | |
| | | | domestic currency (*) | foreign currency | domestic currency | foreign currency |
| | | [col. a] | [col. b] | [col. c] | [col. d] | [col. e] |
| France | 1979: 12 | 1842.5 | 97.4 | 0.6 | 0.4 | 1.6 |
| | 1984: 12 | 3242.3 | 94.5 | 0.6 | 0.9 | 4.0 |
| | 1989: 12 | 4787.8 | 93.9 | 1.3 | 2.2 | 2.6 |
| | 1990: 12 | 5247.2 | 95.4 | 1.8 | 1.2 | 2.8 |
| Germany | 1979: 12 | 727.0 | 95.4 | 0.3 | 3.8 | 0.5 |
| | 1984: 12 | 965.3 | 94.5 | 0.5 | 3.1 | 1.9 |
| | 1989: 12 | 1321.9 | 94.3 | 0.7 | 3.5 | 1.5 |
| | 1990: 12 | 1407.9 | 94.4 | 0.8 | 3.6 | 2.0 |
| Italy | 1979: 12 | 273011.7 | 99.2 | 0.3 | 0.2 | 0.2 |
| | 1984: 12 | 506582.0 | 98.8 | 0.4 | 0.3 | 0.6 |
| | 1989: 12 | 816816.4 | 98.0 | 0.6 | 0.4 | 1.0 |
| | 1990: 12 | 897911.9 | 98.6 | 0.6 | 0.3 | 1.1 |

(*) This column is roughly equivalent to monetary aggregates currently used, since it includes currency in circulation, net of residents' foreign currency deposits with domestic banks.

Legend: [a] shows the hypothetical extended aggregate; [b], [c], [d] and [e] give percentage breakdown. In particular, [b] gives shares of currently used aggregates (M3 for Germany and France , M2 for Italy): [c], [d] and [e] express the shares of the other itmes used for the definition of extended aggregates. [a], [b], [c], [d] and [e] correspond to cells reported in Table 1.

Source: Own calculations based on data from BIS, International Banking and Financial Market Developments.

In Germany we find that, starting from 1985, the gap between the growth rates of the aggregates "extended" to national currency and residents and the traditional aggregate widened (Figure 1).[24] This reflected (see Figure 2) the combined effects of a steep increase in Euro-Deutsche Mark deposits held by residents (from 6 billion dollars in the third quarter of 1985 to 90 at the end of 1990; cell 2) and of the increase recorded in Euro-Deutsche Mark deposits held by non-residents (from 15 to 62 billion dollars in the same period; cell 4). The aggregate extended to domestic-sited banks' liabilities, which was broader than the one extended to residents' holdings until 1985, has become the narrowest aggregate since 1986, also as a consequence of the small increase recorded in non-residents' Deutsche Mark deposits with German banks (from 10 to 34 billion Deutsche Marks; cell 3). These developments were also influenced by the application of the compulsory reserve requirement to short-term bonds issued by banks, in December 1985, as well as by the high compulsory reserve ratios set by the German monetary authorities; the ratios were raised in May 1986 and February 1987 with a view to curbing the pressure on internal liquidity. Further impulse to this relocation process was given by the introduction in January 1989 of a withholding tax on interest income, later repealed.

The traditional money gauge appears to have underestimated the growth of total liquidity in Germany. In 1988 monetary growth targets were largely overshot (by about one percentage point with respect to the 3-6 per cent target range) but in the following two years the growth of M3 (4.8

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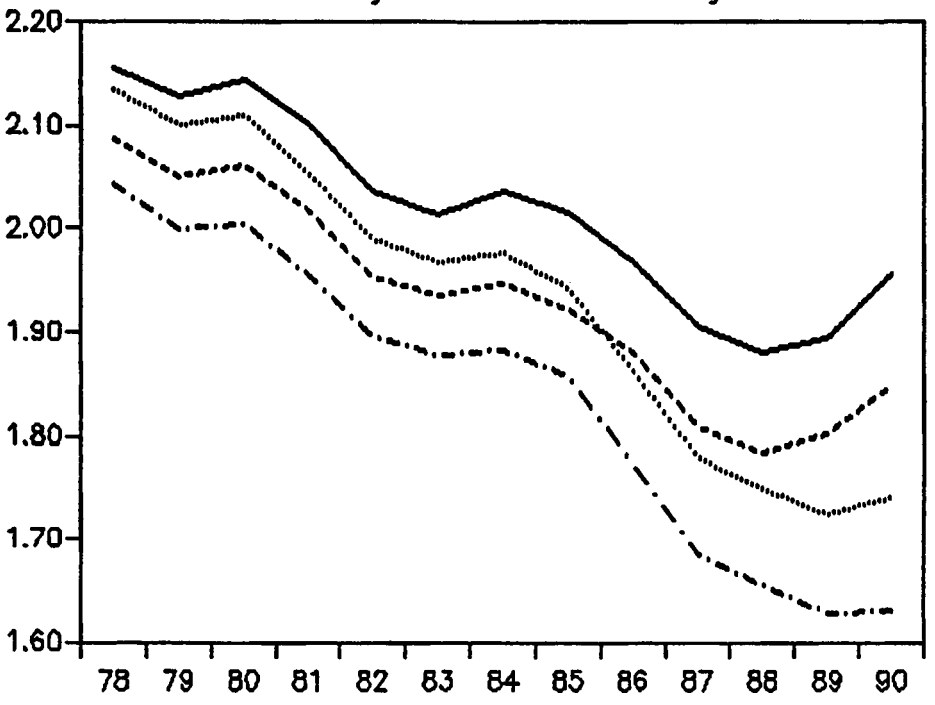
24. Until 1987 the Bundesbank targeted "central bank money", comprising currency in circulation held by the public and banks' liabilities to residents, calculated using the minimum reserve ratios set in 1974. Since 1988 M3 has been used as the target variable.

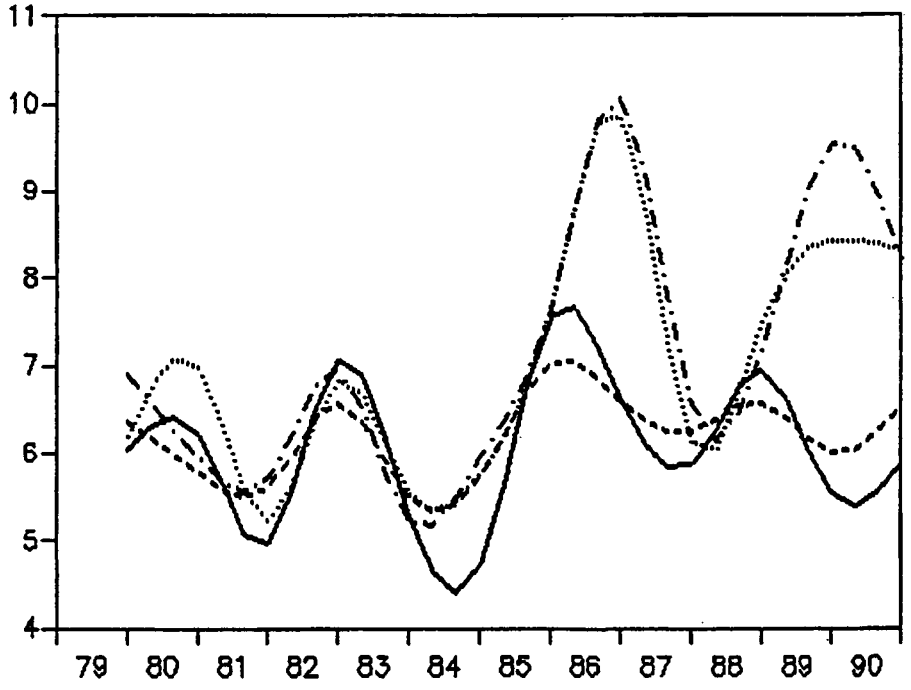
GERMANY

Figure 1

Velocity of circulation of money




Annual growth rates of money(1)



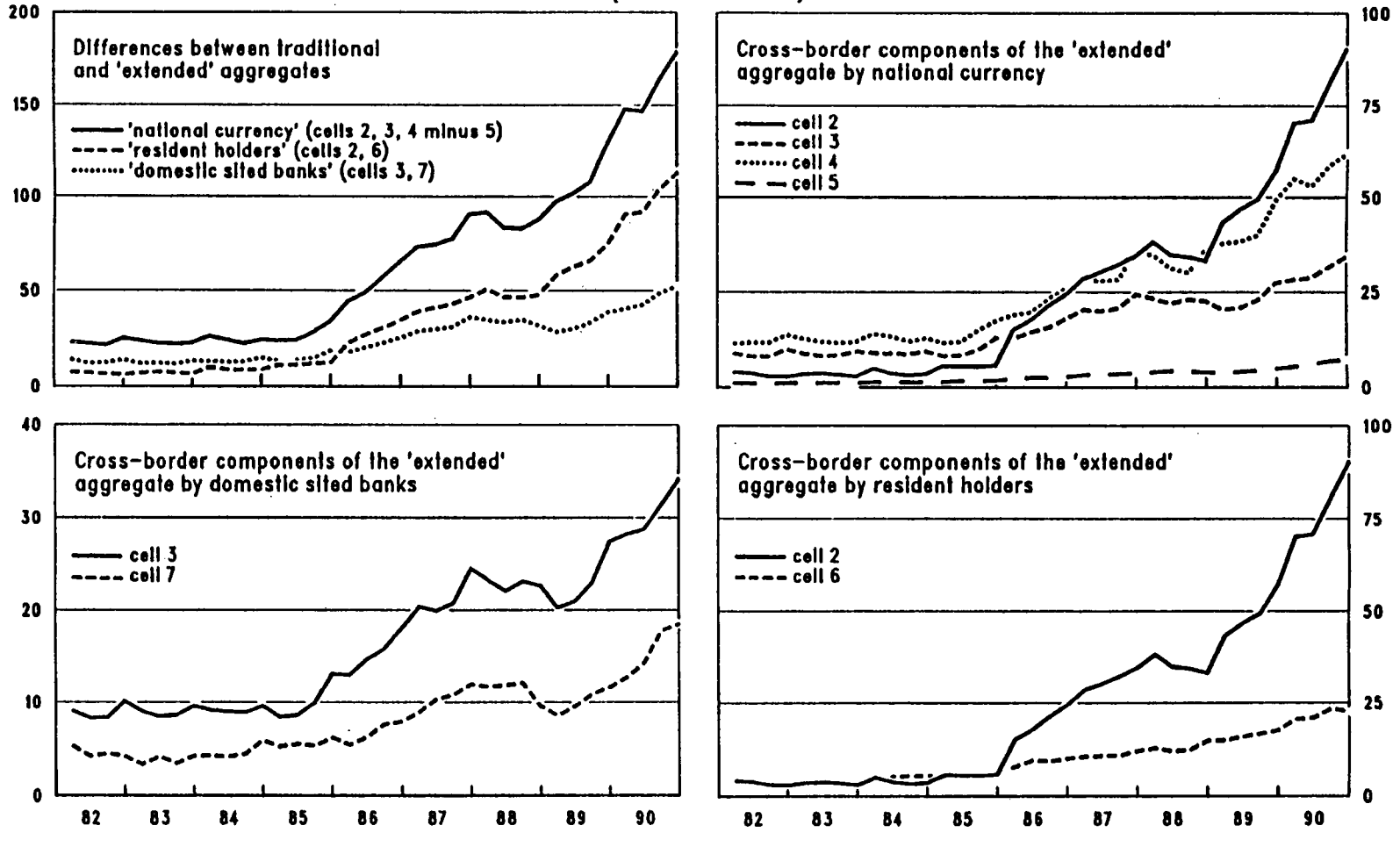

(1) Percentage changes of end-of-period money stocks.

