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Cross-Border Deposits and Monetary Aggregates in the Transition to EMU

Prepared by Ignazio Angeloni, Carlo Cottarelli, and Aviram Levy 1/

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Abstract

This paper discusses the effect of cross-border deposits (CBDs) for the stability of the relation between monetary aggregates and nominal GDP in the five largest EC countries. The analysis is developed in terms of "information content" of alternative money definitions (including or excluding selected subsets of CBDs), derived from a multicountry simultaneous system of money demand equations. We show that in the most recent period traditional money aggregates have lost information value and that they are dominated by alternative money definitions that include CBDs, such as those based on the residency of the holder or on the currency of denomination.

JEL Classification Numbers:
E41, E52, F36

1/ This paper was prepared for the conference on "Monetary Policy in Stage Two of EMU" jointly organized by the Centre for Economic Policy Research (CEPR) and the Paolo Baffi Centre of Bocconi University and held in Milan on September 27-28, 1991. Ignazio Angeloni is Head of the Monetary Analysis Section of the Research Department of the Bank of Italy; Carlo Cottarelli is Senior Economist in the European Department of the IMF; Aviram Levy is Economist in the Research Department of the Bank of Italy. The views expressed in the paper are those of the authors and not necessarily those of the Bank of Italy or the IMF.

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I. Introduction

Along with greater integration of European capital markets, the last few years have witnessed a sharp increase of cross-border banking activities, both on the asset and on the liability sides of banks' balance sheets. By the general term of "cross-border" we mean any banking instrument (asset or liability) for which there is no coincidence between the residency of the (nonbank) holder, the currency of denomination, and the location of the bank that undertakes it. Up to only a few years ago cross-border operations were the prerogative of a few specialized money centers, such as the United Kingdom; more recently, however, the phenomenon has spread to other countries, with traditionally local and highly protected financial markets.

The international dimension of European banking has drawn stimulus from a combination of three factors: virtually complete foreign exchange liberalization by all countries participating in the EMS; exchange rate stability, that has reduced the risk of engaging in uncovered cross-currency operations; persisting inflation and nominal interest rate differentials, coupled with heterogeneity of the fiscal and regulatory environment, which created the incentive for both investors and intermediaries to find the most favorable location for their activities.

The recent growth of cross-border deposits (CBDs) in Europe is documented in Chart 1: the total gross amount, taken as a ratio of the aggregate broad money stock, after having remained nearly constant between 1984 and 1988 at about 5 percent, increased in the following two years by some 3 percentage points. As the same chart shows, the growth is entirely attributable to deposit holdings within the area itself: the net amount of CBDs has remained roughly unchanged.

The growing size of CBDs has several policy implications, that have so far received little attention in the literature. A first problem arises in the context of bank supervision. The multicountry location of deposits implies that supervisory authorities are increasingly called to exercise action to limit solvency risks ultimately borne by residents of other countries; if a lower weight is attached to these risks in the authorities' utility functions, CBDs may incite a socially undesirable laxity in supervision practices.

This paper neglects the supervisory aspects of CBDs, and focuses instead on their consequences for monetary policy. Like any form of capital mobility, CBDs contribute to promote a single European financial market and to amplify the international transmission of monetary conditions and policies. Competition among money-creating centers generates pressure towards interest rate equalization and harmonization of bank instruments and practices, within limits dictated by differences in administrative regulations, fiscal treatments, and so on. As important as they may be, these

effects need not to be discussed in the specific context of CBDs, since they are the result of capital mobility in general 1/.

A more specific consequence of CBDs for monetary policy is related to the effects exerted on monetary aggregates. Presently, money stock statistics compiled by almost all EC central banks exclude deposits held by residents in banks located in foreign countries. The recent growth of these deposits, therefore, reduces the coverage, and may ultimately undermine the significance, of the monetary aggregates as indicators of policy. As CBDs become quantitatively important, failure to account for them may result in an inflationary bias.

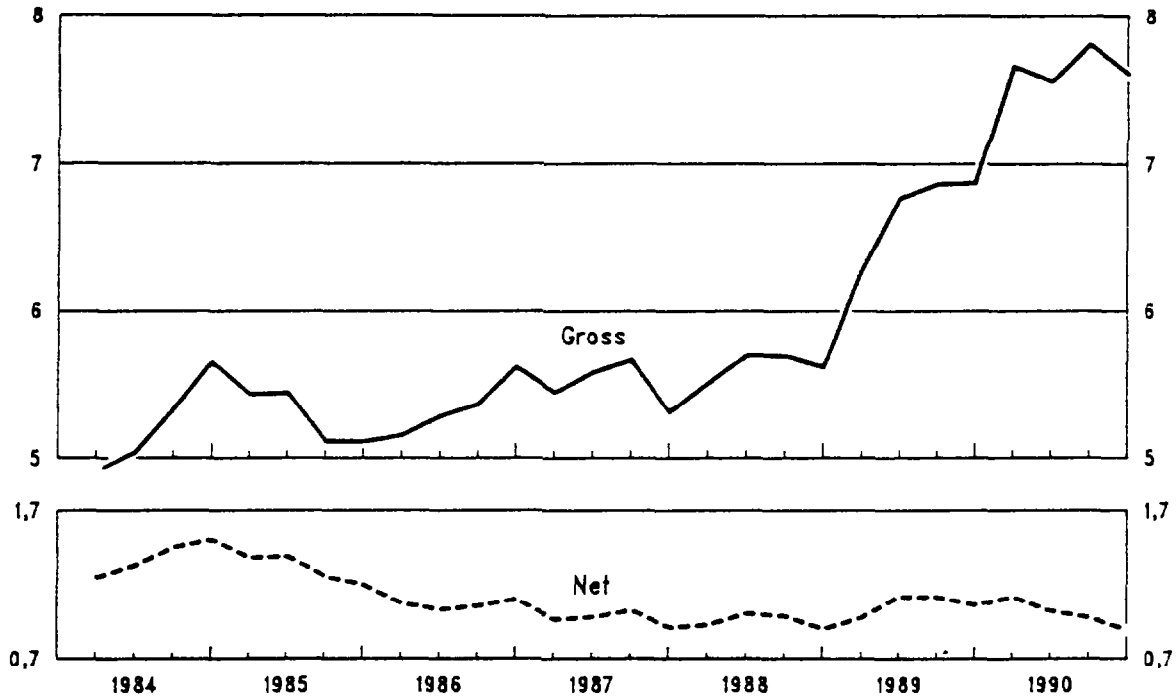
The relevance of the problem is enhanced by recent developments in EC monetary policy coordination after the beginning of EMU's Phase 1. The new consultation procedures set up by the Committee of EC central bank Governors after July 1, 1990 contemplate that economic developments be monitored periodically by means of a set of common indicators, including monetary aggregates; as recently stated by the Committee's Chairman before the European Parliament (March 18, 1991) "... we have greatly strengthened our efforts (...) to promote the coordination of monetary policies (... by) developing in a pragmatic way a system of indicators, with particular emphasis on harmonizing, to the extent necessary and possible, monetary aggregates."

The present paper contributes to this research, looking for empirical evidence on whether, and how, CBDs should be accounted for to enhance the role of monetary aggregates as policy indicators in the transitional phases to EMU. After a brief review of the basic definitions and facts concerning CBDs (Section II), Section III is devoted to a discussion of the model used for the empirical analysis, focused on the definition and measure of the "information content" of monetary aggregates. Section IV discusses the empirical results and the suggested interpretations. The main conclusions are collected in Section V. Finally, the Appendix contains details on statistical definitions and sources.

1/ For a multicountry survey looking at the recent changes in the international transmission of monetary policy, see Bank for International Settlements (1989). For a discussion of the role of CBDs in this context see Goodhart (1990).

GROSS AND NET CBDS IN EUROPE
(as a ratio of aggregate broad money stock)

Chart 1



II. Cross-Border Deposits: Some Basic Information

1. Definition and macroeconomic relevance of CBDs

A summary of all possible combinations of CBDs according to the residency of the holder, the currency of denomination or the location of the bank is presented in Table 1 (drawn from Goodhart (1990)). 1/ Each cell of the table is identified by three indexes, which, in relation to those characteristics, refer either to country A (e.g., domestic) or country B (foreign). 2/

Table 1. Cross-Border Deposits in a Two-Country Example

	Deposits held by			
	residents with domestic banks	residents with foreign banks	nonresidents with domestic banks	nonresidents with foreign banks
in national currency	1 AAA	2 AAB	3 BAA	4 BAB
in foreign currency	5 ABA	6 ABB	7 BBA	8 BBB

For example, cell 1 (AAA) refers to deposits held by residents of country A (first index) in their own currency (second index) and in their own country (third index); while cell 4 (BAB) refers to the deposits held by residents of country B in the currency of country A in their own country. 3/ Thus, according to the previous definition, the term cross-border deposits refers to all deposits included in cells 2-7. 4/

Two concepts will frequently be used in this paper. We define as "currency substitution" any movement between deposits denominated in

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1/ An early reference to this classification can be found in Banca d'Italia (1985), p. 51.

2/ We consider here for simplicity a two-country example. Alternatively, B can be interpreted as the set of all foreign countries.

3/ The branches of foreign banks in country A are here treated like banks of country A; what matters, in this respect, is the location of the bank branch and not the legal residency of its headquarters.

4/ Notice that the definition of CBDs differs from that of Eurodeposits, which includes only the deposits for which the second and third index differ, i.e., cells 2, 4, 5 and 7.

different currencies (i.e., in the vertical direction of the table). Similarly, we call "relocation" a movement of deposits between banks located in different countries (horizontally, between the first two and the last two columns). Starting from cell 1, the CBDs held by residents of country A can therefore be classified as originating from "pure" currency substitution (cell 5), "pure" relocation (cell 2), or a combination of the two (cell 6) (the corresponding cells for residents of country B being respectively cells 4, 7, and 3). 1/

At present, virtually all national monetary aggregates in the EC include only a subset of the deposits held by residents, namely, focusing on country A, those included in cells 1 and (sometimes) 5 (deposits in domestic and foreign currency held in domestic banks). 2/ This practice was considered as a convenient simplification in a period when CBDs were small and relatively stable, and could therefore be omitted without loss of significance for the monetary aggregates. The recent growth of CBDs has, however, raised the issue of the stability of the relation between monetary aggregates and the final targets of economic policy, such as nominal income or prices. 3/

While in principle the "best" national monetary aggregate can be formed by any subset of the cells included in Table 1, in practice three main definitions have been singled out:

(i) All liquid assets held by residents, worldwide and in any currency (denoted by MR). Using the symbols of Table 1, this aggregate for country A would be defined as MR = AAA + AAB + ABA + ABB.

1/ Changes in the holder's residency can be interpreted as balance of payments flows. Any movement across the boxes of the table derives from a combination of currency substitution, relocation, and payments flows.

2/ A partial exception is Germany, where the monetary authorities monitor "M3-extended" which includes short-term bank bonds and deposits held by domestic residents in foreign branches of German banks. However, M3-extended currently plays a very limited role in policymaking; as stated in the 1990 Annual Report, "The Bundesbank has so far refrained from substituting the 'extended money stock M3' as its key monetary policy indicator. It is in particular the poorer indicator qualities of the extended aggregate that argues against any such substitution. The poorer qualities are due, among other things, to the relatively short observation periods available at present for the necessary analysis of the relations with domestic demand, the domestic supply of goods, the trend in the 'velocity of circulation', etc."

3/ The relevance of the stability relation between monetary aggregates and final policy targets holds regardless of the role (e.g., intermediate target versus indicator) performed by monetary variables in the design of monetary policy (see Section III for a discussion of the precise meaning attributed to monetary variables in this paper).

(ii) All liquid assets denominated in the domestic currency (MC). Again for country A, we would have MC = AAA + AAB + BAA + BAB.

(iii) All liquid assets held with domestically located banks (MB); namely, MB = AAA + BAA + ABA + BBA.

In the rest of the paper we will refer to MR, MC and MB as "extended" money definitions. They have the property of being "geographically consistent", in the sense that the sum of monetary aggregates according to each criterion for all countries within a certain area retains the same criterion for the area as a whole. Such property is particularly appealing for a prospective monetary union since it allows cross-country aggregation by simple sum; of course, one has to make a judgment on which one of the three aggregates is to be selected.