— m3 "traditional" ····· m3 "residents" - - - m3 "domestic sited banks" -·- m3 "national currency"

Sources: own calculations based in BIS data; OECD.

GERMANY
(billions of dollars)

Figure 2




Source: own calculations based on BIS data.

and 5.6 respectively) was consistent with the targets (5 and 4-6 per cent in 1989 and 1990 respectively). As a result of the shift of deposits to the Euromarket, the aggregate "extended" to residents showed the highest growth rates (7.5, 8.4 and 7.7 in the three years), in line with the growth of "M3 extended" as calculated by the Bundesbank;[25] in the last two years the increase recorded in the aggregate "extended" to national currency was even higher (9.6 and 8.4 in 1989 and 1990 respectively).

With regard to France, graphs representing the growth of the money supply, as variously defined, are based on the new aggregate M3, which has been used as the target variable for 1991.[26] As shown in Figure 3, until the third quarter of 1989 the expansion of the "extended" aggregates was in line with that of traditional money, both as a ratio to nominal income and in annual growth; since then monetary aggregates, variously defined, have significantly diverged: the growth of M3 "extended" to national currency recorded a strong acceleration (with a three percentage point increase in the third quarter of 1990 compared with the corresponding period of 1989), while traditional M3 and the money stock defined by domestic sited banks experienced a marked deceleration (about 2 per cent) and M3 extended to residents

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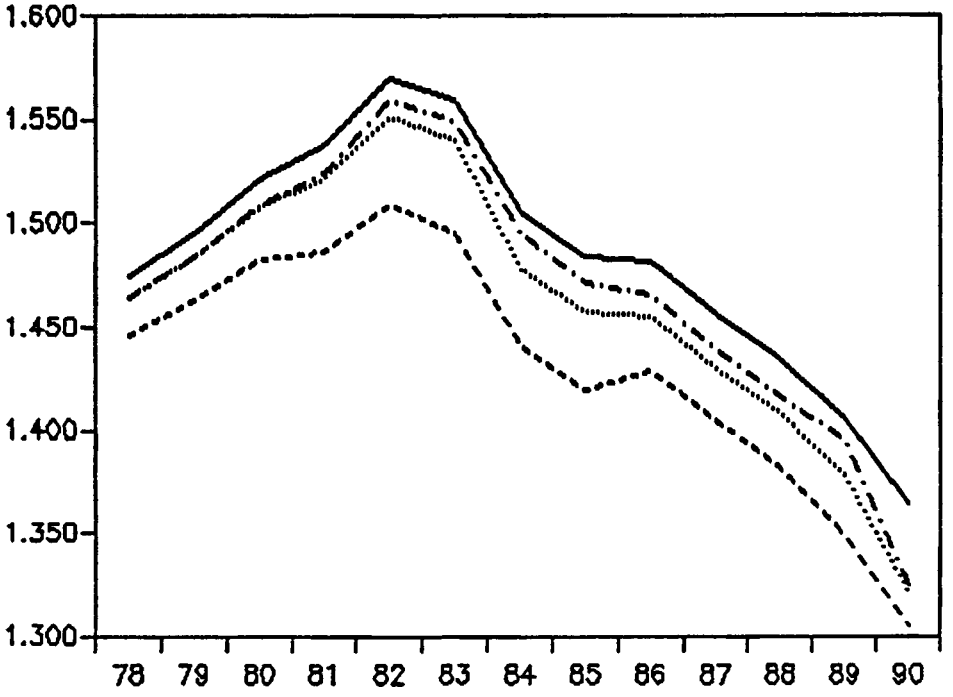
25. As explained in Section 1.2, this aggregate is a subset of the money stock "extended" to residents. From the standpoint of growth, the two aggregates have generally followed a similar course.

26. Since 1988 the French monetary authorities have targeted M2, which includes non-interest bearing transaction balances and high-liquidity deposits. The growing difficulty of interpreting this aggregate in recent years, particularly in 1990, on account of the portfolio adjustments carried out by financial operators, prompted the authorities to undertake a revision of monetary statistics in October 1990. For an analysis of this reform see Banque de France (1990) and Angeloni and Giucca (1990).

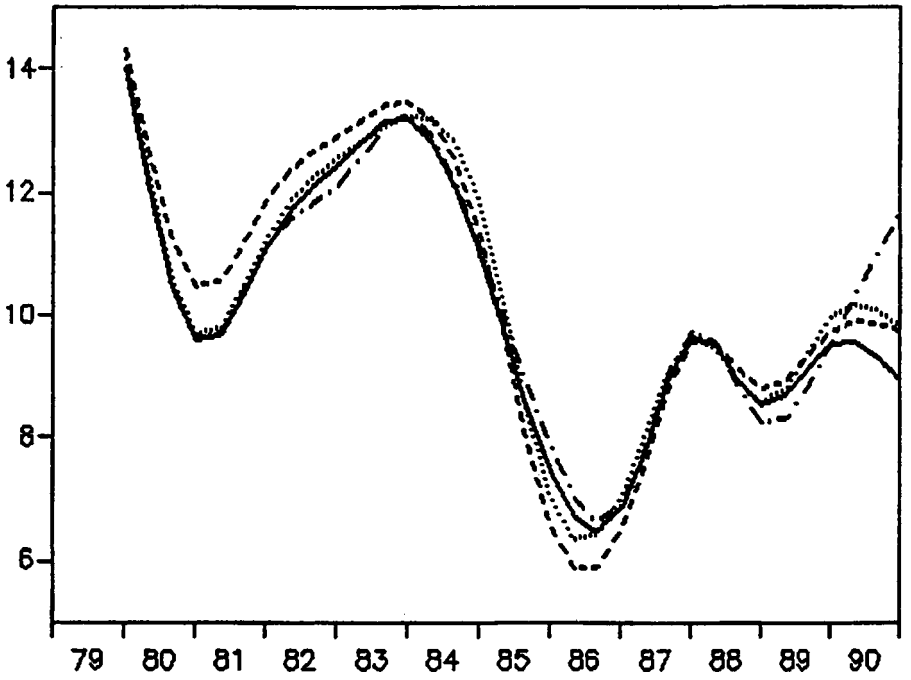
Figure 3

FRANCE

Velocity of circulation of money




Annual growth rates of money(1)




(1) Percentage changes of end-of-period money stocks.

— m3 "traditional" ····· m3 "residents" --- m3 "domestic sited banks" -·- m3 "national currency"

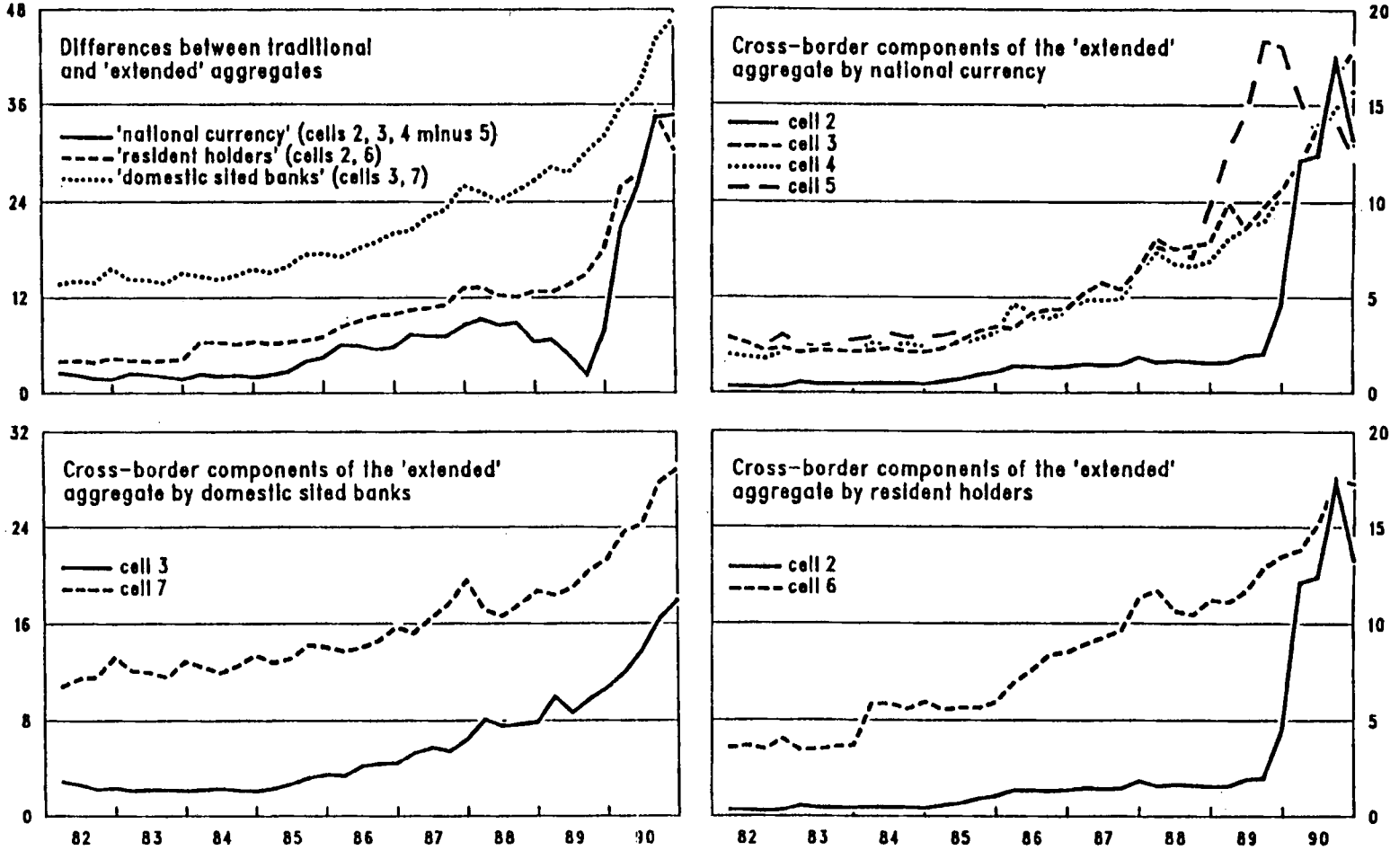
Sources: own calculations based on BIS data; OECD.