Geographical consistency is not the only reason suggesting to look at extended money stock definitions. With the recent expansion of CBDs, the traditional and extended measures of monetary aggregates have started diverging rapidly. Giucca and Levy (1991), for example, have computed that at end-September 1990 Germany's M3 (the traditional broad money target in that country) was 22 percent smaller then the largest "extended" definition (MC in the case of Germany); in France and Italy, which lifted capital controls only recently, the differences were 6.5 and 2 percent, respectively. While conventional wisdom may suggest that traditional aggregates still outperform extended aggregates, this hypothesis has never been subject to thorough empirical analysis. 1/

Note finally that the choice of the most appropriate money definition is relevant not only for each country, but also at the EC level. If the set of all EC countries represented a closed system, the aggregate formed by adding MR, MC or MB across all countries in the area would coincide. However, this is not the case in the presence of non-EC CBDs. Although, as noted earlier, the difference is currently limited, the potential increase in non-EC CBDs could make it more relevant in the future.

2. Recent patterns in deposit relocation and currency substitution in the five largest EC countries

The recent behavior of CBDs in the five largest EC economies is summarized in Charts 2-6. 2/ The charts include, for each country, four panels: in the first, the differences between MR, MC and MB, and the traditional monetary aggregates show the amount by which extended and

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1/ "...it is widely believed/assumed, (does anyone know of any tests of this), that the relationship between nonresident monetary holdings and their expenditures in the country involved is different from, less stable than, and with a lower velocity than, the relationship between residents' money holdings and expenditures"; Goodhart (1990), p. 14.

2/ This section draws heavily from Giucca and Levy (1991).

traditional aggregates have diverged as a result of CBDs; the other three panels show the breakdown of each of these differences in the appropriate cells of Table 1.

A distinguishing feature emerging from the data on Germany (Chart 2) is the dominant role of the domestic currency: at end-1990, out of US$113 billion deposits held abroad by German residents, 90 were denominated in deutsche marks (DM). The fourth panel, referring to cells 2 and 6, shows that until 1985 both types of deposits, in domestic and foreign currency, had been growing slowly. Starting from 1986 the two components took markedly different paths. Foreign currency deposits (cell 6) kept on growing at low rates, probably reflecting their nature of balances held for trade purposes; on the contrary, DM deposits (cell 2) started increasing rapidly, rising by 15 times between 1986 and 1990.

This phenomenon can be related to the evolution of the regulatory and fiscal environment in Germany relative to other European countries. In December 1985 the Government announced the abolition of the exemption from the reserve requirement of short-term bank bonds, effective May 1, 1986. In spite of the simultaneous reduction of the reserve ratio on time deposits, aiming at alleviating the effects of the measure, the holdings of DM deposits abroad increased immediately. 1/ The second event was the introduction, effective January 1, 1989, of the withholding tax on interest income: this measure, repealed on June 30 of the same year, triggered a 30 percent increase of DM deposits abroad between December 1988 and March 1989. Interestingly, the elimination of the tax was not followed by a reversal of the trend, presumably due to the simultaneous sharp rise in the implicit burden of reserve requirements brought about by the increase in market interest rates. 2/ Contrary to pure relocation, currency substitution has remained negligible for German residents; this emerges from data on both cell 5 (pure substitution) and 6 (substitution cum relocation).

The most striking aspect of the evolution of France's cross-border holdings is represented by the brisk, albeit short lived, process of relocation and currency substitution of 1989-90, triggered by changes in the regulations regarding foreign exchange controls and reserve requirements. In the three quarters following the first liberalization measures of early 1989, 3/ foreign currency deposits at home (cell 5 in Chart 3), which were not subject to reserve requirements, almost doubled. The mere introduction

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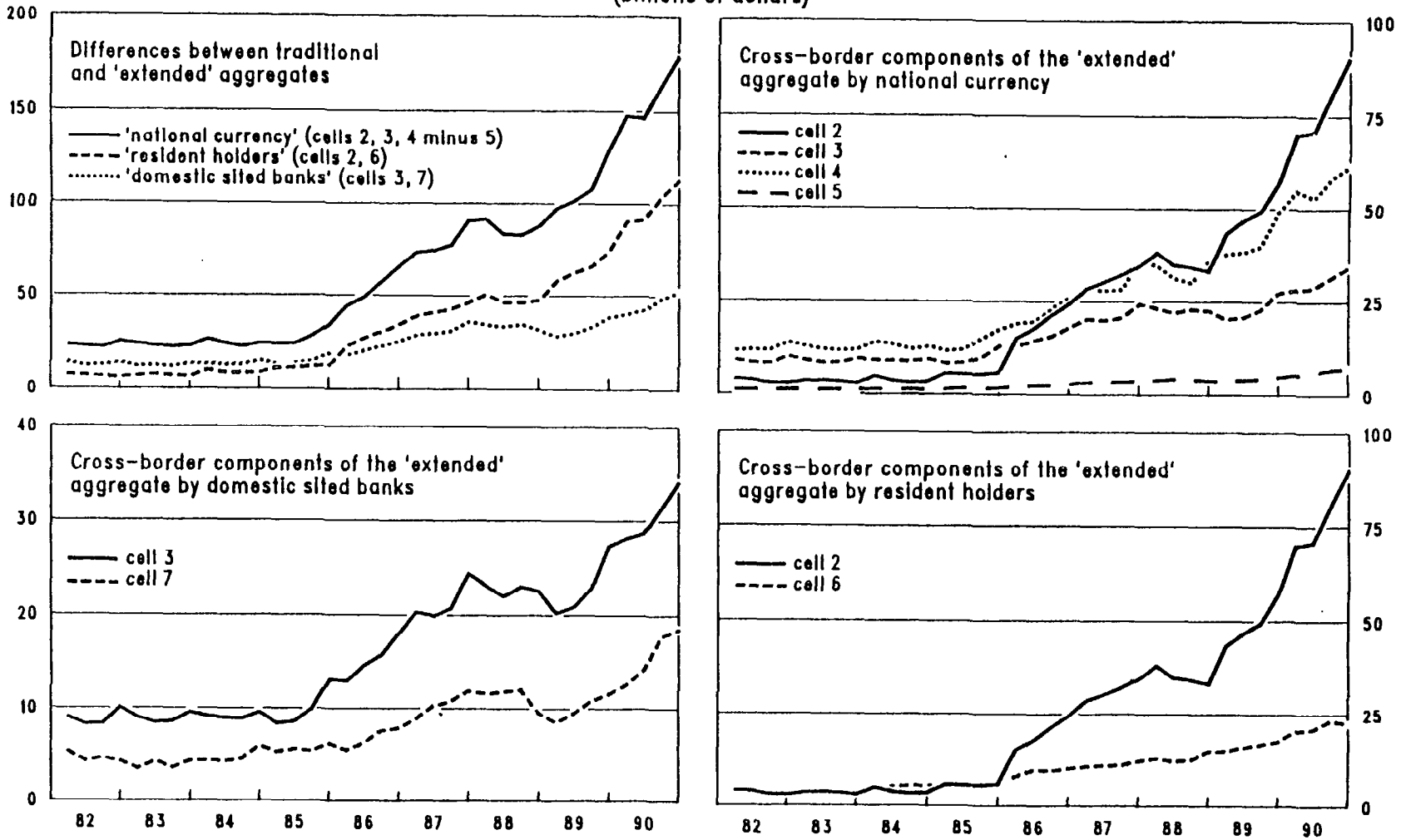
1/ The favorite destinations of deposits' relocation for German holders are the United Kingdom and Luxembourg; see Deutsche Bundesbank (1988).

2/ The German 3-months interbank rate rose from an average 4 percent in 1987-88 to 7.1 and 8.4 respectively in 1989 and 1990. With a broadly unchanged reserve ratio, the implicit burden of reserve requirements doubled.

3/ French capital controls were lifted gradually: among the main steps, in March 1989 authorities eliminated all exchange controls on firms and banks, in December those on individuals (effective January 1, 1990).

GERMANY
(billions of dollars)

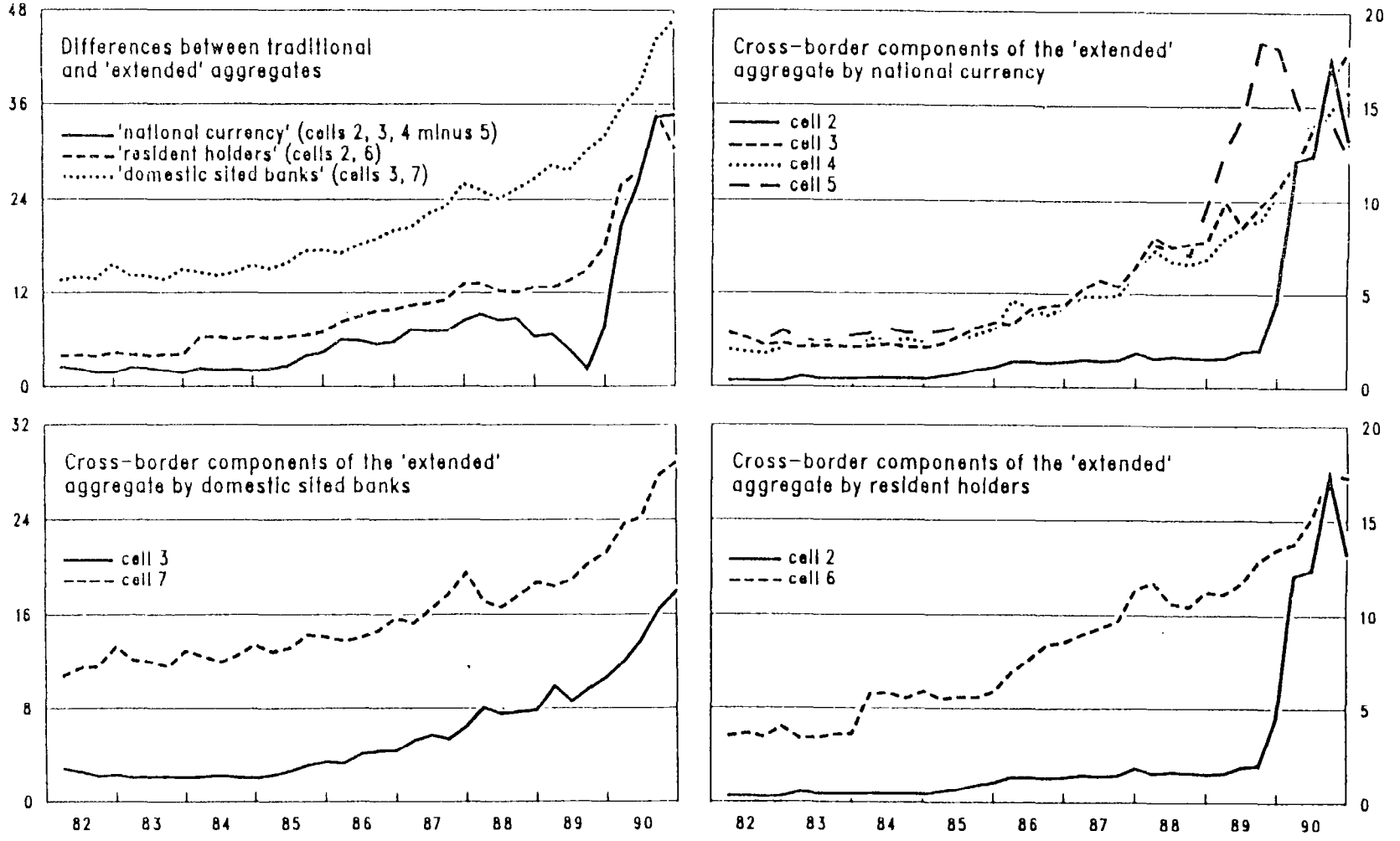
Chart 2



Source: Glucca and Levy (1991).

FRANCE
(billions of dollars)

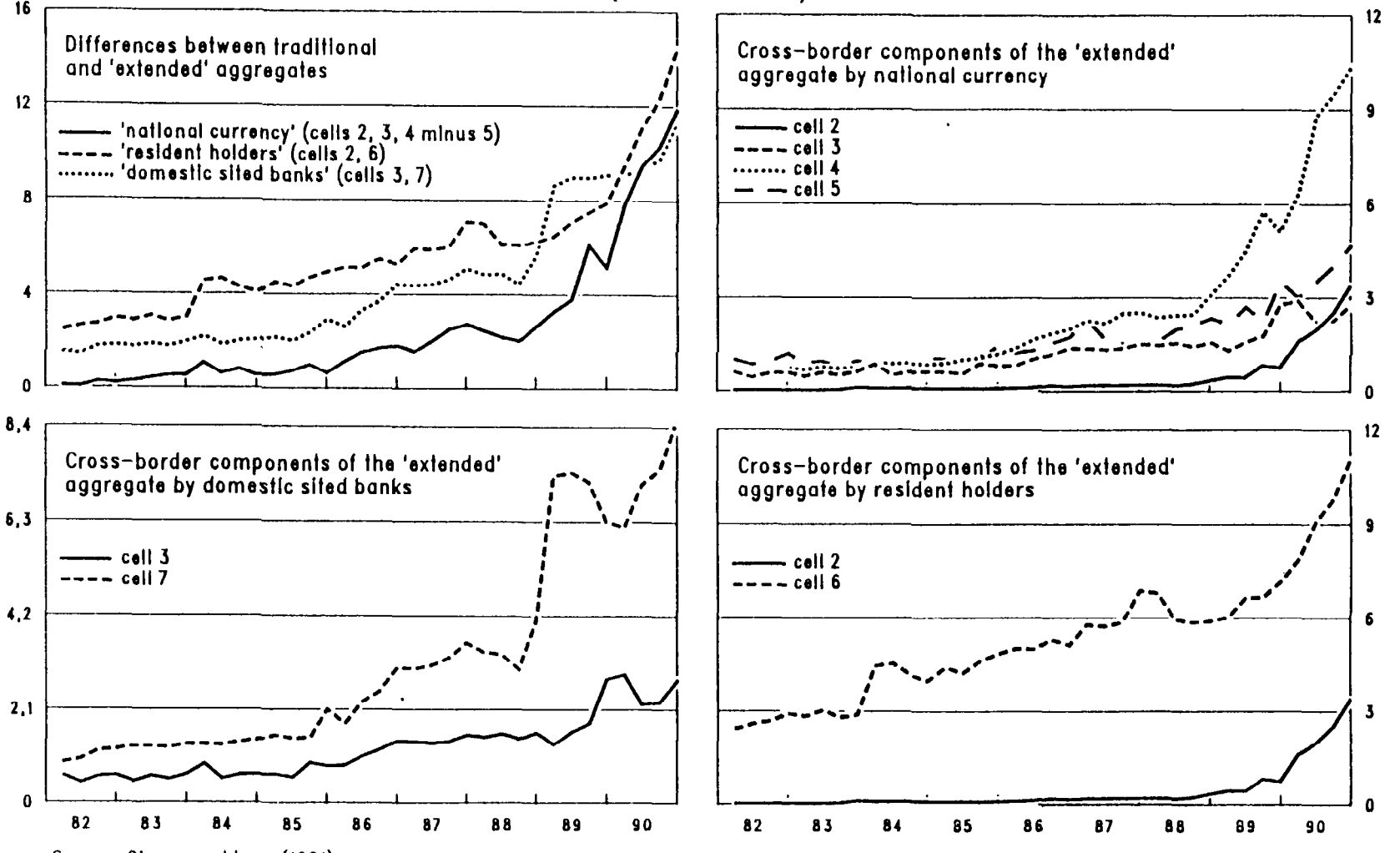
Chart 3



Source: Glucca and Levy (1991).

Chart 4

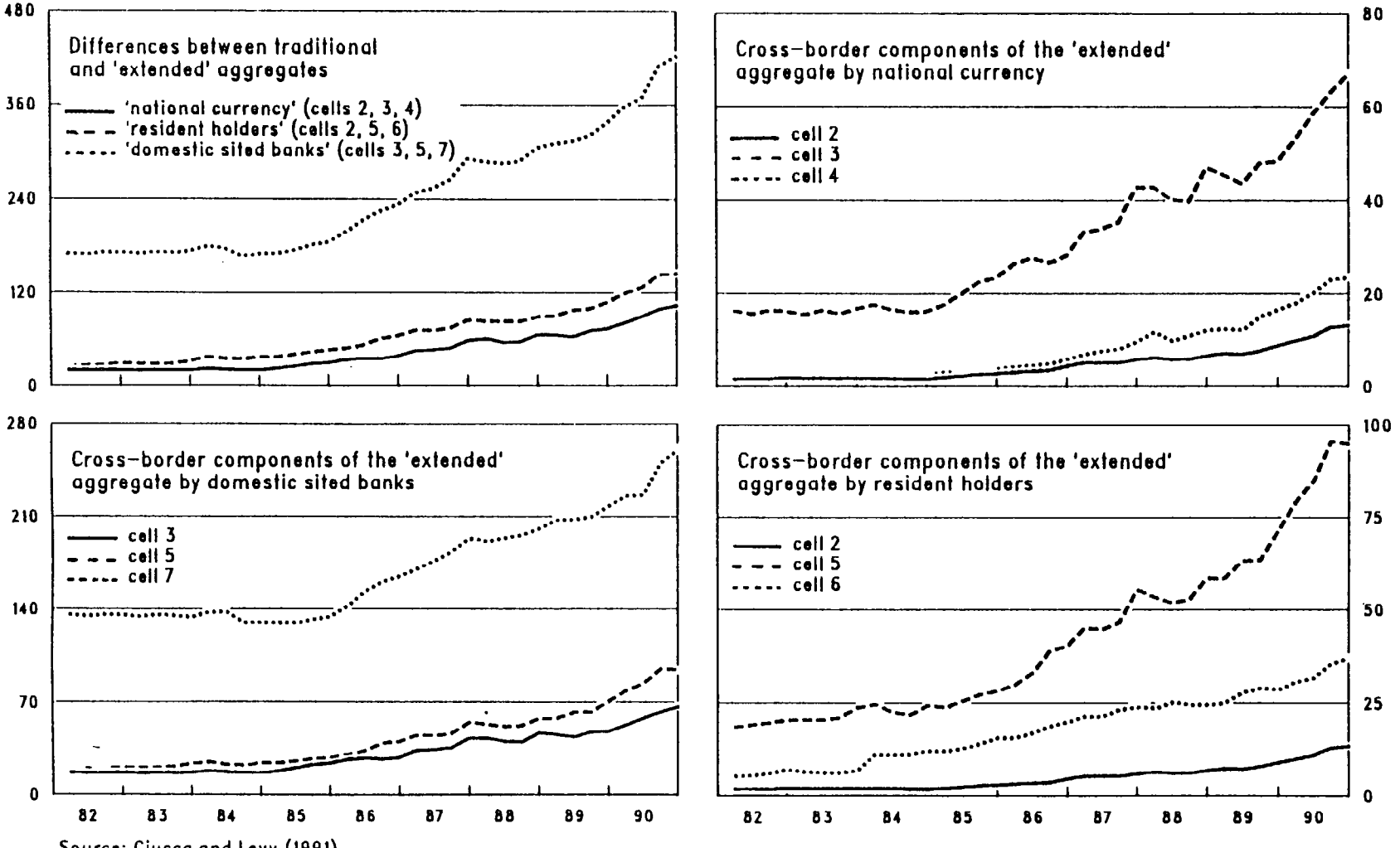
ITALY
(billions of dollars)



Source: Giucca and Levy (1991).

UNITED KINGDOM
(billions of dollars)

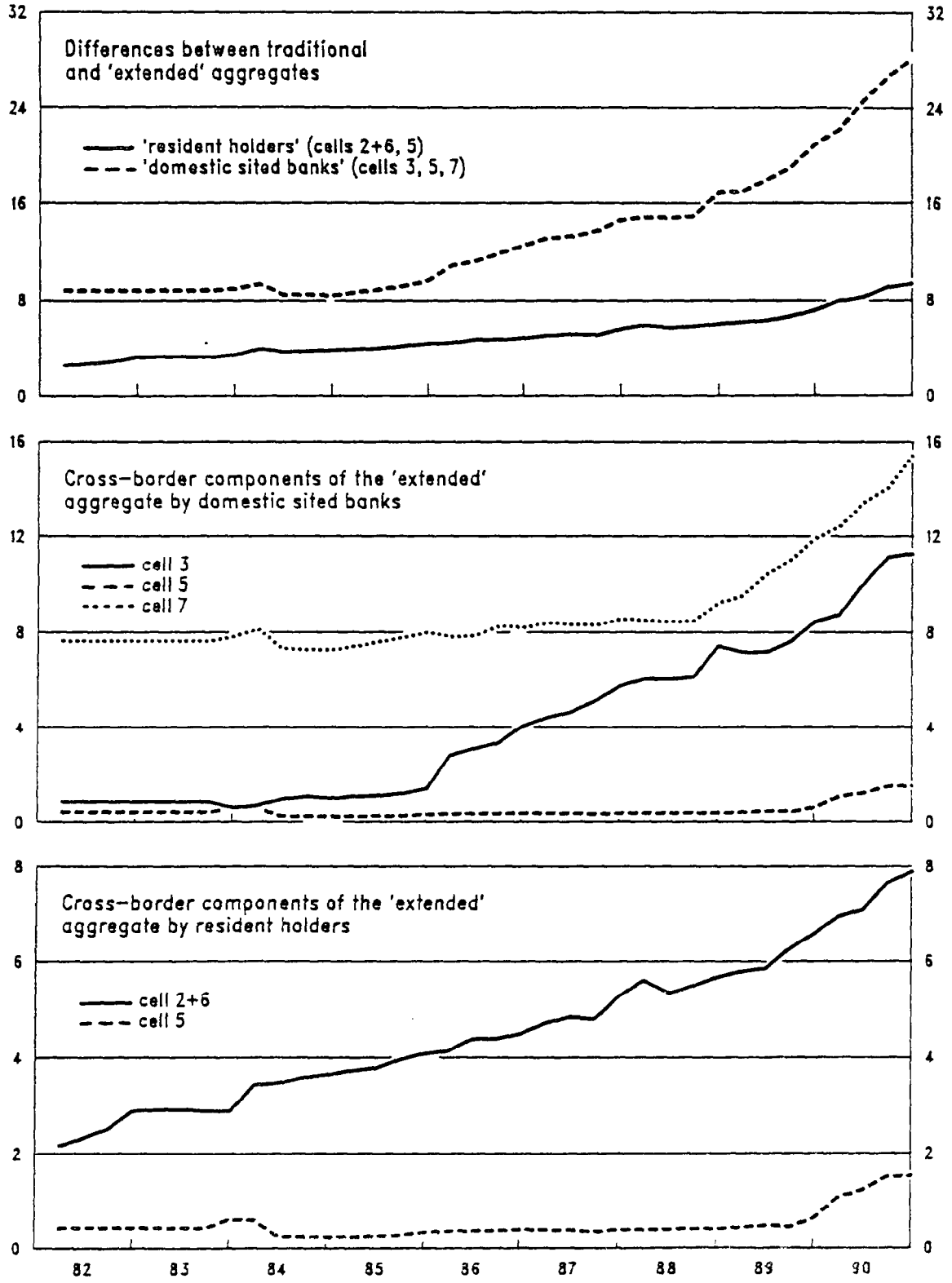
Chart 5



Source: Giucca and Levy (1991).

SPAIN
(billions of dollars)

Chart 6



Source: Giucca and Levy (1991).

of foreign exchange deposits in the aggregate subject to reserve obligation (effective January 1, 1990), though with a coefficient of zero, was sufficient to reverse the phenomenon. 1/ Meanwhile, foreign currency deposits held abroad (cell 6) rose steadily from US$12 billion in June 1989 to US$17 billion at end-1990.

Residents' domestic currency deposits held abroad (Chart 3, cell 2) have remained roughly constant until September 1989. In the following 12 months, after a further relaxation of capital controls 2/ and an increase in the reserve requirements coefficients in October 1990 by 1/2 percentage point, the stock of these assets surged to more than US$17 billion. In October 1990, the reduction of minimum reserve requirements 3/ triggered a substantial repatriation of relocated deposits; those denominated in French francs (FF) declined in the last quarter by 24 percent.