slightly declined (half a percentage point). This reflected (see Figure 4) the strong increase recorded in Euro-franc deposits held by residents (cell 2) after the liberalization of capital flows in January 1990. This contributed significantly to the growth of M3 in national currency (compared with M3 held "by residents") which was also stimulated by the steady increase in franc-denominated assets held by non-residents with both domestic and foreign banks (cells 3 and 4). Figure 4 also shows the decline of Euro-franc deposits held by residents (cell 2) in the fourth quarter of 1990, after the reduction of the minimum reserve ratios.

Finally, in Italy the similarity of the evolution of the four monetary aggregates, both in velocity of circulation and in annual growth, is even more marked than in France (see Figure 5). In the last two years the aggregates "extended" to national currency and to residents have recorded a notable increase (Figure 6), thanks chiefly to Euro-lire deposits held by non-residents (cell 4) and non-lire Eurodeposits held by residents (cell 6). The shift of deposits which followed the liberalization of capital flows in May 1990 (cell 2) was less significant than in France, due to the more recent introduction of these measures: at the end of 1990 Euro-lire deposits held by residents were equal to 0.3 per cent of income and 0.4 per cent of money as against 1 and 1.4 per cent respectively in France (see Tables 3 and 4). All these percentages are much lower than those observed in Germany (5.4 per cent of income and 9 per cent of money) where, as noted, the shift of deposits to the Euromarket began much earlier.

FRANCE
(billions of dollars)

Figure 4

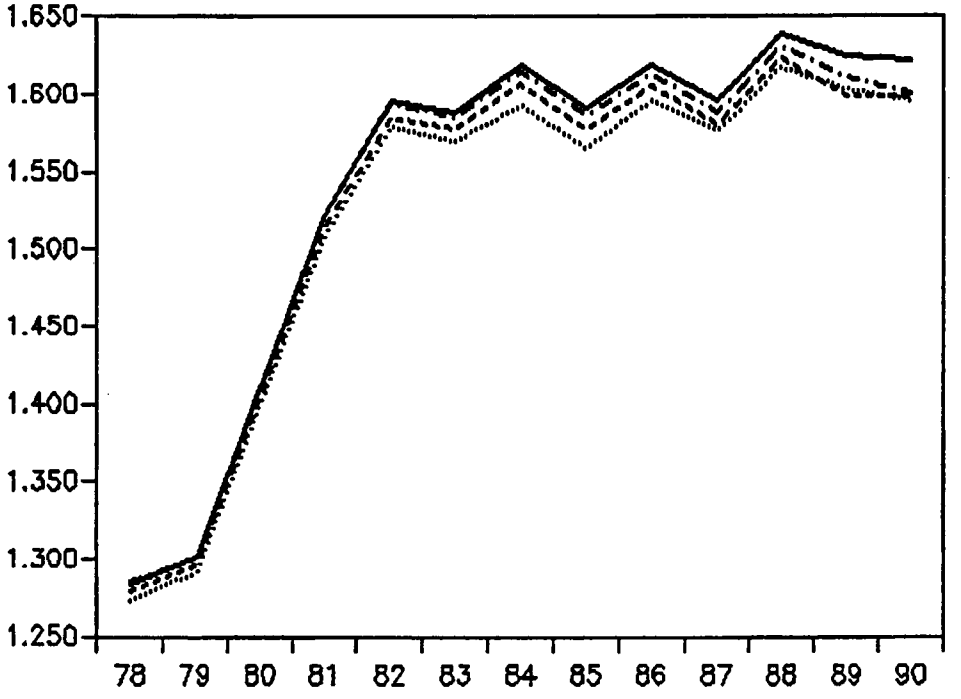



Source: own calculations based on BIS data.

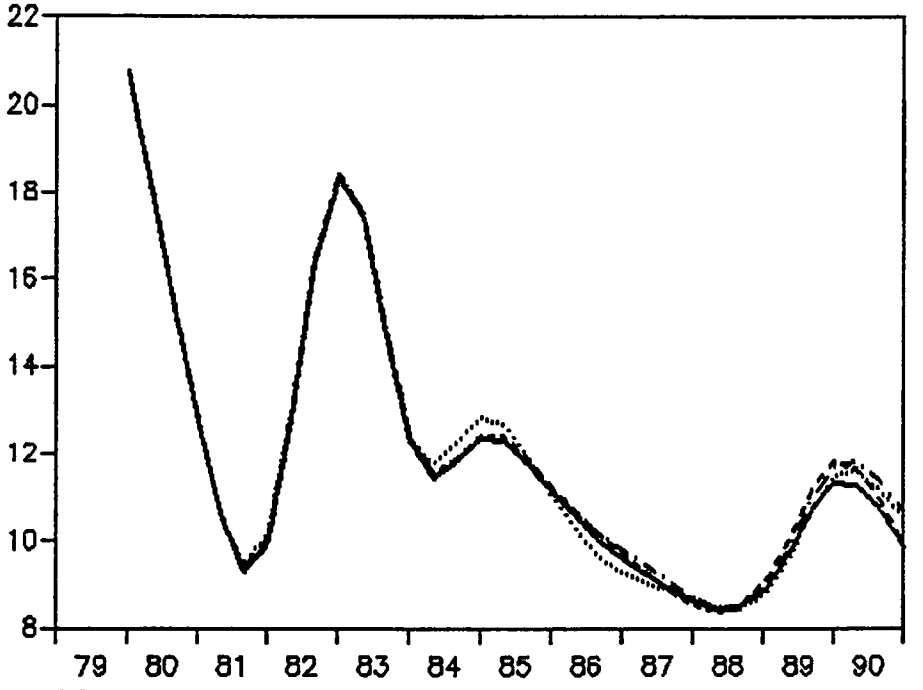
Figure 5

ITALY

Velocity of circulation of money




Annual growth rates of money(1)

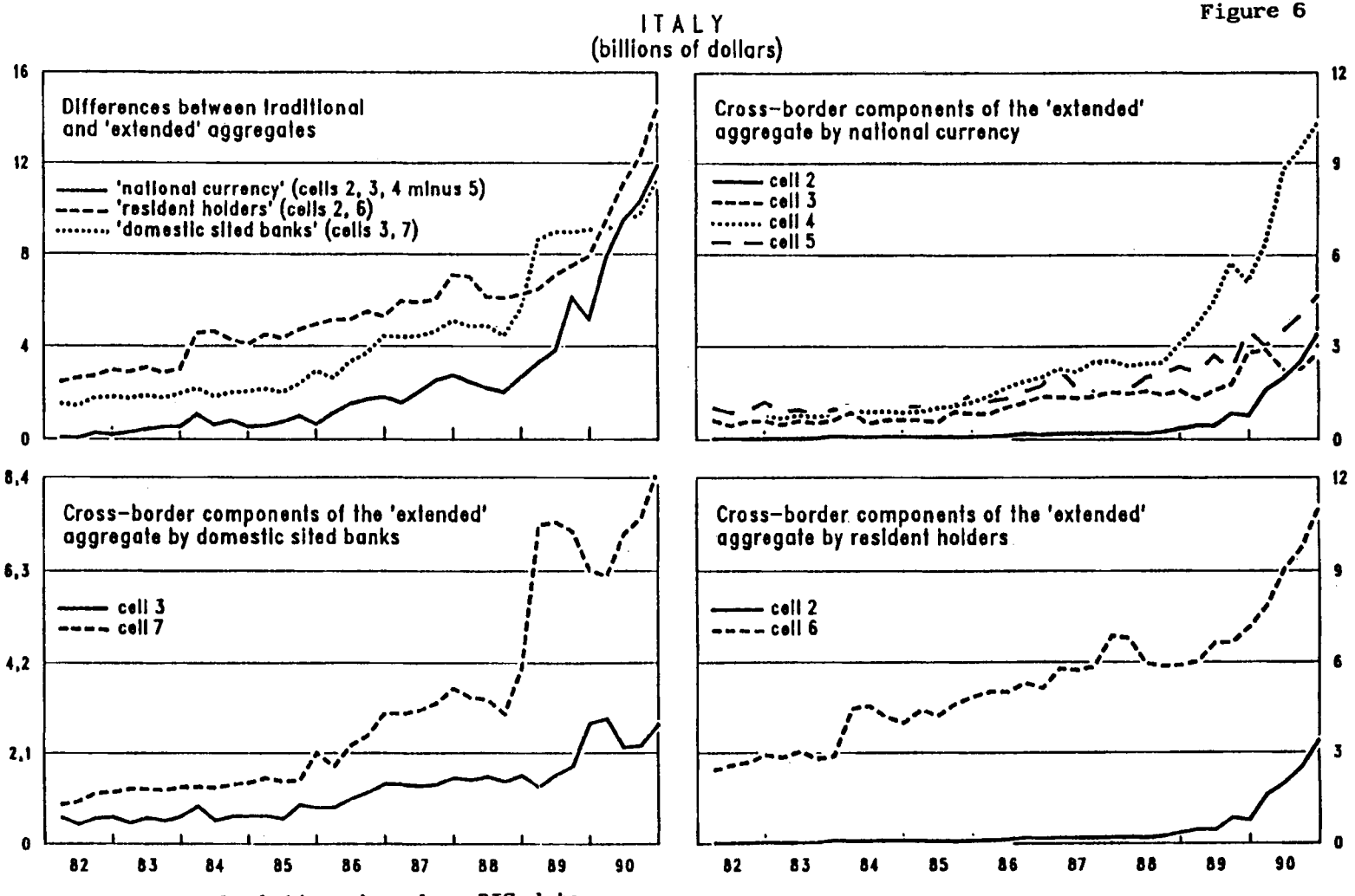



(1) Percentage changes of end-of-period money stocks.