The removal of foreign exchange restrictions exerted a strong impact on CBDs also in Italy. 4/ Lire-denominated deposits held abroad by residents (cell 2, Chart 4) increased steeply, from less than US$1 billion at end-1989 to US$3.4 billion at end 1990. In absolute terms, however, these holdings are dwarfed by foreign currency held abroad (cell 6), whose amount increased in the same period from around US$8 billion to US$11 billion. Relocation of deposits is spurred by the implicit burden of bank reserve requirements, currently the highest in Europe, 5/ and by the high taxation on interests; despite the high fiscal burden, a sharp increase took place in the amount of foreign deposits relocated in Italy (cell 7, third panel of Chart 3) in the course of 1989. A once-and-for-all portfolio adjustment may have resulted

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1/ See Banque de France (1991). The effectiveness of the "threat" can be explained considering that a coefficient increase would have been applied to the entire stock of foreign currency deposits.

2/ On October 1, authorities relaxed regulations governing Euro-franc borrowing by French banks. This relaxation made it possible for French banks to relocate FF deposits abroad, in order to circumvent domestic reserve requirements, by transferring them to foreign branches (mainly to Luxembourg and the United Kingdom) and borrowing back the relocated funds (see Banque de France (1991)).

3/ The measures included a drop of the coefficient applied to term deposits and CDs from 3 to 0.5 percent, and on savings deposits from 3 to 2 percent; bank cash balances were allowed to be included in the computation of required reserves. In addition, in 1990 the authorities reduced the withholding tax on interest earned on time deposits from 46 to 37 percent.

4/ The main steps in the process of exchange liberalization in Italy were: (a) the relaxation of the constraints on banks' net foreign currency position (October 1988); (b) the removal of restrictions on short-term, nonmonetary capital outflows and on foreign exchange deposits of exporting firms (January 1990); (c) the full liberalization of capital outflows (May 1990). Capital inflows were never restricted.

5/ The average coefficient of reserve requirements in Italy is currently near 22 percent. The average remuneration of reserves is around 6 percent.

from a "confidence effect" triggered by the foreign exchange liberalization measures enacted in late 1988, which stimulated a massive wave of capital inflows. The same factor can also explain the steep climb of foreign deposits in Italian lire (though mainly held abroad; see cell 4 in the second panel).

Less dramatic changes in the patterns of CBDs have taken place in the remaining two countries. In the United Kingdom the smooth growth of CBDs and their distribution among different categories (Chart 5) reflect the country's long-term role as international banking center. Traditionally, the largest stock of cross-border deposits is the one held in home banks by non residents in foreign currencies (US$260 billion at end-1990, cell 7 of Chart 5); pure relocation (cell 2) has been much smaller (US$13 billion). In Spain (Chart 6), both pure currency substitution (cell 5) and relocation (cells 2 and 6, plotted together since the currency breakdown is not available) have so far been negligible, in both size and dynamics. The smoothness of the growth of residents' deposits holdings abroad in 1990 might be due to the offsetting effects of the simultaneous reduction of banks' reserve requirements (end-March) and the abolition of capital controls (early April).

III. Choice of the Empirical Model

The correct definition of money partly depends on the role that monetary aggregates are supposed to perform in the design of monetary policy. Economic literature identifies two alternative ways in which monetary aggregates can be used for such purpose. 1/ The first is to view them as intermediate targets in a two-step policy process: the central bank controls the money stock through the available instruments (open market intervention, discount window policy, and the like) and in turn the money stock affects the final policy objectives through a direct causal link with the private sector's spending behavior. The second approach is to view monetary aggregates as information variables: money does not necessarily "cause" private sector's behavior, but provides early (possibly advanced) information on it, thus being a potential ingredient of a feedback-policy rule. Controllability of the money stock is a crucial requirement for the first approach, while it is irrelevant for the second.

The appropriate role for monetary aggregates in the context of the transitional phases of EMU appears to be mainly informational, for two reasons. Firstly, financial innovation and liberalization in most European economies have presumably eliminated any significant (exploitable) role for cash and other liquidity constraints in the determination of aggregate spending; "relative price" effects (through interest or exchange rate changes) tend to prevail over "quantitative rationing" in financially advanced, highly open economies. 2/ Secondly, for countries belonging to

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1/ See, for example, Friedman (1990).
2/ See the discussion in Goodhart (1989), Section IV.

the exchange rate mechanism the scope for controlling the money stock is limited by the external constraint. The interesting question to ask in this framework is thus how money market integration and CBDs have affected the informational role of monetary aggregates, and what definitions of money are most appropriate to enhance or to preserve such a role.

Two different, complementary lines of research can be taken in this context. The first, following McKinnon (1982), is to examine the properties of an aggregate, EC-wide measure of the money stock. A number of recent papers 1/ have been devoted to the identification and estimation of money demand functions for the whole EMS area; their conclusion is that these functions appear in general to possess good economic and statistical properties. A second approach is to look at the interaction of a set of individual country equations. The choice between the "aggregate" versus the "multicountry" approach depends on two factors: first, the relative size of the aggregation vis-à-vis the specification bias 2/; the former will tend to be large if there are substantial differences among the individual equations, the latter if the specification errors tend to be canceled out by aggregation. Second, and on more practical grounds, one must also consider that disaggregated equations provide information on individual countries, whereas an aggregate equation does not.

Several reasons suggest that the estimation of a set of single country equations is preferable for addressing the issues raised by this paper. First, as noted before, CBDs tend to be larger within Europe than between Europe and the rest of the world; the data at the individual country level are therefore likely to be more informative for the purpose of discriminating among alternative hypotheses concerning CBDs. Second, in the context of stages 1 and 2 of EMU, where each country retains ultimate responsibility on monetary policy and exchange rates are not yet irrevocably fixed, indicators relating to individual countries remain crucially important for policy makers. Third, even if aggregation is the ultimate goal, the estimation of individual equations may provide elements on its feasibility, such as the degree of differentiation among individual money demands and the nature of the cross-country covariances. 3/ Of course, conflicting results may arise from a disaggregated analysis: for example, the same money concept may not turn out to be the best for all countries. However, this is not necessarily a drawback, since in the current, transitional phases of EMU full harmonization of monetary aggregates should be implemented only if it does not lead to a deterioration of their value as indicators.

1/ See, for example, Bekx and Tullio (1989) and Kremers and Lane (1990).

2/ The meaning and importance of these biases are discussed in the aggregation literature, e.g., see Pesaran et al. (1989). For an application to money demand, see Kremers and Lane (1990), paragraph 3.

3/ Ceteris paribus, negative covariances among cross-country error terms tend to reduce the standard error of an aggregate equation, thus leading to better estimates.

An empirical measure of the information content of monetary aggregates can be derived from Theil (1967). Considering a random variable Y and an information set M, we can define the information content of M on Y as the extent to which the knowledge of M allows to reduce the uncertainty of Y (measured by its variance, V(Y)). In symbols:

$$I_{M,Y} = [V(Y) - V_M(Y)] / V(Y) \qquad (1)$$

where $V_M(Y)$ is the variance of Y conditional on M. To make this definition operational, one needs a model to express the link between (or the joint probability density of) Y and M. 1/ For this purpose, one could perform "reduced form"-type tests of exclusion restrictions, 2/ regressing Y on (lags of itself and of) M and testing the significance of M. In practice, this simple approach is not an appealing one, particularly if applied to broad money stock definitions, because it neglects the endogeneity of money. Alternatively, one could use structural econometric models; 3/ this approach, however, becomes rapidly difficult as the number of countries increases. In selecting the empirical model, one has also to take into account some statistical limitations, that reduce the sample available for estimation: the quality of BIS data on eurodeposits tends to be poor before 1982-83, and the phenomenon of CBDs has acquired substantial importance in many countries only in the most recent years.

In view of the nature of the problem and the constraints, we have chosen to work with the following simple model:

1/ Note that a simple analysis of stability of the money demand function is not sufficient, though it is necessary, to draw conclusions on the information content of money demand. Suppose, for example, that a stable money demand function can be identified, but that its short-run elasticity and residual correlation with respect to nominal income are low; then the informational value of such function is likely to be low, despite its stability.

2/ As, for example, in Friedman (1983).

3/ Friedman (1984) specifies a small-scale econometric model of the U.S. economy and measures the informative value of money and credit by a two-step estimation procedure. For a criticism of his method, see Goldfeld (1984). Angeloni and Cividini (1990) compute measures of the information content of alternative monetary policy indicators by simulation of a large-scale econometric model of the Italian economy.

$$M_j = \alpha_j Y_j + \beta_j R_j + \epsilon_j \qquad (2.1)$$

$$Y_j = \gamma_j Z_j + \eta_j \qquad (2.2)$$

where the subscript j indicates the country, (2.1) represents a standard demand for money equation (in nominal terms), as a function of nominal income (Y) and a set of predetermined variables (R_j, notably including interest rates 1/), and (2.2) is the generating process for Y, as a function of a (generally different) set of predetermined variables Z_j. We have assumed that the information set available to the policymaker (say, Hj) includes the model and all predetermined variables, as well as the contemporaneous value of M_j; its problem is to infer the value of the unobserved Y_j. 2/3/ Under these assumptions, the information content of M_j on Y_j, I_j, depends on α_j and on the residuals' covariance matrix in the following way 4/:

$$\begin{aligned} V(Y_j|Z_j) &= \sigma_{22,j} \\ V(Y_j|H_j) &= \sigma_{22,j} - \frac{(\sigma_{12,j} + \alpha_j \sigma_{22,j})^2}{\sigma_{11,j} + 2\alpha_j\sigma_{12,j} + \alpha_j^2\sigma_{22,j}} \\ I_j &= 1 - \frac{V(Y_j|H_j)}{V(Y_j|Z_j)} \end{aligned} \qquad (3)$$

where σ_{ii} denotes the elements of the covariance matrix (e.g., σ_{12} = cov (ϵ_j, η_j)). The information content I_j ranges from zero to one; it is zero when $\alpha_j = \sigma_{12,j} = 0$, and one when $\sigma_{12,j}^2 = \sigma_{11,j}\ \sigma_{22,j}$.

Given these definitions, the design of our empirical analysis is the following. First, model (2) was estimated as a system of 2 x N simultaneous equations by Zellner's (1962) SURE estimation method with quarterly data

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1/ We implicitly assume that interest rates are pegged by monetary policy, and are thus exogenous to the model.

2/ In other words, the policymaker observes the reduced form error of M_j, $\alpha\eta_j + \epsilon_j$, and uses this information to estimate the value of η_j. We do not consider here the possibility that money be used to provide cross-country information.

3/ Working with quarterly data, these informational assumptions are restrictive on two grounds. Firstly, in most countries national income figures are not available with a one quarter lag. Secondly, other real sector indicators (e.g., industrial production and price indices) typically are available within the current quarter, and therefore can be used to estimate current GNP/GDP. The two factors tend to compensate each other, since the first increases the potential value of money as an indicator, while the second reduces it.

4/ Graybill (1961), theorem 3.10.

over 1982-90 1/, for the five largest participants in the EMS (N=5). The model was estimated for four broad money definitions: the traditional one used in each country 2/ and the three extended definitions (MR, MC and MB) obtained by adding to the traditional definition the appropriate "cells" of Table 1. 3/ All estimates were then used to compute (3) across the five countries and money measures (with the exclusion of MC for Spain for which data are not available). In order to better appreciate the effect of the recent rise of CBDs, the information content was computed not only for the entire sample, but also separately for the last two years. 4/ To do this without re-estimating the model (which would not be possible due to lack of degrees of freedom), we introduce the further assumption that the recent changes in the pattern of CBDs have not affected α_j, the income elasticity of money demand, but only the covariance matrix, which can be estimated directly from the residual vectors. As a term of comparison, a model for the demand for narrow money for the five countries (supplemented by the corresponding five income equations) was also estimated. 5/ This provided a benchmark in evaluating the information value of the broad money aggregates, as narrow money is expected to be less affected by CBDs (which include primarily term deposits and CDs).