— m2 "traditional" ····· m2 "residents" ••• m2 "domestic sited banks" -·· m2 "national currency"

Sources: own calculations based on BIS data; OECD.

Figure 6




Source: own calculations based on BIS data.

# 4 - Aggregate money supply in the countries adhering to the narrow fluctuation band of the EMS exchange rate mechanism

## 4.1 Construction of the indicators

This Section reports some preliminary estimates for the aggregate indicators of money supply in the EMS countries. To construct such indicators alternative options were evaluated concerning three main issues: a) the choice of the "reference" monetary aggregate (broad or narrow money); b) the group of countries (the EEC, the ERM countries or only the countries adhering to the narrow ERM fluctuation band); c) the formula for converting national currencies into a common currency (current exchange rates, Purchasing Power Parities or constant exchange rates).

As regards the first issue, the construction of European monetary indicators proposed so far in the literature[27] was carried out by adding up national narrow monetary aggregates, not including CBDs. This procedure does not substantially violate the principle of "international consistency" since most cross-border holdings, as already noted in Section 1.2, are in the form of financial assets, namely time deposits and CDs, which are generally included only in the broad definitions of monetary aggregates. However, this procedure for determining the total quantity of money in the area could induce important distortions in the interpretation of the resulting overall monetary stance. Such distortions may arise from both portfolio shifts produced by financial innovations and the diversification of international portfolios, of which currency substitution is

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27. See Kremers and Lane (1990), Bekx and Tullio (1989).

only one example. These views seem to be at the basis of the monetary policy coordination procedures adopted by the Committee of Governors. Following this line, we decided to construct a "European" monetary aggregate by adding CBDs, in accordance with the three internationally consistent criteria presented in Section 1, to the broad national aggregates that are already used as target variables or monetary policy indicators in the countries considered.

We then chose the group of countries adhering to the narrow ERM fluctuation band,[28] since these were considered most representative of a highly integrated area, in view of the constraints imposed on exchange rates and the almost unrestricted capital mobility. The remaining countries (Spain and the United Kingdom in the group of the ERM countries and Greece and Portugal in the EEC) were also excluded for lack of statistical information on certain kinds of CBDs.

For the conversion of monetary aggregates into a common currency, we opted for Purchasing Power Parities (PPP), a method that is widely used by both the OECD and Eurostat. This method allows correct measurement of the relative weight of each country with respect to the total aggregate and eliminates distortions produced by exchange rate developments (which would occur if conversion were based on nominal exchange rates); therefore the growth rate of the resulting aggregate indicator exactly reflects the development of individual national variables.[29]

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28. Except Luxembourg, for which monetary statistics are not available in the BIS Data-bank.

29. A recent work on the aggregate money demand in the ERM area (see Kremers and Lane (1990)) shows that PPP are preferable to fixed exchange rates; according to the authors, the choice of the latter explains the instability of parameters of the money demand estimate proposed in a previous study (see Bekx and Tullio (1989)).

The PPP methodology was also used in a recent paper by the Bank of Italy Research Department[30] dealing with the construction of an aggregate indicator of consumer inflation in the ERM area. In line with this work the conversion rates used in the present paper for determining the overall money supply and nominal income were calculated using the average PPP for the period 1986-88, in order to reduce the effects of arbitrariness in reference periods.

## 4.2 The evolution of the overall money stock

Figure 7 shows the evolution of the velocity of circulation of the area-wide "traditional" money stock for the last thirteen years, obtained by adding up broad national monetary aggregates used as intermediate objectives (or monetary policy indicators) in individual countries.[31] During the eighties there was a slight decline,[32] in line with the reduction of the aggregate short-term interest rate. This relationship, however, appears to have broken down during the last two years.

We also constructed aggregate money supply indicators based on the three criteria that ensure

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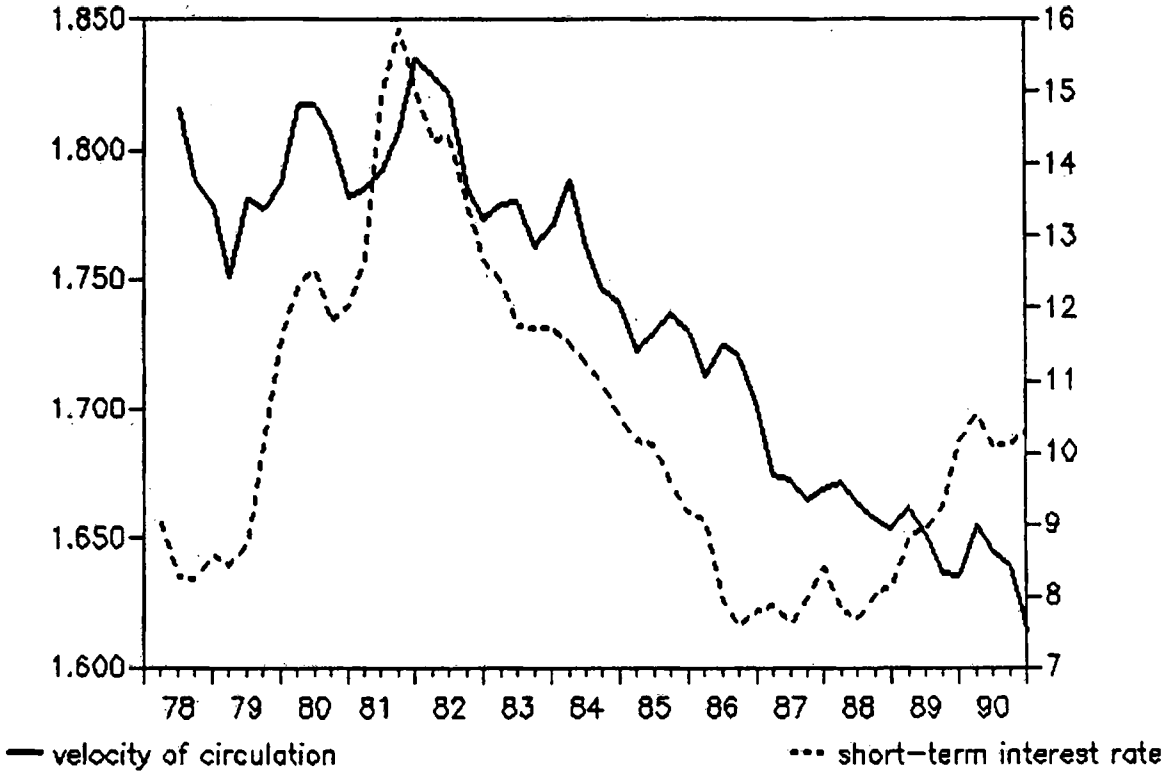
30. See Caselli et al. (1991).

31. The following monetary aggregates have been used: M2 for Italy, the Netherlands, Belgium and Denmark; M3 for Germany, France and Ireland. The aggregate indicators of income, the interest rate and the exchange rate have been obtained using the methodology proposed in Caselli et al. (1991).

32. Velocity is calculated on the basis of quarterly data on money and income; income data are expressed as annualized rates, which accounts for the small scale of data.

Figure 7

Short-term interest rate and velocity of money in the group of countries adhering to the narrow ERM fluctuation band




Sources: BIS, OECD.

consistency across the area. Since the countries considered do not form a closed economy, each criterion actually gives a different measure of the overall money stock,[33] in that: classification by currency implies that assets in EEC currencies held by non-EEC residents are included in the overall monetary aggregate; classification by issuer results in the inclusion of deposits held by non-residents with banks located in the Community (in any currency); and classification by holder involves the inclusion of deposits held by EEC residents (in any currency) with banks located outside the Community.

In terms of sheer size of the three "extended" aggregates the broadest definition is the one including domestic sited banks' liabilities, which at the end of 1990 exceeded the "traditional" aggregate by about 270 billion dollars (at PPP exchange rates), or by nearly 13 per cent; conversely, the narrowest "extended" definition is the one based on deposits held by residents. These results are in line with those reported in Section 2, concerning the total amount of each of the three classifications of CBDs (see footnote 18).

The foregoing suggests that neither the function of the currencies of the area as international reserve currencies (which has an impact on the monetary aggregate defined by currency) nor the propensity of residents to hold liquid assets with foreign banks (which influences the aggregate defined by holder) is as important as the attraction exerted by domestic-sited banks (and payments systems) on non-EEC agents (which influences the aggregate

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33. Correcting CBDs from extra-area components (holders, currencies and banks in third countries) is feasible only for a limited number of countries and with a certain degree of approximation; in the future, however, correction will become a necessary operation.

defined by issuer).[34]

The evolution of growth rates and the velocity of circulation[35] of the variously defined monetary aggregates suggest some directions for further analysis on the relationship between the aggregate money stock, as variously defined, and the global income of the area. Concerning growth rates (see Figure 8), in the period under review the expansion of the area-consistent monetary aggregates was more pronounced than that recorded by "traditional" money; the divergence appears to have widened during 1989-90. Figure 8 also shows an indicator of velocity volatility for the four definitions of money (moving coefficient of variation calculated on 8-term rolling samples). The aggregate "traditional" money stock of the area has the stablest velocity of circulation. The velocity volatility of the aggregate defined by residents was higher than that recorded by the other definitions in 1984-85 and, together with the aggregate defined by banks, in 1989-90.