IV. Empirical Results

1. Model selection strategy

The first step in the statistical procedure outlined in Section III is the econometric estimate of model (2). Model selection strategy was primarily influenced by data availability and by the need to keep the specification search process within reasonable bounds. Income equations were based on the following simple autoregressive time series model:

$$Y = a_0 + a_1 Y_{-1} + a_2 t \qquad (4)$$

1/ As mentioned, the length of the sample period is limited by the availability of reliable data on CBDs.

2/ M2 for Italy; M3 for Germany and France; M4 for the United Kingdom; ALP for Spain. See Appendix for a precise definition of the aggregates used for each country.

3/ For simplicity, the same model was fitted for all extended money definitions.

4/ This also takes partially into account the possible increase in the "moneyness" of CBDs due to reduced exchange rate uncertainty (on this point, see Goodhart (1990)). Indeed, foreign currency deposits may be considered as less liquid when their capital value is uncertain because of exchange rate variability.

5/ M0 for the United Kingdom; M1 for all other countries.

where Y is the log of nominal GDP and t is a linear time trend. As to the demand for money it was decided to adopt for all countries a fairly standard specification expressing the demand for money in terms of income and the opportunity cost of holding monetary balances. The specification search for the demand for money equation started, for each country j (we omit for simplicity the corresponding subscript), from the following equilibrium relation:

$$M^i = b_0 + b_1 Y + b_2 i^i_M + b_3 i_S + b_4 i_L + b_5 dP + b_6 de + b_7 t \qquad (5)$$

where, in addition to the variables previously defined, M^i is the log of the nominal money stock, i^i_M, i_S and i_L are, respectively, the nominal interest rates on monetary balances (in the i-th definition), on short-term (usually three-month) financial assets and on bonds, dP is the inflation rate, and de is the depreciation of the exchange rate, a proxy for the yield of foreign assets. 1/ Note that a linear trend is also included to take into partial account the possible effect of financial innovation during the sample period. These regressors are largely consistent with those used in most money demand equations recently estimated for the five European countries considered here (see Table 2).

A choice had also to be made on the most appropriate econometric procedure to estimate the model and on the related issue of dynamic specification. In this respect, recent econometric research has suggested two complementary approaches. The first (the so-called "from-general-to-specific" approach) recommends the use of fairly overparametrized models including long unrestricted lags for all regressors and the progressive scaling down of the model through appropriate restrictions and diagnostic tests. The second (the error correction mechanism or ECM approach) is based on a fairly specific dynamic representation which appears particularly appropriate when the model variables are nonstationary. Here, again, our choice was a constrained one. The use of an overparametrized dynamic specification, even if limited to specific variables, was clearly impossible due to the insufficient number of degrees of freedom and the fairly large size of the simultaneous system (10 equations). As to the ECM approach, and, more generally, to the analysis of cointegration, its application to all the estimated equation appeared to be excessively complex. First, the use of the "two step procedure" introduced by Engle and Granger (1987) has well-known drawbacks in small samples (see, for example, Pagan and Wickens

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1/ The inclusion of this variable is potentially important in this context as movements in cross-border deposits can be significantly affected by expected depreciation. Actual depreciation of the ECU exchange rate during the current quarter was used as a proxy for expected depreciation. In principle, it would have been possible to include as regressors also foreign interest rates, on both money and other financial assets. Again, this would have required a further large loss of degrees of freedom.

Table 2. Some Recent Results on the Estimate of Demand for Money Equations in the Five Largest EC Countries

Authors	Country	Dependent Variable 1/	Regressors 2/								Dynamic 3/ Specification	Cointegration 4/
			Income (In Real Terms)	Own Yield	Short Rate	Long Rate	Inflation	Foreign Interest Rate	Exchange Rate Change	Main Other Variables		
Muscatelli and Papi (1990)	IT	M2/P	Y	Y	N	Y	N	N	N	trend	ECM	Y
Angeloni (1991)	IT	M2 5/	Y	Y	Y	N	N	N	N	--	PA	N
von Hagen and Neumann (1988)	GE	NM/P	Y	N	N	Y	N	Y	N	--	DL	N
von Hagen and Neumann (1988)	GE	M2/P	Y	N	N	Y	Y	N	N	--	DL	N
Baade and Nazmi (1989)	GE	NM/P	Y	N	Y	N	N	N	N	--	PA	N
Thorton (1990)	GE	NM/P	Y	N	Y	N	N	N	N	--	PA	N
Frowen and Buscher (1990)	GE	NM/P	Y	N	Y	N	N	N	N	--	PA	Y
Bordes and Strauss-Khan (1989)	FR	NM/P	Y	N	Y 6/	Y 6/	Y	N	N	wealth	ECM	Y
Bordes and Strauss-Khan (1989)	FR	M2/P	Y	N	N	Y	N	N	N	wealth	ECM	Y
Cuthbertson and Taylor (1989)	UK	NM	Y	N	Y	N	N	N	N	price level	PA	N
Hendry and Ericsson (1991)	UK	NM/P	Y	Y	Y	N	Y	N	N	--	ECM	Y 7/
Bahmani-Oskooee (1991)	UK	NM/P	Y	N	Y	N	N	N	N	real exchange rate	DL	N
Nasseh (1989)	UK	NM/P	Y	N	Y	N	N	N	N	--	PA	N
Nasseh (1989)	UK	M2/P	N 8/	N	N	Y	N	N	N	wealth	PA	N
Dolado and Escriva (1989)	SP	M2/P	Y	Y	N	Y	Y	N	N	--	ECM	Y

1/ NM = narrow money; M2 = broad money, P = price level

2/ The table indicates whether a variable was included (Y) or not included (N) in the 'preferred' equation of each paper.

3/ ECM = error correction model PA = partial adjustment, DL = distributed lags

4/ Y = cointegration test successfully performed, NA = cointegration tests not performed

5/ Net of currency in circulation

6/ Bordes and Strauss-Khan (1989) show cointegrating equations including either the short- or the long-term interest rate

7/ While not formally tested, the ECM specification used by Hendry and Ericsson implies the existence of a cointegrating relation.

8/ Nassen (1989) cannot reject a model in which permanent income replaces wealth as scale variable A current income specification is instead rejected

(1989), Section V.3.2) and it does not provide ways to perform hypothesis testing on the variable included in the "cointegrating equation". Second, the use of a one-step ECM model would require strong a priori information on the long-run relation between money and its determinants. Finally, the use of more sophisticated techniques, such as those pioneered by Johansen (1988 and 1989) appeared extremely arduous given the number of equations to be simultaneously estimated.

In light of these difficulties, we decided to follow a more traditional approach. A standard partial adjustment mechanism, based on the inclusion of a lagged dependent variable in all equations, was used in all money demand equations; the entire model, including, for each money definition, five income equations and five money demand equations, was simultaneously estimated by GLS. T-statistics and basic diagnostic tests were used to guide the specification search, including the choice of the most appropriate lag structure for the relevant regressors. This procedure is appropriate under the hypothesis of stationarity of the regressors; as shown in Table 3, reporting the results of the usual Dickey-Fuller and Augmented-Dickey-Fuller tests, this hypothesis appears indeed to be warranted for many of the variables used in the estimates. 1/

2. Empirical estimates of the demand for money

Tables 4.a-4.e summarize the empirical estimates of the money demand equations for the five money definitions considered here. 2/ Together

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1/ Of course this does not per se validate the use of standard econometric techniques. However, it has been noted that in several cases the nonstationarity of some variables is consistent with standard distributions of parameter estimates (see Park and Phillips (1988, 1989), West (1989), Diebold and Nerlove (1988)). Note also that some series appear to be characterized by roots laying outside the unit circle; in these instances simple data transformation such as first or second order differentiation would not help in attaining stationarity. Note finally that while cointegration among the set of included variables was not formally tested (testing for the existence of a "long-term" stable relation over a relatively short time sample does not seem particularly useful) the set of included variables is similar to that considered by other studies of the money demand where cointegration was found over a longer time horizon (Table 2).

2/ The estimates of the GDP models (equation (4) in the text) are omitted for brevity. The specifications of the selected models are consistent with the results of the stationarity tests for GDP reported in Table 3. The coefficient estimates of the income equations differ slightly across the models including the various money demand definitions, due to the use of a simultaneous estimation technique.

Table 3. Stationarity Tests 1/

(1982-Q1, 1990-Q4)

	Narrow money	Broad money	MR	MC	MB	Nom. income	Broad money rate	Short term rate	Long term rate
Italy	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	$\rho>1$	I(0)
	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)
Germany	I(1)	I(1)	$\rho>1$	$\rho>1$	$\rho>1$	$\rho>1$	I(1)	I(1)	I(1)
	I(1)	I(1)	$\rho>1$	$\rho>1$	$\rho>1$	$\rho>1$	I(0)	I(1)	I(1)
France	I(0)	I(0)	I(0)	I(1)	I(0)	I(0)	I(0)	I(1)	I(0)
	$\rho>1$	$\rho>1$	$\rho>1$	$\rho>1$	$\rho>1$	I(0)	$\rho>1$	I(1)	I(1)
United Kingdom	I(1)	$\rho>1$	I(1)	$\rho>1$	I(1)	I(1)	I(1)	I(1)	I(0)
	$\rho>1$	I(1)	$\rho>1$	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Spain	$\rho>1$	I(0)	I(0)	n.a.	I(0)	I(0)	$\rho>1$	I(1)	I(1)
	I(1)	I(0)	I(0)	n.a.	I(0)	I(1)	I(1)	I(1)	I(1)

1/ The table reports for each country and variables the results of the stationarity analysis based on the Dickey Fuller (first line) and the Augmented Dickey Fuller (second line) tests implemented following the model selection strategy recommended in Dolado-Jenkinson (1987). The significance level is 5 percent. Data are quarterly and expressed in logs; the Augmented Dickey Fuller test was run with 2 lags, as suggested by Diebold and Nerlove (1988).

Table 4a. Estimates of the Demand for Narrow Money

(GLS: 1982-Q1, 1990-Q4)

	Italy	Germany	France	United Kingdom	Spain 1/
Constant	0.83 (4.50)	-0.95 (-2.74)	0.47 (2.29)	-0.11 (-1.38)	6.61 (3.78)
M_{-1}	0.50 (3.72)	0.79 (11.3)	0.55 (5.07)	0.87 (9.86)	--
Y	0.45 (3.59)	0.29 (2.94)	0.33 (3.79)	0.08 (1.54)	0.16 (1.84)
i_M	--	--	--	--	--
i_{M-1}	0.33 (2.23)	--	--	--	--
i_S	--	-0.35 (-2.71)	--	--	--
i_{S-1}	-0.33 (-2.23)	--	--	-0.15 (-3.31)	--
i_L	--	--	-0.55 (-2.63)	--	-0.45 (-2.42)
i_{L-1}	--	--	--	--	--
t	--	--	--	--	-0.08 (-7.25)
s.e. (*100)	0.86	1.35	1.27	0.49	1.62
H	0.32	2.04	-0.29	0.33	(1.47) 2/

1/ The estimated equation for Spain also includes a squared trend with a coefficient of 0.00073 and a t statistics of 19.03.

2/ Durbin-Watson test for Spain.

Table 4b. Estimates of the Demand for Broad Money
(Traditional Definition)

(GLS: 1982-Q1, 1990-Q4)

	Italy	Germany	France	United Kingdom	Spain
Constant	0.56 (2.14)	-0.22 (-1.84)	-0.81 (-3.57)	-0.87 (-5.44)	0.25 (3.76)
M_{-1}	0.64 (4.94)	0.86 (15.90)	0.67 (7.97)	0.91 (5.43)	0.84 (11.52)
Y	0.33 (2.66)	0.16 (2.58)	0.41 (3.83)	0.01 (0.06)	0.05 (2.09)
i_M	0.48 (1.23)	--	--	--	--
i_{M-1}	--	0.57 (2.72)	--	0.15 1/ (2.06)	--
i_S	--	--	0.25 (3.93)	--	0.11 (1.72)
i_{S-1}	-0.23 (-1.35)	--	--	--	--
i_L	--	-0.57 (-2.72)	--	--	-0.11 (-1.72)
i_{L-1}	--	--	--	-0.15 1/ (-2.06)	--
Wealth	--	--	--	0.10 (3.67)	--
s.e. (*100)	0.95	0.68	0.67	0.51	0.75
H	-0.05	-0.54	-1.79	0.54	0.59

1/ The own rate and the long-term rate enter the equation for the United Kingdom with a two-period lag.