## 5 - "Extended" monetary aggregates as leading indicators of nominal income: some statistical evidence for France and Germany

In order to compare the information variable properties of traditional aggregates and the alternative

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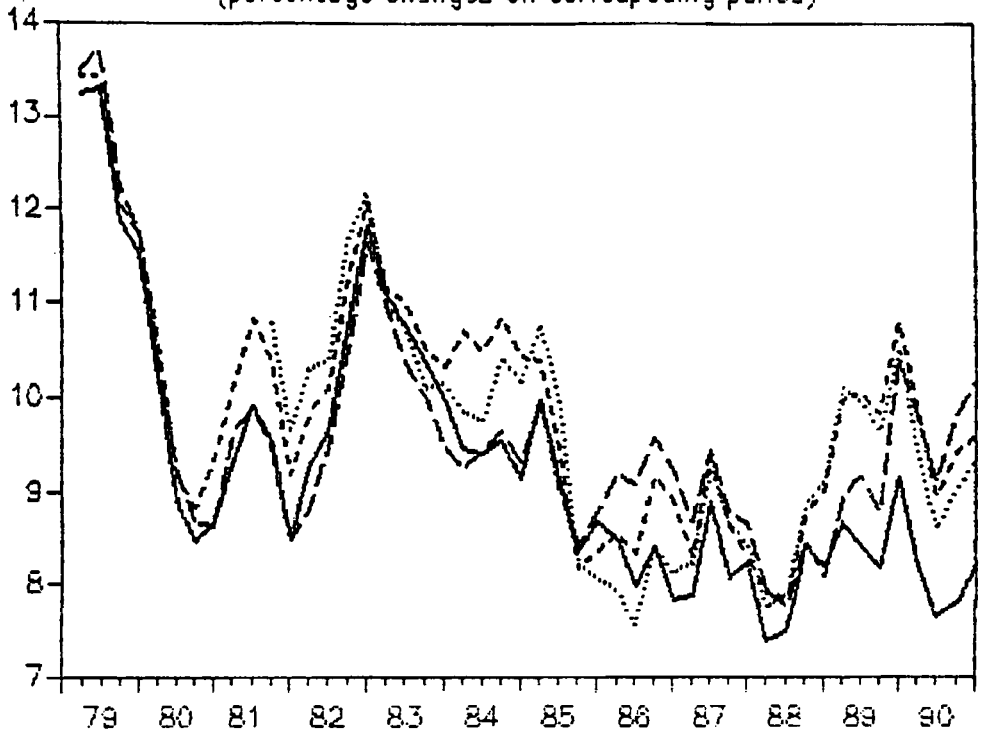
34. At the national level examples of this classification can be found in Germany, where the largest extended definition is the one based on national currency, in the United Kingdom and the Netherlands where the largest "extended" aggregates are those based on domestic sited banks' liabilities and residents' holdings, respectively.

35. The latter is not shown in the Figure.

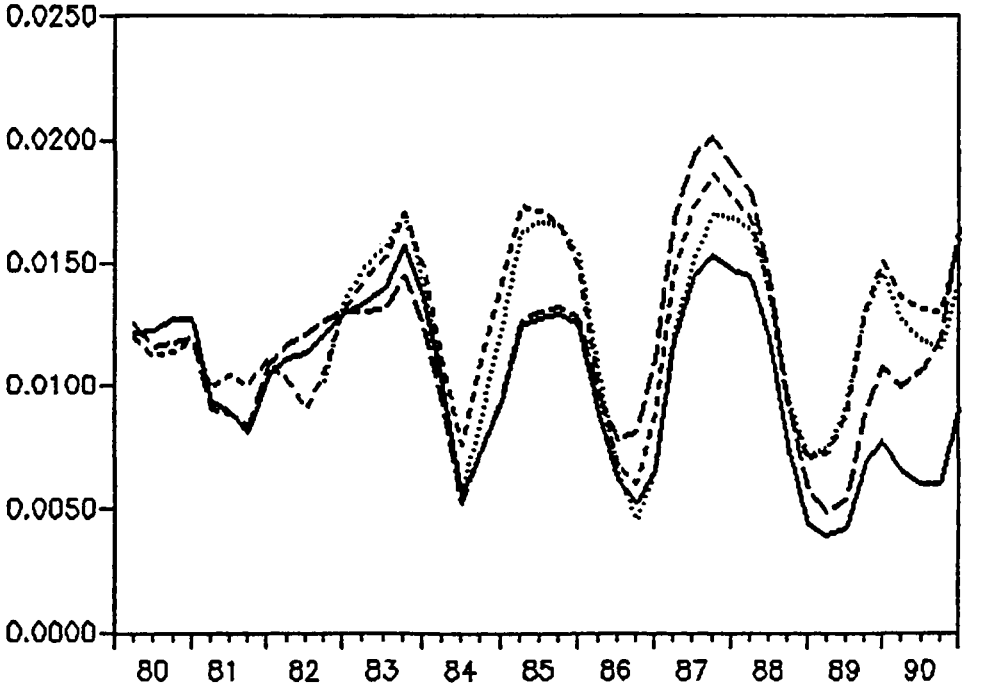
Figure 8

Monetary aggregates in the group of countries
adhering to the narrow ERM fluctuation band
(percentage changes on correspoding period)




— "traditional" -- "national currency"(*) --- "resident" ····· "domestic sited banks"
(*) Not including Denmark and Ireland

Volatility of velocity of monetary aggregates
in the countries adhering to the narrow ERM fluctuation band




— "traditional" -- "national currency"(1) --- "residents" ····· "domestic sited banks"
(1) Not including Denmark and Ireland.
Sources: own calculations based on BIS data; OECD.

"extended" definitions in relation to final objectives (namely nominal income), their leading indicator properties have been examined for Germany and France. A Vector Autoregressions (VAR) system has been estimated with nominal income, money (in the traditional and "extended" definitions) and interest rates. Within this framework, Granger causality tests -- which tell us whether or not past values of a series "help" in predicting the current values of another series -- have been run with different definitions of money, and the decomposition of the forecast error variance analyzed for the two countries' nominal income.[36]

It goes without saying that the results of this kind of analysis should be read with some care, since these are "atheoretical" and non-structural techniques[37] and the emphasis of the analysis is on the short term relationship

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36. This methodology is described in Sims (1972), Sims (1980) and Granger (1969). Recent applications to the relationship between money and income can be found in Friedman and Kuttner (1988), Blundell-Wignall, Browne and Manasse (1990), de Kock and Radecki (1990) and Rinaldi (1991). Cooley and LeRoy (1985) provide a critical evaluation of this approach.

37. As for the structural techniques, three main approaches can be distinguished in the empirical literature on the demand for money: the "partial adjustment" models (PA) proposed in the seventies, according to which a fraction of the difference between the optimal quantity of money and its actual amount is eliminated in each period; "buffer-stock" and "disequilibrium" models, based on the assumption that the quantity of money held is composed of a desired portion and an unexpected (or transitory) one, which implies that the observed quantity of money mainly reflects the supply; and "error correction" models, which take account of both the long-term relationship between the variables and their short-term behavior. The last two models responded to the need to eliminate the instability of the functions based on PA. Detailed surveys on this subject can be found in Cuthbertson (1985) and, more recently, Boughton and Tavlas (1990) and Goldfeld and Sichel (1990).

among the variables[38].

## 5.1 The VAR model specification

When constructing a VAR system some preliminary steps are necessary, in order to specify the model as correctly as possible. These include: the choice of the variables to include in the system; the stationarity analysis of the series, in order to decide whether to take the variables in levels or differences; and the selection of the number of lags of each variable.

As regards the first issue, we opted for a three-variable system (also in consideration of the small sample available, i.e. 48 observations), consisting of money (in alternative definitions), nominal income and a money market interest rate. These are the variables most often used in the empirical literature on monetary policy indicators and information variables.[39]

In order to analyse the stationarity of the series an Augmented Dickey-Fuller test was carried out, the results of which are described in Appendix B. As theory suggests and

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38. Structural techniques are employed by Angeloni, Cottarelli and Levy (1991), who compare the "information content", with respect to nominal income, of traditional and extended aggregates in the largest five EC countries. Using a multi-country simultaneous system of money demand equations they show that in the most recent period (1989-90) traditional aggregates have been dominated by alternative definitions that include CBDs, in particular those based on the residence of the holder and on the currency of denomination.

39. See for instance Friedman and Kuttner (1988) and Blundell-Wignall et al. (1990).

the results of previous works confirm,[40] the null hypothesis of non-stationarity (or unit root) could not be rejected for any of the series; the variables were therefore taken in logarithmic first differences.

With regard to the number of lags to be included for each variable, several criteria have been proposed in the literature,[41] most of which involve minimizing a function of the squared residuals with a penalty on the number of lags. Using the nominal income equation as a reference for the system, application of the Akaike and the Schwartz criteria[42] provided conflicting results (the former test suggesting a very high number of lags and the latter only one lag). We thus resorted to a more empirical method, based on the analysis of the overall "fit" of the equation: starting from a high number of lags we reduced them progressively until the coefficient of the last lag was found to be significant; in this way 4 and 3 lags were selected respectively for Germany and France.

Each variable has been regressed on its own lagged values and those of the other three variables as follows:

$$\Delta Y_t = C + \sum_{i=1}^{n} \alpha_i \Delta Y_{t-i} + \sum_{i=1}^{n} \beta_i \Delta M_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta R_{t-i}$$

$$\Delta M_t = \quad " \quad " \quad "$$

$$\Delta R_t = \quad " \quad " \quad "$$

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40. See Schmidt and Herrmann (1990) and De Bandt (1991), who conduct a cointegration analysis for Germany and France respectively.

41. For a comparison of their properties, see Lütkepohl (1985) and Kang (1989).

42. The main criteria are described in Judge et al. (1985).

where Y is the logarithm of income, M the logarithm of monetary aggregates and R is the level of the short-term interest rate;[43] n (the number of lags) is equal to 4 for Germany and 3 for France.

## 5.2 Extended aggregates and income in France and Germany

In the upper part of Table 6, the VAR equations are presented for France's money,[44] income and short-term interest rates for the period 1979-90. As the F-tests on exclusion restrictions reveal, there appears to be a uni-directional causality going from money to income, which holds for all definitions of money.

Discriminating among the latter is not easy, since for all definitions past changes of money significantly "help" to predict present changes in nominal income. The only difference between the equations is that the exclusion restrictions for M3 in the "traditional" definition and M3 based on the location of the bank are rejected at a higher significance level; these two equations also present a slightly higher coefficient of determination ($R^2_a$) and lower root-mean-square and percentage errors (RMSE).

With regard to Germany, the inspection of the VAR estimates for the period 1979-90 in the lower part of Table 6 reveals that the exclusion restrictions cannot generally be rejected outside the main diagonal, i.e. each variable is

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43. Money and income variables are seasonally adjusted.

44. The traditional aggregate used is the newly-defined M3 which is the aggregate currently targeted by the authorities.

Table 6

**Vector Autoregressions: exclusion restrictions for income, money and interest rate (1)**
**(quarterly data)**

| Dependent Variable | Independent Variables (2) | | | Diagnostics (3) | |
|---|---|---|---|---|---|
| | Y | M | R | $R^2_a$ | RMSE |
| | **France: 1979.1-1990.4** | | | | |
| a) M=M3 trad. | | | | | |
| Y | 1.16 | 2.99 (**) | 1.10 | 0.31 | 0.0078 |
| M | 1.72 | 0.55 | 1.10 | 0.08 | |
| R | 0.26 | 0.41 | 3.37 (**) | 0.08 | |
| b) M=M3 curr. | | | | | |
| Y | 2.20 | 2.49 (*) | 1.16 | 0.29 | 0.0079 |
| M | 0.62 | 0.40 | 1.56 | 0.02 | |
| R | 0.14 | 0.16 | 3.50 (**) | 0.08 | |
| c) M=M3 banks | | | | | |
| Y | 1.46 | 3.53 (**) | 1.03 | 0.33 | 0.0077 |
| M | 1.25 | 0.54 | 1.69 | 0.11 | |
| R | 0.30 | 0.62 | 3.51 (**) | 0.08 | |
| d) M=M3 res. | | | | | |
| Y | 2.04 | 2.51 (*) | 1.15 | 0.29 | 0.0079 |
| M | 1.15 | 0.24 | 1.04 | 0.03 | |
| R | 0.17 | 0.25 | 3.42 (**) | 0.08 | |
| | **Germany: 1979.1-1990.4** | | | | |
| a) M=M3 trad. | | | | | |
| Y | 3.19 (**) | 1.52 | 1.88 | 0.19 | 0.0086 |
| M | 0.31 | 1.24 | 3.05 (**) | 0.07 | |
| R | 1.06 | 0.35 | 2.22 (*) | 0.12 | |
| b) M=M3 curr. | | | | | |
| Y | 2.92 (**) | 1.14 | 1.95 | 0.16 | 0.0088 |
| M | 0.08 | 0.62 | 1.29 | -0.13 | |
| R | 0.92 | 0.17 | 2.13 (*) | 0.11 | |
| c) M=M3 banks | | | | | |
| Y | 3.22 (**) | 1.45 | 1.77 | 0.19 | 0.0086 |
| M | 0.30 | 1.07 | 2.76 (**) | 0.07 | |
| R | 1.03 | 0.28 | 2.01 | 0.12 | |
| d) M=M3 res. | | | | | |
| Y | 2.75 (**) | 0.89 | 1.78 | 0.14 | 0.0089 |
| M | 0.17 | 0.98 | 2.38 (*) | -0.02 | |
| R | 1.09 | 0.39 | 2.04 | 0.13 | |

(1) The autoregressive models include the logarithms of seasonally adjusted nominal income (Y) and money (M in all different definitions) and the level of the short-term interest rate (R). All series are expressed as first differences. The order of the VAR model is 3 for France, 4 for Germany.

(2) Figures are obtained by calculating an F test: the null hypothesis is that all the lagged values of the independent variable in question are equal to zero. The null hypothesis can be rejected at a 10 (*) and 5 per cent (**) significance level.

(3) $R^2_a$ = adjusted R-squared; RMSE = root-mean-square error; RMSPE = root mean square percent error; MPE = mean percent error.

Sources: BIS, IMF.

explained only by its own past values; short-term interest rates are an exception since they significantly "lead" changes in the money stocks. The important and, in a way, unexpected result which emerges from the estimates is that no definition of money enters significantly into the income equations, which is to say that money does not "Granger-cause" nominal income.

The contrast between this result and the commonly accepted notion that a stable demand for money (M3) exists in Germany (claimed by the authorities and confirmed by previous empirical studies[45]) led us to check the stability of the relationship between money and income by means of recursive procedures.

## 5.3 The stability of the relationship between money and income in Germany and France

The first stability analysis conducted used Granger causality tests in recursive form: F-tests were run on the significance of money in the income expression, increasing the number of observations one at a time starting from the smallest sample (1979:1-1982:3).[46]

As shown in the left panel of Figure 9, in the case of Germany the causality relationship between money and income crucially depends on the sample used; when 1990 is included in the sample period, all the definitions of money stop conveying information on the future evolution of

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45. Among the most recent works see Blundell-Wignall et al. (1990), Schmidt and Herrmann (1990).

46. This procedure is used in Blundell-Wignall, Browne and Manasse (1990).

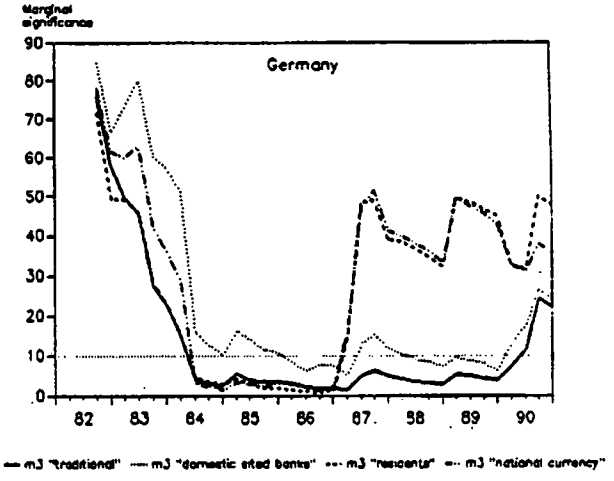
Figure 9

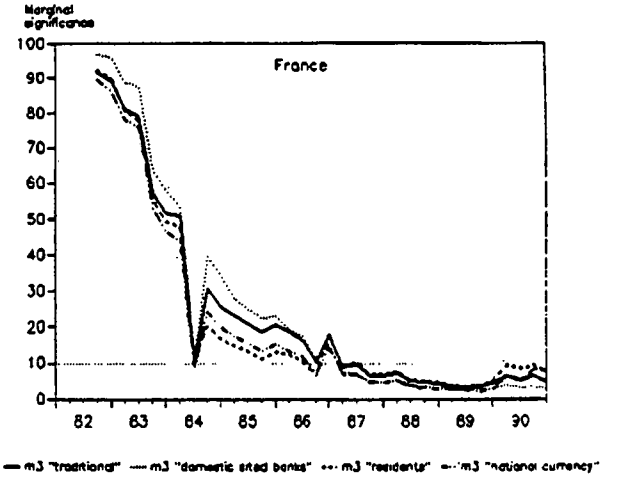
Money as a leading indicator of nominal income: recursive Granger causality tests

$$\Delta y_t = C + \sum_{i=1}^{n} \alpha_i \Delta y_{t-i} + \sum_{i=1}^{n} \beta_i \Delta m_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta R_{t-i} + \varepsilon$$

$H_o : \beta_i = 0$

(Money leads income significantly when the marginal significance of the F-test, charted here, is below 10 per cent)




Note: A recursive F test was conducted for joint significance of the money coefficients (at the 10 per cent level), starting with the minimal sample (1979:1-1982:3) and increasing the number of observations one at a time; marginal significance is the percentage of the test distribution lying to the right of the computed test statistic.

income. More specifically, Figure 9 suggests that in Germany traditional money leads income significantly for the longest period: the marginal significance is below the 10 per cent level from the beginning of 1984 to the first quarter of 1990.[47] Among the "extended" aggregates, the one defined by the residence of the bank is significant over approximately the same period (from 1984 to the end of 1989, albeit at a lower average level of significance). The "extended" measures defined by national currency and resident holders cease to be significant at the beginning of 1987.

In the case of France (right panel of Figure 9) the instability is much less pronounced and is induced by the inclusion of 1985 and 1986 in the sample period; all the money aggregates "lead" income significantly from 1987 onwards.

The pronounced instability recorded for Germany in 1986-87 and 1990 is also confirmed by an indicator of the volatility of the velocity of monetary aggregates as variously defined (see Figure 10).[48] A comparison between indicators suggests that until 1985 the velocity of traditional money moved in line with that of the other aggregates, but that in 1985-89 it was the most stable; an inverse relationship between aggregates was recorded in 1990.

There are thus two periods in which the inclusion of new observations appears to have brought about marked instability: 1986 and 1987 for the "extended" aggregates

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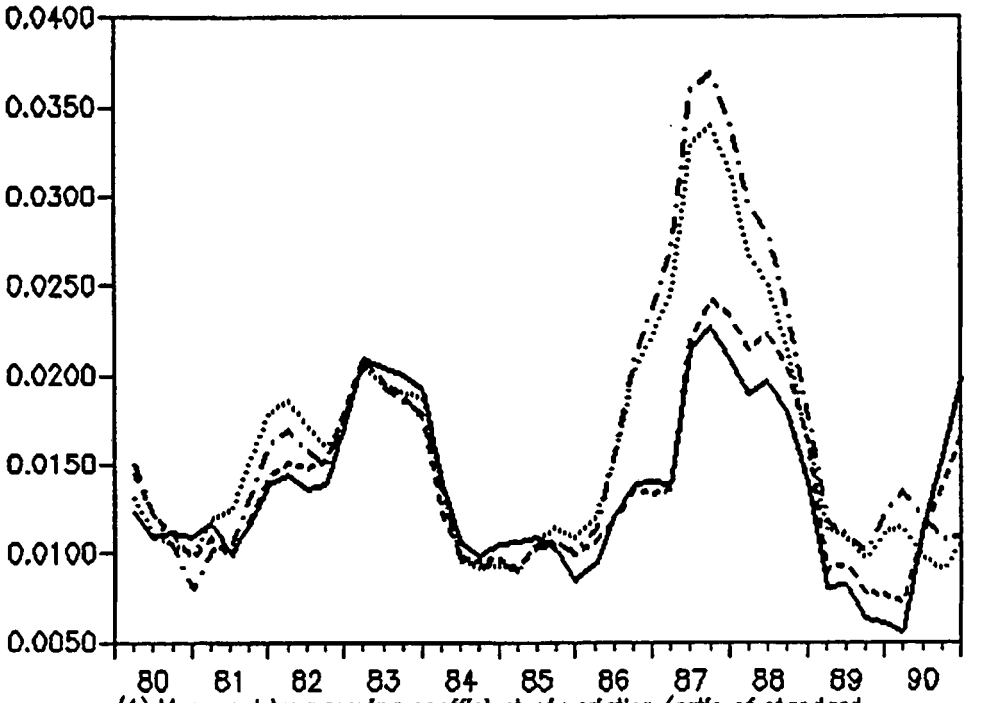
47. Here and below, the sample periods in the analysis of the significance of money all start with 1979:I and end in the quarter under consideration; in other words we always refer to the "end periods" of estimates.