Table 4c. Estimates of the Demand for MR

(GLS: 1982-Q1, 1990-Q4)

	Italy	Germany	France	United Kingdom	Spain
Constant	0.32 (1.24)	-0.50 (-2.75)	-0.90 (-4.16)	-1.22 (-4.20)	0.25 (3.77)
M_{-1}	0.52 (3.64)	0.88 (18.13)	0.68 (9.30)	0.86 (15.31)	0.87 (13.11)
Y	0.49 (3.39)	0.19 (2.74)	0.41 (4.44)	0.06 (0.43)	0.04 (1.87)
i_M	1.05 (2.40)	--	--	--	--
i_{M-1}	--	0.54 (2.83)	--	0.19 1/ (1.44)	--
i_S	--	--	0.27 (4.14)	--	0.12 (1.90)
i_{S-1}	-0.35 (-1.96)	--	--	--	--
i_L	--	--	--	--	-0.12 (-1.90)
i_{L-1}	--	-0.54 (-2.83)	--	-0.19 1/ (-1.44)	--
Wealth	--	--	--	0.12 (2.69)	--
s.e. (*100)	0.96	0.61	0.64	0.87	0.73
H	1.23	0.41	-0.94	0.07	0.58

1/ The own rate and the long-term rate enter the equation for the United Kingdom with a two-period lag.

Table 4d. Estimates of the Demand for MC 1/

(GLS: 1982-Q1, 1990-Q4)

	Italy	Germany	France	United Kingdom
Constant	0.03 (0.10)	-0.53 (-2.70)	-0.57 (-2.56)	-1.03 (-5.99)
M_{-1}	0.66 (4.56)	0.88 (17.89)	0.82 (10.68)	0.90 (24.43)
Y	0.36 (2.41)	0.19 (2.67)	0.24 (2.43)	0.00 (0.04)
i_M	0.51 (2.03)	--	--	--
i_{M-1}	--	0.59 (2.91)	--	0.18 2/ (2.33)
i_S	--	--	0.28 (4.05)	--
i_{S-1}	-0.21 (-1.13)	--	--	--
i_L	--	--	--	--
i_{L-1}	--	-0.59 (-2.91)	--	-0.18 1/ (-2.33)
Wealth	--	--	--	0.11 (4.14)
s.e. (*100)	0.98	0.65	0.63	0.52
H	0.90	-0.18	-2.08	0.21

1/ Data on CBDs denominated in Spanish pesetas are not available.
2/ The own rate and the long-term rate enter the equation for the United Kingdom with a two-period lag.

Table 4e. Estimates of the Demand for MB

(GLS: 1982-Q1, 1990-Q4)

	Italy	Germany	France	United Kingdom	Spain
Constant	0.32 (1.22)	-0.47 (-3.15)	-0.74 (-3.50)	-1.39 (-3.51)	0.28 (4.13)
M_{-1}	0.63 (4.31)	0.78 (13.10)	0.70 (9.10)	0.83 (10.16)	0.83 (13.58)
Y	0.37 (2.52)	0.26 (3.62)	0.37 (3.82)	-0.09 (-0.46)	0.05 (2.53)
i_M	0.68 (1.55)	--	--	--	--
i_{M-1}	--	0.52 (2.30)	--	0.00 1/ (0.39)	--
i_S	--	--	0.26 (3.88)	--	0.14 (2.47)
i_{S-1}	-0.24 (-1.30)	-0.52 (-2.30)	--	--	--
i_L	--	--	--	--	-0.14 (-2.47)
i_{L-1}	--	--	--	-0.00 1/ (-0.39)	--
Wealth	--	--	--	0.21 (2.59)	--
s.e. (*100)	0.99	0.72	0.70	1.71	0.71
H	1.05	-0.35	-0.90	0.56	0.80

1/ The own rate and the long-term rate enter the equation for the United Kingdom with a two-period lag.

with the coefficient estimates, the tables report t statistics for all coefficients and the equation standard error and H statistics. 1/

Two general observations are in order. First, the specifications are broadly consistent with the data, with standard errors generally between 0.5 and 1 percent and with no residual autocorrelation in almost all cases. 2/ Second, it was found that, in most cases, simple specifications could adequately describe money demand behavior. Most equations include, together with the constant, the lagged dependent variable and nominal income, only one or two interest rates. The coefficients on inflation and exchange depreciation were never significantly different from zero and only in one case was a trend variable was included in the preferred equation. 3/

Estimates of the demand for narrow money are presented in Table 4.a. Impact coefficients on the GDP variable vary substantially, from a minimum of 0.08 for the United Kingdom to a maximum of 0.45 for Italy, indicating that the aggregation bias is potentially high (see Section IV.3). The own yield is generally not significant, with the exception of Italy, where checking deposits have always been remunerated at market-determined interest rates. 4/ The relevant "alternative yield" is the short-term interest rate for Italy, Germany, and the United Kingdom and the long-term interest rate for France and Spain. A comment is required for Spain, the only case in which both a linear and a quadratic trend were included in the final specification. The ratio between narrow money and GDP in Spain shows a

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1/ Some restrictions have been imposed on the estimated coefficients, particularly those on interest rate variables, for which the inclusion of an interest rate differential, rather than two independent interest rates, appeared more appropriate. All restrictions have passed F-tests at the five-percent significance level. The couples of restricted interest rate coefficients are easily identified by the equality of the absolute value of coefficient and t statistics.

2/ The H statistics slightly exceeds the five-percent critical level only for the demand for M1 in Germany and for the demand for MC in France (i.e., in 8 percent of all estimated equations). Broadly speaking, it cannot be ruled out that this autocorrelation is spurious and due to sample variability.

3/ Of course, this result may have been influenced by possible mispecifications in the estimated equations. Actual depreciation is likely to be a poor measure of expected depreciation; moreover, constraints on capital movements varied in intensity over time so that the impact of expected depreciation on capital movements is likely to have changed during the sample period. The absence of exchange rate effects is, however, consistent with the findings of other studies (Table 3).

4/ The lack of significance of the own rate is not surprising in light of the problems of measurement of this variable in most countries. Note that the yield of narrow money in the United Kingdom is zero by definition as in this country narrow money (MO) includes only cash in circulation.

marked U shape during the sample period. This shape (which is caught by the quadratic trend) is due to two factors: first, the increase in marketed treasury paper in the first half of the 1980s explains the initial decline in the ratio. Second, the birth of highly remunerated deposit accounts (Supercuentas) in the late 1980s explains the subsequent recovery of the ratio. 1/

Broad money equations (Tables 4.b-4.e) have a structure similar to those of narrow money. Again, the impact coefficient of income varies widely across countries and interest rates influence significantly the demand for monetary balances. Adjustment lags are, however, somewhat longer than for M1, as revealed by higher coefficients on the lagged dependent variable and by higher order lags on some interest rates (up to two quarters in the case of the United Kingdom). The own rate has the expected positive sign in Italy, Germany and the United Kingdom, but is not significant in France and Spain. In these two countries, however, the short-term rate has a positive sign, and may therefore be interpreted as a proxy for the own yield of broad money, which is probably badly measured by published data. 2/ The long-term rate has always the expected negative sign, but it is not significant in Italy and France. 3/ As in Grice and Bennett (1984), Nasseh (1989) and Hall, Henry and Wilcox (1989), private wealth is a significant determinant of broad money demand in the United Kingdom, regardless of its specific definition. In this country the income effect is correspondingly weaker and never significant at the five-percent level. 4/

A direct comparison of the estimates presented in Tables 4.b-4.e does not allow a clear identification of the "best" definition of broad money.

1/ A second anomaly of the money equation for Spain is that GDP enters with a three-period moving average (the reported coefficient has been consistently adjusted in Table 4.a to show the impact effect). This is due to the high irregularity of the GDP series for Spain, showing changes in annual growth rates up to 10 percentage points from one quarter to the other. Note in this respect that quarterly national accounts are not published in Spain and that the series used in this paper has been estimated (see Appendix).

2/ Indeed the definition of broad money used for Spain (ALP) includes treasury bills, whose rate is used in the equation for Spain as short-term interest rate.

3/ The lack of significance of the long-term rate was expected in the case of Italy, where treasury bills and floating-rate government bonds have represented the main alternative to bank deposits throughout the 1980s. Note instead that, in principle, the exclusion of the long-term rate from the demand for broad money in France is not consistent with its inclusion in the demand for narrow money (Table 4a).

4/ The lack of significance of income in the United Kingdom broad money equations (and, indeed, the lack of cointegration between these two variables and various interest rates) is confirmed by the results presented in Frowen and Buscher (1990).

Note, however, that in all countries (with the exception of Spain), the statistical fit of the equation is clearly less satisfactory when the MB definition is used: standard errors increase markedly and some coefficients lose their significance. Not surprisingly, given that the difference between MB and other broad money definitions is more marked in the United Kingdom, the equation for the United Kingdom deteriorates more significantly, with a sharp rise in the standard error and a drop of the t statistics on the interest rate. Even before a formal analysis of the information variable of different monetary aggregates, this finding hints at the possible weakness of MB as indicator of income developments.

3. Cross-country relationships

Having estimated our multicountry models, we are now in the position to examine our central issues. In this section we will test the validity of some cross-country restrictions among parameter values and look at the pattern of cross-country covariances; the next section will be devoted to the analysis of the information value of alternative monetary aggregates.

Cross-country restrictions and covariances are important in two ways. Firstly, they provide information on whether the conditions for aggregating money stocks at the European level are met. Roughly similar money demands across countries contribute to mitigate the aggregation problem, while negative error covariances tend to reduce the aggregate noise, thus making the estimation of an EC-wide equation more precise. Moreover, the two issues have an interest on their own, since they shed light on the degree of integration of money markets, currency substitution and capital mobility.

The results of some tests of cross-country restrictions among money demand parameters are reported in Table 5. Five hypotheses were tested: equality of the coefficient of the lagged dependent variable; equality of the short- and long-run elasticities with respect to nominal income; equality of the short- and long-run semielasticities with respect to interest rates. The table shows the percentage contained in the right tail of the relevant asymptotic distribution; values smaller than 5 thus indicate tests significant (i.e., hypotheses rejected) at the 5 percent significance level. The tests were computed both for the entire group and for a smaller one including only France, Germany and Italy; the distinction could be relevant because it is conceivable that the smaller group, composed by countries that have belonged to the EMS for the whole sample period, may display a higher degree of financial integration, and parameter homogeneity,

Table 5. Likelihood-ratio Tests of Cross-Country Restrictions

(Significance levels in percent)

	Narrow Money	Broad Money	MR	MC	MB
All 5 countries					
Lagged dependent	0.7	7.7	9.2	41.4	51.9
Nominal GNP/GDP, short term	14.7	0.7	0.1	41.8	0.5
long term	4.2	0.6	0.1	0.2	0.2
Interest rates, short term	4.7	7.5	2.6	0.9	35.6
long term	0.1	3.2	1.6	1.0	31.1
France, Germany and Italy					
Lagged dependent	11.6	6.8	3.9	24.5	59.0
Nominal GNP/GDP, short term	64.5	6.7	9.4	42.9	64.2
long term	0.8	0.1	0.0	0.1	0.3
Interest rates, short term	2.3	1.6	0.5	0.3	12.7
long term	0.8	0.9	0.3	0.4	12.6

than the larger one. 1/ Two tests were used: the likelihood-ratio statistic described by Judge et al. (1985) (page 475) and the F statistic, recommended as a better alternative in small samples.

In the main, homogeneity of money demands appears to be strongly rejected, for all money definitions. For the large group, the null hypothesis is refuted (at the 5 percent level) 100 and 64 percent of the times, respectively, for the F and likelihood ratio tests; the "core" EMS group, with, respectively, 96 and 56 percent, does not perform much differently in this respect. Parameter restrictions are more easily accepted on the lagged dependent variable and on the short-term income elasticity; those on interest rates are virtually always rejected. On the whole, although parameter equality is only a sufficient condition for exact aggregation (Pesaran et al. (1989)), the results of Table 5 nevertheless convey a note of caution on the aggregated approach to the estimation of EC money demand functions.

Indications along the same vein derive from the results on cross-country correlation coefficients, shown in Tables 6.a and 6.b. The data in Table 6.a are obtained from estimation over the entire sample (1982-90), while those in Table 6.b are computed from the last two years of the estimated residuals. The "t-statistics" reported in parentheses are the ratios of the coefficients to an asymptotic approximation of their standard errors. 2/ The coefficients tend to be relatively high and positive for the income equations, revealing positive correlation of cycles and/or inflation particularly among France, Germany and Italy; correlation values are in some cases above 0.5 with "t-statistics" close to 3. On the contrary, correlation among the money equations, although in many cases negative as expected, is weak, and the "t-statistics" are generally well below 2. Again, therefore, on the basis of these results the conditions for substantial gain from aggregation do not seem to be met, neither for the nine-year period, nor apparently for the most recent two years.

1/ In order to carry out the tests it was necessary to introduce some modifications in the models. A lagged dependent variable was included in the M1 model for Spain, and own and cross interest rates were introduced in all models for broad money definitions. The "short-run" income coefficient for Spain includes all the three moving average terms, since, for reasons already explained, the moving average effect may spuriously result from imperfect interpolation of annual GDP data. The test of the interest rate effect on narrow money refers to the coefficient of the cross rates only; for Italy, the only country that has an own rate effect on M1, we assumed that the own rate reacts to the t-bill rate with a coefficient of 0.75 (approximately, one minus the marginal coefficient of reserve requirements). For broad monies, the interest rate effect are tested with respect to the differential between the own and cross rates.

2/ Derived from Graybill (1961), theorem 10.14.

Table 6a. Cross-Country Correlation Coefficients of Error Terms 1/

(Based on 1982-90 sample period)

Nominal Income 2/

	IT	GE	FR	UK	SP
IT	1	.24	.46	.49	-.12
		(1.44)	(2.74)	(2.96)	(-.69)
GE		1	.34	-.1	-.01
			(2.04)	(-.59)	(-.03)
FR			1	.33	-.12
				(1.98)	(.72)
UK				1	-.13
					(-.79)
SP					1

Narrow Money

	IT	GE	FR	UK	SP
IT	1	.07	-.04	-.05	-.07
		(.45)	(-.25)	(-.29)	(-.39)
GE		1	-.27	.11	.24
			(-1.6)	(.64)	(1.43)
FR			1	-.02	-.18
				(-.13)	(-1.05)
UK				1	-.02
					(-.11)
SP					1

Broad Money

	IT	GE	FR	UK	SP
IT	1	-.22	-.15	-.09	-.09
		(-1.33)	(-.87)	(-.55)	(-.56)
GE		1	-.02	.08	-.03
			(-.11)	(.45)	(-.19)
FR			1	.13	.37
				(0.76)	(2.2)
UK				1	.15
					(0.89)
SP					1

MR

	IT	GE	FR	UK	SP
IT	1	.07	-.02	-.13	-.09
		(.41)	(-.13)	(-.77)	(-.56)
GE		1	-.05	.06	.01
			(-.31)	(.34)	(.04)
FR			1	.11	.24
				(.63)	(1.42)
UK				1	-.04
					(-.27)
SP					1

MC

	IT	GE	FR	UK	SP
IT	1	.09	-.09	-.14	n.a.
		(.56)	(-.55)	(-.83)	
GE		1	-.06	-.10	n.a.
			(-.35)	(-.62)	
FR			1	.25	n.a.
				(1.51)	
UK				1	n.a.
SP					1

MB

	IT	GE	FR	UK	SP
IT	1	.02	.02	.01	0
		(.14)	(.10)	(.07)	(.03)
GE		1	.05	.09	-.05
			(.32)	(.51)	(-.30)
FR			1	.14	.43
				(.84)	(2.60)
UK				1	-.02
					(-.11)
SP					1

1/ In parenthesis: ratio of the correlation coefficient to the inverse of the square root of the sample size.

2/ Estimated from the system of narrow money demand equations. Estimates in the other systems are roughly similar.

Table 6b. Cross-Country Correlation Coefficients of Error Terms 1/

(Based on 1989-90 sample period)

Nominal Income 2/

	IT	GE	FR	UK	SP
IT	1	.1	.58	.68	.13
		(.3)	(1.64)	(1.92)	(.36)
GE		1	-.04	-.31	-.22
			(-.11)	(-.88)	(-.63)
FR			1	.66	-.07
				(1.86)	(-.19)
UK				1	.38
					(1.07)
SP					1

Narrow Money

	IT	GE	FR	UK	SP
IT	1	-.61	.15	.09	-.05
		(-1.72)	(.42)	(.26)	(-.13)
GE		1	-.05	-.23	-.25
			(-.15)	(-.65)	(-.71)
FR			1	.59	-.31
				(1.68)	(-.88)
UK				1	-.32
					(-.9)
SP					1

Broad Money

	IT	GE	FR	UK	SP
IT	1	-.34	-.20	.08	.19
		(-.96)	(-.57)	(.22)	(.53)
GE		1	.23	-.64	-.00
			(.64)	(-1.82)	(-.01)
FR			1	-.34	.53
				(-.97)	(1.51)
UK				1	-.12
					(-.33)
SP					1

MR

	IT	GE	FR	UK	SP
IT	1	.61	.16	.03	.16
		(1.73)	(.46)	(.09)	(.46)
GE		1	-.16	-.07	.32
			(-.44)	(-.19)	(.91)
FR			1	-.33	.11
				(-.94)	(.31)
UK				1	.01
					(.02)
SP					1

MC

	IT	GE	FR	UK	SP
IT	1	.65	-.23	-.48	n.a.
		(1.85)	(-.65)	(-1.35)	
GE		1	-.64	-.45	n.a.
			(-1.81)	(-1.27)	
FR			1	.05	n.a.
				(.13)	
UK				1	n.a.
SP					1

MB

	IT	GE	FR	UK	SP
IT	1	.26	.26	.55	.33
		(.73)	(.75)	(1.55)	(.92)
GE		1	.26	-.06	.14
			(.74)	(-.16)	(.39)
FR			1	-.36	.51
				(-1.02)	(1.43)
UK				1	.06
					(.17)
SP					1

1/ In parenthesis: ratio of the correlation coefficient to the inverse of the square root of the sample size.

2/ Estimated from the system of narrow money demand equations. Estimates in the other systems are roughly similar.

Looking more closely at the latter result, observe that a negative residual correlation across equations could derive not only from genuine phenomena of relocation or currency substitution, but also from erroneous classification of CBDs. To see this, consider a simple two-country world. Suppose that the correct specification of money demand in both countries is, say, that by resident holder (MR), and that cross-country error terms are not contemporaneously correlated. It is straightforward to show that by mistakenly specifying the equations according, say, to the currency criterion (MC) one would introduce negative correlation in the error terms; indeed, using the symbols introduced in Section II, we have $MR_A - MC_A = ABA + ABB - BAA - BAB = - (MR_B - MC_B)$, where the subscript indicates the country to which the aggregate refers to. Similarly, in most other cases in which one were to use the "wrong" definition of money stock, one would tend to introduce negatively correlated error terms, as shown in Table 6.c, upper part. 1/ In light of this implication, one may find surprising that the estimation of the model according to all extended definitions of broad money display negligible residual correlation.

An explanation can be found considering a third country, C, assumed to be attractive as a location for banking activities (a tax haven), but whose currency is not normally held by international investors. Assuming that deposits are typically denominated in currencies of A and B, and held by residents of the same country either in their own country or in country C, one can write a revised version of Table 1 to list all possible deposit combinations (Table 7).

Table 7. Cross-Border Deposits in a Three-Country Example

	Deposits held by			
	residents with domestic banks	residents with banks located in C	nonresidents with banks located in C	nonresidents with banks located in own country
in national currency	1 AAA	2 AAC	3 BAC	4 BAB
in foreign currency	5 ABA	6 ABC	7 BBC	8 BBB

1/ This result holds, though weakened, in a multicountry setting.

Table 6c. Extended Money Stock Definitions and Cross-Country Correlation of Money Demand Residuals

True Model	Fitted Model	Correlation of the Induced Residuals 1/
	Two Country Example	
MR	MC	-1
MR	MB	-1
MR	M2	0
MC	MR	-1
MC	MB	-1
MC	M2	-1<...<0
MB	MR	-1
MB	MC	-1
MB	M2	0
	Three Country Example	
MR	MC	0
MR	MB	0
MR	M2	0
MC	MR	0
MC	M2=MB	-1<...<0
MB	MR	0
MB	MC	-1<...<0
MB	M2	0

1/ The correlation is -1 when the induced residuals are identical but opposite in sign; it is between -1 and 0 if they include a part which is identical but opposite in sign; it is 0 when they are completely different.

As shown in the lower part of Table 6.c, the implications of this model for the residual correlations differ from the previous ones. Provided currency substitution is negligible, and even if relocation is important, cross-country error terms will not generally display negative correlation. This evidence is in broad agreement with the indications of Section II, that showed that movements across different currencies appear to be still of minor importance compared to "relocation," and that the latter involves to large extent countries outside the group we are considering. 1/

4. The information value of alternative monetary aggregates

Tables 8.a-8.b report the results of the analysis of the information content of the five monetary aggregates. Table 8.a provides the percentage reduction in the error variance of income obtained by using the information embodied in the monetary aggregates as computed from (3).

The table shows that the information value of monetary aggregates is far from irrelevant, exceeding the 10 percent threshold in many instances. Moreover, the information content of all aggregates appears to be higher in the last two years than on the average of the entire sample in around two thirds of the individual cases considered, and for all money definitions in the simple average computed across countries (last two lines of Table 8.a). 2/ While we do not have a precise explanation for this result, 3/ our conclusion is consistent with the relatively higher stability of money to income ratios observed in 1989-90 with respect to the previous period. The variance of the percentage change in the money to income ratio declined, on the average computed across our country sample and money definitions, from 4.8 percent in 1982-88 to 2.2 percent in 1989-90 (and from 2.8 to 1.2 percent excluding Spain). An increase was observed only in 5 out of the 24 money/country combinations here considered.

The last column of the table shows that the information content of monetary aggregates is, over the entire sample, higher in Italy and Germany. In the most recent period, while remaining high in Italy, the information

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1/ Luxembourg and, to a lesser extent, Belgium; the United Kingdom is the obvious exception.

2/ This statement remains true, with the exception of M2, if the average is computed without including the United Kingdom, the country where the information value of the aggregates has increased more.

3/ Our finding could be due to the phasing out of forms of financial innovation which, during the 1980s, affected significantly the stability relation between monetary aggregates and GDP (e.g., the payment of interest on bank deposits, the creation on new markets in competition with bank deposits, the development of new payment systems).

Table 8a. Information Content of Monetary Aggregates

(Values)

		Narrow Money	Broad Money	MR	MC	MB	Average
Italy	1982-90	8.6	4.7	7.3	3.9	4.5	5.8
	1989-90	21.1	1.1	3.8	3.8	3.6	6.7
Germany	1982-90	6.8	2.1	8.8	9.3	0.6	5.5
	1989-90	10.6	8.8	23.4	30.7	7.9	16.3
France	1982-90	0.0	5.4	4.9	2.6	3.8	3.3
	1989-90	0.5	0.1	8.9	7.5	3.8	4.2
United Kingdom	1982-90	11.2	5.1	0.3	1.4	0.1	3.6
	1989-90	23.5	26.3	15.1	9.0	1.0	15.0
Spain	1982-90	9.2	2.6	1.9	n.a.	0.5	3.6
	1989-90	3.2	0.3	0.0	n.a.	0.0	0.9
Average	1982-90	7.2	4.0	4.6	4.3	1.9	4.4
	1989-90	11.8	7.3	10.2	12.8	3.3	9.1

Table 8b. Information Content of Monetary Aggregates

(Ranks)

		Narrow Money	Broad Money	MR	MC	MB
Italy	1982-90	1	3	2	5	4
	1989-90	1	5	3	2	4
Germany	1982-90	3	4	2	1	5
	1989-90	3	4	2	1	5
France	1982-90	5	1	2	4	3
	1989-90	4	5	1	2	3
United Kingdom	1982-90	1	2	4	3	5
	1989-90	2	1	3	4	5
Spain	1982-90	1	2	3	n.a.	4
	1989-90	1	2	3	n.a.	3
Average	1982-90	2.2	2.4	2.6	3.3	4.2
	1989-90	2.2	3.4	2.4	2.3	4.0

content has increased more in Germany, and especially in the United Kingdom. Monetary aggregates appear to be less informative in France and, especially in 1989-90, in Spain. 1/

We can now compare the information contents of alternative monetary aggregates taking into account both the quantitative results of Table 8.a and the qualitative summary provided in Table 8.b, showing the ranking among alternative aggregates in each country, for the entire sample and for the last two years.