48. This is a moving coefficient of variation, defined as the ratio between the standard error and the mean and calculated on a rolling sample of 8 observations.

Figure 10

VOLATILITY OF VELOCITY OF MONETARY AGGREGATES (1)

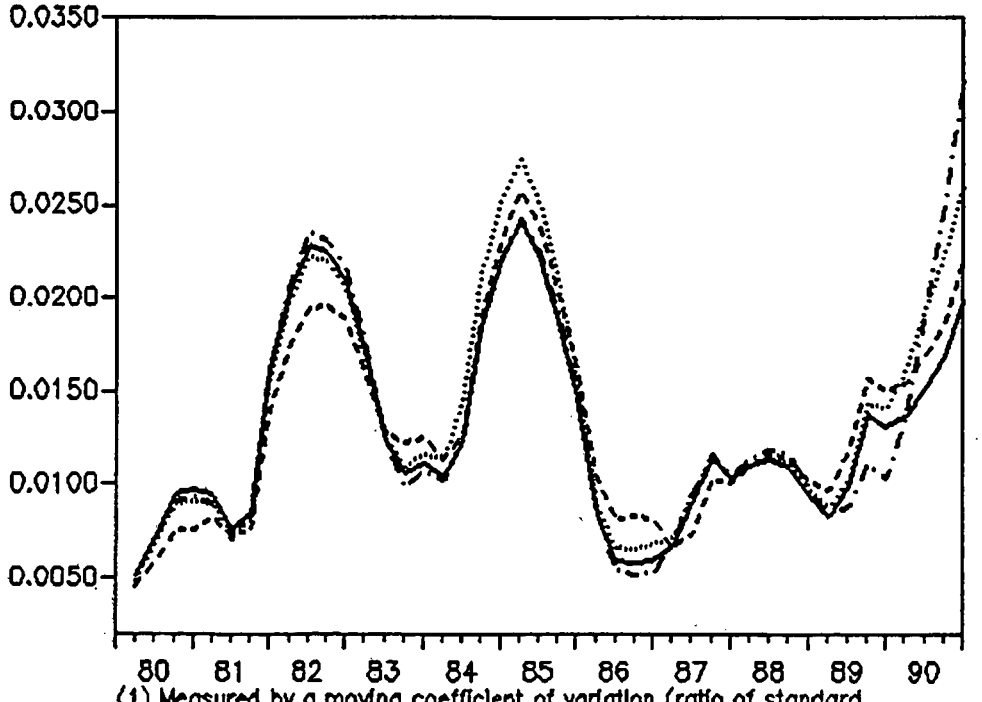
GERMANY




(1) Measured by a moving coefficient of variation (ratio of standard error over mean for a rolling sample of 8 periods), quarterly data.

— m3 "traditional" ····· m3 "residents" -·- m3 "domestic sited banks" -·- m3 "national currency"

FRANCE




(1) Measured by a moving coefficient of variation (ratio of standard error over mean for a rolling sample of 8 periods), quarterly data.

— m3 "traditional" ····· m3 "residents" -·- m3 "domestic sited banks" -·- m3 "national currency"

Sources: own calculations based on BIS data; OECD.

defined by residence and by currency and 1990 for all the definitions.

Instability in the first subperiod seems to be related to the large increase in residents' Euromark deposits, which started at the beginning of 1986 after the introduction of the reserve requirement on funds raised by banks through the issue of short-term bonds and continued through the years that followed (see Section 3); this effect appears to have altered the significance of coefficients with a lag of about one year due to the use of the recursive technique (based on a fixed starting date and a progressive increase in the number of observations).

The instability and low significance of all the monetary definitions during 1990 are probably the result of the high income growth rate, which was higher than in any year in the eighties despite the monetary restrictions adopted in 1989,[49] and the consequent slowdown in the growth of the monetary aggregates.

Figure 10 also shows that the volatility of French money velocity sharply increased on three occasions: in 1982, 1985 and 1990. In the last case the increase was more pronounced for the definitions of money based on the holders' residence and the national currency.

Keeping in mind the above-mentioned problems, the VAR system for Germany has been re-estimated over the sample ending in 1989, the last year in which any money definition is found to be significant in the income equation. Table 7 shows that nominal income is unidirectionally "caused" by

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49. During 1989 the German monetary authorities raised official interest rates in January, April, June and October.

**Vector Autoregressions: exclusion restrictions for income, money and interest rate (1)**
**(quarterly data; 1979.1-1989.4)**

| Dependent Variable | Independent Variables (2) | | | Diagnostics (3) | |
|---|---|---|---|---|---|
| | Y | M | R | $R^2_a$ | RMSE |
| a) M=M3 trad. | | | | | |
| Y | 5.26 (**) | 2.93 (**) | 2.64 (*) | 0.38 | 0.0069 |
| M | 0.46 | 1.42 | 2.96 (**) | 0.10 | |
| R | 1.02 | 0.30 | 2.19 (*) | 0.11 | |
| b) M=M3 curr. | | | | | |
| Y | 3.25 (**) | 0.98 | 2.71 (**) | 0.24 | 0.0076 |
| M | 0.14 | 0.92 | 1.31 | -0.13 | |
| R | 0.96 | 0.25 | 2.12 | 0.11 | |
| c) M=M3 banks | | | | | |
| Y | 4.82 (**) | 2.54 (*) | 2.48 (*) | 0.35 | 0.0070 |
| M | 0.16 | 1.18 | 2.42 (*) | 0.05 | |
| R | 1.01 | 0.24 | 1.95 | 0.11 | |
| d) M=M3 res. | | | | | |
| Y | 3.37 (**) | 0.95 | 2.52 (*) | 0.24 | 0.0076 |
| M | 0.27 | 1.31 | 2.37 (*) | .. | |
| R | 1.12 | 0.44 | 2.07 | 0.13 | |

(1) The autoregressive models include the logarithms of seasonally adjusted income (Y) and money (M in all different definitions) and the level of the short-term interest rate (R). All series are expressed as first differences. The order of the VAR model is 4.

(2) Figures are obtained by calculating an F test: the null hypothesis is that all the lagged values of the independent variable in question are equal to zero. The null hypothesis can be rejected at a 10 (*) and 5 per cent (**) significance level.

(3) $R^2_a$ = adjusted R-squared; RMSE = root-mean-square error; RMSPE = root mean square percent error; MPE = mean percent error.

Sources: BIS, IMF.

interest rates and, for two definitions of the "extended" aggregates, by money. Interest rates also significantly lead changes in the money stocks. The income equations show that only the traditional definition of M3 and, although at a lower significance level, the one based on the location of the intermediary "Granger-cause" nominal income. The superiority of these two definitions in terms of information variables is confirmed by the higher coefficients of determination ($R^2_a$) and the lower root-mean-square errors (RMSE).

## 5.4 The decomposition of forecast error variances

The VAR system[50] has been transformed into its moving average representation, in which each of the variables, in turn, is expressed in terms of the innovations (error terms) of all the variables of the system. By means of this representation, the forecast error variance of nominal income has been decomposed[51] in order to compare the relative contributions of alternative definitions of money (as opposed to the contributions of the interest rate and the lagged values of nominal income itself, which are not reported);[52] variance decomposition can be thought as a way of measuring the strength of Granger-causal relations.

As regards Germany, Table 8 shows that after eight

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50. With three variables: nominal income, money (in alternative definitions) and interest rates.

51. The RATS computer package was used to calculate the variance decompositions.

52. The robustness of the results was verified against different orderings of the variables, a factor to which the Choleski factorization is known to be sensitive.

**Table 8 : Forecast Error Variance Decomposition for nominal income**

| | M3 "traditional" | M3 "by banks" | M3 "by residents" | M3 "by currency" |
|---|---|---|---|---|
| **Germany** | | | | |
| Sample: 1979:1-1989:4 | | | | |
| 2 Quarters | 1.7 | 0.2 | 5.4 | 3.2 |
| 4 Quarters | 6.6 | 4.8 | 7.5 | 5.7 |
| 8 Quarters | 10.8 | 7.0 | 8.6 | 6.1 |
| Sample: 1979:1-1990:4 | | | | |
| 2 Quarters | 0.8 | 0.4 | 3.7 | 2.6 |
| 4 Quarters | 3.1 | 3.5 | 6.5 | 6.2 |
| 8 Quarters | 6.8 | 5.0 | 8.5 | 7.5 |
| **France** | | | | |
| Sample: 1979:2-1990:4 | | | | |
| 2 Quarters | 12.8 | 9.9 | 7.1 | 5.2 |
| 4 Quarters | 19.3 | 19.4 | 12.3 | 11.8 |
| 8 Quarters | 23.2 | 25.3 | 15.3 | 14.6 |

Notes: The numbers indicate the percentage of the forecast error variance of nominal income explained by each definition of money after n quarters; the procedure is based on the Choleski factorization of the variance/covariance matrix of the residuals by ordering the variables in the following way: money, income, interest rate.

quarters, over the sample period 1979-89 it is the traditional definition of money which explains the highest percentage (10.8 per cent) of the nominal income error variance; however, if the sample period is extended to 1979-90, 8.5 per cent of the error variance is accounted for by the definition of money based on the residence of the holder. Besides the sensitivity of the results to the sample period, it should be noted that the percentage contribution of money is generally very low compared with those (not reported in the Table) of lagged nominal income (on average 75 per cent after 8 quarters) and interest rates (15 per cent); this suggests a weak short-run relationship between money and income.

In the case of France, a larger share of the income error variance is accounted for by innovations in M3 as defined traditionally and based on the location of the bank, thus signalling a slight superiority of these two definitions.

In summary, from this procedure different information contents are found across definitions of money for France and Germany and an instability, for the latter country, of the relationship between money and the final variables emerges in 1990.

## Conclusions

Between 1977 and 1990 cross-border holdings of liquid assets increased markedly in every Community country considered: on average they grew by a factor greater than thirteen. There are, however, some significant differences across countries pointing to large disparities within the Community as a result of the differences in tax systems,

compulsory reserve requirements, the financial openness of the economy, the relative efficiency of national financial systems, as well as the role of some currencies as international reserve currencies. These factors have influenced not only the size but also the rate of change of currency substitution and relocation.