A feature emerging clearly from both tables is the weak performance of MB, which confirms the indications already drawn in Section IV.2. We can thus conclude that the location of deposits with the banking system of a given country does not provide good indications of income developments in that country.

All other conclusions are contingent on the sample period considered. Over the entire sample, the most informative aggregate is narrow money, both from a quantitative (Table 8.a, second row from bottom) and a qualitative (Table 8.b, second row from bottom) point of view. This may come as a surprise as, in many countries, financial deregulation in the 1980s led to the payment of interest on sight deposits, a potential source of instability for the relation between narrow money and income. Several factors explain our result. First, we are here concerned with very short-term projections (one quarter) and in this context financial innovation, altering the long-run relation between money and income, may not be very relevant. Moreover, in one case (Spain) the trend variables provide a proxy for financial innovation. Second, in the sample period financial innovation did not necessarily affect our narrow money definitions; recall, in this respect, that: (i) as narrow money definition for the United Kingdom we are considering M0 (i.e., monetary base), which has been less affected by financial innovation than M1; (ii) in Italy the birth of a market for government paper affected the demand for narrow money mainly in the early 1980s; and (iii) in Germany financial innovation has always affected bank deposits less than in other countries.

1/ The results for Spain are probably to a large extent fictitious. As the quarterly GDP series used for Spain is extremely unstable (see Section IV.2), it is not surprising that money provides little information on it. However, the decline in the information content observed in the last two years is consistent with the results presented by Dolado and Escriva' (1991). They impute the loss of information value of all monetary aggregates to the disintermediation of banks after the imposition of credit ceilings in the second half of 1989, which stimulated the expansion of the commercial paper market.

The information content of narrow money is particularly high in Italy, in the United Kingdom and Spain; it is zero in France. 1/ Note also that the over the entire period the performance of three broad money aggregate, M2, MR and MC, is very similar (the average information content is, respectively, 4, 4.6, and 4.3 percent); only in the last two years the performance begins to diverge sharply.

Consider now the 1989-90 period. Focusing first on the broad money measures, MC appears the most informative aggregate, followed by MR, while the traditional definition of broad money (M2) ranks third. This ranking holds regardless of whether we look at the quantitative information of Table 8.a or to the qualitative information of Table 8.b (here the difference between the first two definitions is in favor of MR, but negligible). As to individual countries, the loss of information value of the traditional money definitions is particularly strong in France and in Italy (in both absolute and relative terms). In Germany, the information value of the traditional aggregate increases but much less than that of the extended ones; the ranking remains unchanged. Only in the United Kingdom does M2 improve its relative position. 2/ These findings, jointly with the fact that traditional definitions of broad money perform poorly in periods and countries (such as France, Italy, and Germany in 1989-90) when CBDs rise rapidly, support the inclusion of CBDs in the relevant monetary aggregates.

The issue of which CBDs should be included is less clear-cut. The performances of MC and MR are close also in the last period. MC appears to have on average higher information content than MR (12.8 percent against 10.2 percent), but the former average excludes Spain, where, as seen, the information value is quite low for all aggregates. Indeed, for the average of the four largest countries the two aggregates have the same information content (12.8 percent).

Overall, the results unambiguously indicate that "BBA type", i.e., purely relocated foreign deposits (e.g., German deposits in deutsche marks held in Italy, or, in a European perspective, U.S. deposits held in U.S. dollars in European countries) should not be included in the monetary aggregates of the host country; 3/ purely relocated domestic deposits

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1/ Bordes and Strauss-Kahn (1989) find that, contrary to some broad money definitions, narrow money in France is cointegrated with income. This is not necessarily inconsistent with our conclusions, because cointegration refers to the existence of a long-run equilibrium relation, while we focus on very short-run information properties.

2/ The case of Spain is peculiar because, as mentioned, all aggregates lose information value, with no change in their relative position.

3/ This is implied by the negative performance of MB, which is the only definition including BBA deposits.

should instead be included in national money definitions. 1/ Unfortunately, the evidence is not clear with respect to the CBDs involving forms of currency substitution, namely all residents' deposits in foreign currency (ABA+ABB), and all foreign deposits in domestic currency (BAA+BAB). Indeed, the former set of deposits is included in MR and excluded from MC, while the opposite occurs for the second set.

A last remark refers to the results on narrow money in the last two years. The narrow aggregates continue to be informative, dominating M2 and performing slightly better than MR and only marginally worse than MC. While remaining by far the most informative aggregate in Italy and Spain, narrow money loses some relative ground in the United Kingdom, while it maintains its position in Germany; only in France its information content remains consistently poor. Overall, the performance of narrow money definitions in both sample periods is remarkably good, and suggests the possibility that their usefulness as policy indicators in Europe may currently be underestimated.

V. Conclusions

In this paper we analyzed the relevance for monetary control in Europe of the sharp increase of CBDs observed in the last few years. The starting point of the analysis was the observation that, at present, the bulk of CBDs are (almost entirely) excluded from conventional money demand definitions in all EC countries. Thus, an increasing share of banks' liabilities is presently not considered as part of the money supply not only at the national but also at the European level. This is potentially a cause for concern for the monetary authorities as the stability relation between traditional monetary aggregates and final policy targets may be undermined. We addressed this issue by computing the "information content", with respect to nominal income, of five monetary aggregates: narrow and broad monies, as traditionally defined in each country, and three extended broad aggregates including CBDs (based on the residency of the holder, the currency of denomination, and the residency of the issuer bank). The information content was computed for each money definition and for each of the five largest EC countries, using the estimated coefficients of a simultaneous multicountry system of money demand and income determination. As a by-product, the empirical model was also used to examine the issue of aggregation of money stocks at the EC level. Due to data limitations, the model was kept simple, by using relatively strong prior assumptions; further analyses, as well as qualitative improvements in the BIS data, will allow in the future to check and strengthen our results.

In summary, our evidence supports the relevance of CBDs for the stability of money-income relationships. As a result of the geographical

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1/ These two indications are obviously consistent. They imply that deposits of the AAB type are related to income of country A and unrelated to income of country B.

mobility of deposits (currency substitution appears so far to be less important) traditional broad monetary aggregates have become relatively more unstable and are dominated by the extended aggregates, particularly in the definitions based on holders' residency and on the currency of denomination. On average, narrow money emerges as the most informative aggregate over the entire data sample, but has recently lost some ground with respect to the broader aggregates.

These results have implications for monetary targeting both at the national and at the EC level. They suggest that national monetary aggregates should be redefined to include CBDs. Which CBDs are to be included appears to be less obvious. While the definition based on the residency of the host bank appears clearly inadequate, it was not possible to discriminate between the definitions based on the residency of the holder and on the currency of denomination. This is possibly a consequence of the fact that currency substitution is still a limited phenomenon and that, therefore, the definitions of money based on the residency of the holder and on the currency of denomination tend to be relatively similar.

Contrary to earlier findings, our results do not support the idea that national money stocks can as yet be easily combined into an EC-wide aggregate, having a well-defined stability relation with GDP. Our counter-evidence is based on the heterogeneity of individual country parameters and on the lack of significant negative cross-country correlations among money demands, which reveal that integration of payment systems and money markets is far from being complete. Should an EC-wide monetary aggregate at some point become a key indicator for EC monetary policy (presumably, in Phase 2 of EMU), our results on CBDs suggest, again, that the criteria based on resident holders or currency of denomination should be preferred; further evidence is needed to discriminate between the two.

Data Description and Sources

1. Cross-border deposits

Data on CBDs are provided by the Bank for International Settlements (BIS) (so-called territorial statistics). With reference to the definitions given in paragraph 2.1, data on cells 2, 4, 5, and 6 are available in the Statistical Annex of the BIS quarterly, International Banking Developments. 1/ The same source also provides the sum of cells 3 and 7: the breakdown was obtained from unpublished BIS data.

The raw data from each country are represented by the end-of-quarter foreign currency and external positions of individual banks of reporting countries: these positions are first conveyed to a central authority in the respective countries, usually the central bank, which in turn, after aggregating the data (giving rise to cells 3, 5, and 7 of Table 1) and converting them into U.S. dollars, transmits them to the BIS. The instruments included are sight, time and saving deposits (on all the maturity spectrum), and bank CDs.

Among the major shortcomings of the series the following are most commonly mentioned: the distinction made by reporting banks between bank and nonbank sectors is based on rules which are not fully harmonized; "fiduciary accounts" in Swiss banks are not reported officially to the BIS (which explains the relatively low external positions reported by this country); for many negotiable instruments it is difficult to identify the nationality of the holder. The series starts in most cases at the end of 1977, but due to major coverage breaks their reliability improves only after 1982.

2. Monetary aggregates

All traditional monetary aggregates were obtained, directly or indirectly (i.e., via the BIS Data-Bank), from national sources. Raw, end-of-period data in domestic currency terms were seasonally adjusted through X-11. All extended money stock definitions were computed by adding/sub-tracting to the broad money stock (unadjusted) the appropriate cells of CBDs, converted in domestic currency, then seasonally adjusting the total. 2/

1/ For a description of the coverage and composition of these data, see BIS (1988).

2/ For the United Kingdom, data on cells 3 and 7 were estimated for 1982 and 1983, since the BIS series starts only in 1983-Q4. For cell 5, data for this period were taken from Bank of England's Quarterly Bulletin. For Spain, no breakdown is available between deposits denominated in pesetas and other currencies; moreover, data in cells 3, 5, and 7 were estimated for 1982 and 1983, since the BIS data start in 1983-Q4.

Definitions of traditional aggregates are as follows: 1/

	Narrow Money	Broad Money
Germany	M1	M3
France	M1	M3
Italy	M1	M2
United Kingdom	M0	M4
Spain	M1	ALP

3. Interest rates

For Germany, the own return on broad money is a weighted average (with variable weights) of the returns on: M1 (assumed to be zero); M2-M1 (proxied with the interest rate on 3-month deposits); M3-M2 (proxied with the interest rate on saving deposits at statutory notice). Short- and long-term alternative rates are the 3-month interbank rate and the rate on government bonds with maturity over 4 years.

For France, the own return on broad money is a weighted average (with fixed weights based on average shares in M3) of the returns on: M1 (assumed zero); M2-M1 (proxied with the interest rate on "comptes sur livrets"); M3-M2 (proxied with the interest rate on "dépots à terme et bons de caisse"). Short-and long-term alternative rates are the 3-month interbank rate and the rate on long-term government bonds.

For Italy, the own return on M1 is a weighted average (with variable weights) of the return on paper currency (zero) and the return on bank deposits. The return on M2 is a weighted average (with variable weights) of the rates on paper currency (zero), bank and postal deposits. The alternative rate is the rate on treasury bills. All interest rates are net of the withholding tax.

For the United Kingdom, the own return on broad money is a weighted average (with fixed weights based on average shares of M4) of the returns on: bank retail deposits (proxied with the rate on deposit accounts at 7-day notice at London clearing banks); building society shares and retail deposits (proxied with the rate on building society shares); banks and building society wholesale deposits (proxied with the simple average of overnight and 3-month interbank rates). Short- and long-term alternative rates are the 3-month interbank rate and the rate on 20-year government bonds.

For Spain, the own return on broad money was proxied with the rate on 6- to 12-month time deposits. Short- and long-term alternative rates are

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1/ Most recent definitions of each aggregate.

the treasury bill rate and the rate on government bonds with maturity of more than two years.

4. Other variables

Nominal GNP/GDP (GNP for Germany, GDP for all other countries) data are from OECD Main Economic Indicators; for Spain, annual data were interpolated using the series of industrial production. For Italy, a revised ISTAT-Bank of Italy series was used. Total gross personal wealth (financial and tangible) for the United Kingdom was kindly provided by the Bank of England.

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