At the end of 1990 the largest "extended" aggregates (inclusive of national currency deposits, domestic-sited banks' liabilities and residents' holdings of liquid assets, respectively) and the aggregates presently used as target variables differed by 20 per cent in Germany, 5 per cent in France and 2 per cent in Italy (7.4, 2.7 and 1 per cent respectively in 1979); the differences are particularly large in the small countries of the Deutsche Mark area, where foreign trade has a greater incidence: in the Netherlands the "extended" aggregate defined with respect to the residence of the holder and traditional M2 differed by 54 per cent (10.3 per cent in 1979).

As regards Germany, it emerges that in recent years the "extended" aggregate inclusive of all residents' liquid assets has grown more than traditional M3, as residents have shifted deposits to the Euromarket. In France and Italy the period since the liberalization of capital flows in 1990 has seen sizeable portfolio shifts towards foreign-located intermediaries, both in domestic and foreign currency, due, among other reasons, to interest income taxation and reserve requirement disparities.

Indicators of the aggregate money supply for the group of countries adhering to the narrow ERM fluctuation band show that each of the three "extended" criteria actually gives a different measure of the global money stock of the area, due to the different treatment of transactions with non-EEC residents and of non-EEC currencies. From 1979 to

1990 the largest "extended" definition was the one including deposits with domestic-sited banks (which exceeded traditional money by about 13 per cent at the end of 1990); the narrowest aggregate was based on the residence of the holder. These results suggest that, for the area as a whole, neither the role of the currencies of the countries considered as international reserve currencies (which affects the aggregate defined by currency of denomination) nor the propensity of residents to hold deposits abroad (which affects the aggregate defined by the holder's residence) is as important as the preference of non-EEC residents for domestic-sited banks (and payments systems). As regards the evolution of the aggregates, the area-wide "extended" measures generally show higher growth rates than the aggregate traditional money stock. The indicators of velocity volatility for the four definitions of money appear to confirm that the aggregate money stock based on traditional definitions is more stable than the national "extended" measures including CBDs.

Estimates of the relationship between money definitions and nominal income provide different results for France and Germany.

In the case of France it is difficult to discriminate between traditional and "extended" definitions of money since, on the basis of Vector Auto-Regression estimates and Granger causality tests, all the definitions "help" to predict the future evolution of nominal income to roughly the same extent. This may reflect the fact that the differences between the definitions are still small, owing to the short time elapsed from the exchange rate liberalization.

As regards Germany, the above-mentioned statistical tools applied over the period 1979-1990 reveal an unstable relationship between money and nominal income. In the case of

the "extended" definitions based on the holder's residence and the currency denomination, the relationship collapses around 1986-87; in the case of traditional M3 and the definition based on bank location, it collapses when 1990 is included in the sample. When the analysis is restricted to the period 1979-1989, the traditional definition of M3 and, to a lesser extent, the one based on bank location seem superior to the others.

These results do not provide univocal indications for the prospective choice of the most relevant "extended" definition in terms of its relationship with final variables. This may be due to the intrinsic limits of the methodology adopted and to the fact that appreciable size differences between the alternative definitions have only arisen recently. Indeed, this evidence seems to justify the orientation of the EEC monetary authorities not to include CBDs for the time being in the national broad monetary aggregates, but in an extended measure with the status of an auxiliary aggregate.

## APPENDIX A
## DATA SOURCES

Cross-border deposits. Data on these deposits are provided by the Bank for International Settlements (BIS). With reference to the definitions given in Section 2 and used throughout the paper, data on cells 2, 4, 5 and 6 are available in the BIS quarterly "International Banking and Financial Developments", Statistical Annex. As regards cells 3 and 7, for which only the sum is available in this publication, the breakdown was obtained from unpublished BIS data.

Each national authority provides the BIS with the raw data on its banking system's end-of-period external (i.e. vis-à-vis non resident holders) and foreign currency positions; the instruments included are sight, time and saving deposits and CDs. The BIS combines these data to calculate the position of each reporting country vis-à-vis each of the others. These positions are calculated for both individual currencies and groups of currencies and a breakdown between bank and non-bank holders is available.

Monetary aggregates. For traditional monetary aggregates (M3 for both Germany and France), end-of-period, seasonally adjusted data were taken from the BIS Data-bank. In order to obtain the extended money definitions, the appropriate cells of cross-border deposits (seasonally adjusted with X-11) were converted into domestic currency and added/subtracted to national money stocks.

Nominal income. Seasonally adjusted nominal GNP and GDP (for Germany and France, respectively) were taken from the OECD's Main Economic Indicators.

Interest rates. For both Germany and France, 3-month interbank interest rates (period averages) were used, taken from the BIS Data-bank.

## APPENDIX B
## STATIONARITY ANALYSIS: AUGMENTED DICKEY-FULLER TESTS

In order to establish whether to difference the variables used in the VAR equations of Section 5, a stationarity analysis was carried out using unit root tests.

One of the many tests proposed by the burgeoning literature on unit roots is the Augmented Dickey-Fuller (Dickey and Fuller (1981) and Said and Dickey (1984)).

The null hypothesis of non-stationarity (or unit root) is verified by checking whether the lagged level of the variable in question enters with a significantly negative coefficient in a regression of the change of the variable on the lagged changes and the lagged level of the variable (see the footnotes to Table A.1).

There are some difficulties associated with this test. One problem, shared by most stationarity tests, is its low power in rejecting the null hypothesis when the series is generated by a process with a root smaller than, but very close to, unity. A more specific issue is related to the choice of the number of lagged dependent variables to include in the right-hand side of the equation.

In this regard, the procedure we adopted was to start with a number of lags equal to $T^{1/4}$, where T is the number of observations,[53] and increase it until the error term of the equation is found to be white noise;[54] in this way 3 lags were selected for all the equations, except for Germany's monetary aggregates, which required four lags.

In order to avoid the possibility that, regardless of the properties of the series, the presence of a

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53. See Diebold and Nerlove (1988).

54. This hypothesis is tested with a Modified Lagrange Multiplier for the first and fourth order autocorrelation.

deterministic trend biases the results of the tests towards non-stationarity, three models were estimated, with and without a time trend and a constant, starting from the more general one.

From the t-statistics and F-tests reported in Table A.1, it can be seen that the null hypothesis of a unit root can never be rejected; all the series, for both Germany and France, seem to follow either a random walk with drift or a stochastic trend, except for interest rates, which seem characterized by a pure random walk process. This evidence was confirmed when the tests were repeated on the first differences of the series, with the results indicating a clear stationarity for all of the series.

Table A.1

**Stationarity analysis: Augmented Dickey-Fuller tests**

| Variables | $T_\tau$ (1) | $T_\mu$ (2) | T (3) | $\Phi_3$ (4) | $\Phi_1$ (5) | $\Phi_2$ (6) | TREND (7) | COST (8) |
|---|---|---|---|---|---|---|---|---|
| **Germany** | | | | | | | | |
| M3 traditional | -2.8 | -0.1 | 4.0 | 3.8 | 7.9 | 8.6 | 0.1 | 4.0 |
| M3 domestic banks | -2.4 | 0.1 | 4.4 | 3.0 | 9.7 | 9.2 | 0.1 | 4.5 |
| M3 residents | -1.5 | 1.6 | 3.8 | 2.5 | 7.8 | 6.2 | 1.7 | 3.6 |
| M3 currency | -1.5 | 1.7 | 3.4 | 2.8 | 6.8 | 5.6 | 1.8 | 3.2 |
| Nominal Income | -2.2 | 0.1 | 4.0 | 2.5 | 7.8 | 7.3 | 0.2 | 4.0 |
| Interest rate | -2.2 | -2.0 | -0.1 | 2.3 | 2.1 | 1.6 | -0.1 | 0.6 |
| **France** | | | | | | | | |
| M3 traditional | -1.4 | -2.6 | 2.3 | 4.0 | 7.5 | 5.4 | -2.5 | 2.7 |
| M3 domestic banks | -1.7 | -1.9 | 2.2 | 3.1 | 5.2 | 4.3 | -1.7 | 2.5 |
| M3 residents | -1.7 | -2.0 | 2.5 | 3.0 | 6.2 | 5.0 | -1.8 | 2.8 |
| M3 currency | -1.9 | -1.3 | 2.5 | 2.5 | 4.9 | 4.5 | -1.2 | 2.8 |
| Nominal Income | -1.0 | -3.7 | 1.7 | 6.6 | 9.1 | 5.9 | -3.5 | 1.9 |
| Interest rate | -2.9 | -2.0 | -0.1 | 4.8 | 2.1 | 3.3 | -1.0 | 0.3 |

Notes: Quarterly data; all variables are seasonally adjusted and expressed in logs, except for interest rates. The estimation period is 1977.4-1990.4. The critical values for the first three statistics are tabulated in Fuller (1976), Table 8.5.2; the critical values for $\Phi_1$, $\Phi_2$ and $\Phi_3$ are tabulated in Dickey-Fuller (1981). All equations include three lags of the dependent variable $\Delta y_t$ except for Germany's money definitions which include four.

(1) Test statistic of the hypothesis that $\rho=1$ in the unconstrained model $Y_t = \alpha_0+\rho Y_{t-1}+\alpha_1\Delta y_{t-1}+\ldots+\alpha_n\Delta y_{t-n}+\beta(t-T/2)+e_t$.

(2) Test statistic of the hypothesis that $\rho=1$ in the unconstrained model $Y_t = \alpha_0+\rho Y_{t-1}+\alpha_1\Delta y_{t-1}+\ldots+\alpha_n\Delta y_{t-n}+e_t$.

(3) Test statistic of the hypothesis that $\rho=1$ in the unconstrained model $Y_t = \rho Y_{t-1}+\alpha_1\Delta y_{t-1}+\ldots+\alpha_n\Delta y_{t-n}+e_t$.

(4) Test statistic of the joint hypothesis that $\beta=0$ and $\rho=1$ in the unconstrained model as in (1).

(5) Test statistic of the joint hypothesis that $\alpha_0=0$ and $\rho=1$ in the unconstrained model as in (2).

(6) Test statistic of the joint hypothesis that $\alpha_0=\beta=0$ and $\rho=1$ in the unconstrained model as in (1).

(7) Test statistic t of the coefficient $\beta$ in the model $\Delta Y_t = \alpha_0+\beta(t-T/2)+\alpha_1\Delta y_{t-1}+\ldots+\alpha_n\Delta y_{t-n}+e_t$.

(8) Test statistic t of the coefficient $\alpha$ in the model $\Delta Y_t = \alpha_0+\alpha_1\Delta y_{t-1}+\ldots+\alpha_n\Delta y_{t-n}+e_t$.

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