A macroeconomic view of Eurodollar market expansion after 1973

Galy, Michel

Banque de France, 39 rue Croix des Petits Champs, 75001 Paris, France

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Michel Galy (*)

Summary

This paper analyzes the Eurodollar market, investigating the reasons for its expansion and the consequences for monetary policy. In the first part of the paper, the issue of credit and money creation by offshore banks is considered. The nature of the liquidity creation process is shown to be dependent on the specific definitions of money and balance of payments position that are adopted by the national authorities. The concepts of money (in domestic and foreign currencies)held by residents and of basic balance are specified, and it is demonstrated that the domestic economy of a given country is not directly affected by the external use of its currency between non-residents. The development of these external transactions, however, proves to be directly dependent on the domestic policies followed by the monetary authorities of that country.

The second part of the paper is devoted to an empirical analysis of the development of the Eurodollar market during the period from 1974 to 1980. Estimates of a partial adjustment model show that credit expansion in the Eurodollar market during this period was largely "demand determined," owing to the monetary policy implemented by the Federal Reserve. The econometric results stress the key role of international trade in the development of the Eurodollar activities during these years. Implications of these results for the regulation of Euromarkets are briefly considered in the conclusion.

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* Mr. Michel Galy is deputy director at Banque de France. A first version of this paper was completed during a period while he was in the Research Department of the International Monetary Fund on secondment from Banque de France. David I. Folkerts-Landau, Malcolm Knight and Denis Richard from the Research Department provided extensive comments on this earlier draft. The author retains all responsibility for the remaining errors. The views expressed in this paper do not reflect necessarily the position of the French monetary authorities.

I. Introduction

Among the most controversial questions concerning Eurocurrency banking activities, 1/ two issues are of particular concern for central bankers: first, the possibility that these activities are able to create liquid assets and bank credit outside the reach of monetary authorities; and second, the question of what are the fundamental factors accounting for the dramatic expansion of these operations since 1973. This paper attempts to provide theoretical and empirical answers to these questions, using a multinational portfolio approach that emphasizes the balance sheet constraints of the bank and nonbank sectors both at home and abroad.

Following a discussion of the effect of Eurodollar expansion on the money supply process and related external payments imbalances in a schematic accounting framework in Section II, the mechanics of credit and broad-money creation by Eurobanks is considered. In Sections III and IV an empirical analysis of the behavior of banks and nonbanks from 1974 to 1979 is conducted to test the hypotheses developed in Section II for both the broad and narrow definitions of money supply. It is also argued, following Heller (1979), that during this period Eurobanks were able to supply Eurodollar loans at an interest rate that was essentially determined exogenously in the U.S. domestic financial market. In this sense, the flow of Eurocredit was largely "demand-determined." Building on this characteristic, Section V presents a partial-adjustment model of the Eurodollar market, stressing the importance of world trade as a major factor in its expansion, while Section VI provides empirical estimates of this model. Finally, several proposals for the regulation of Euromarkets are presented in the conclusion.

II. The Effects of Eurodollar Activities on the Money Stock and the Balance of Payments: A Framework for Analysis

Much of the existing literature on the effects of Eurodollar activities on the U.S. balance of payments and money stock treats the two subjects as if they were unrelated. In this section, a multinational view is adopted and the need for consistent definitions for these two statistical concepts is stressed.

Table 1 presents a financial asset-sector matrix for bank and nonbank agents in a multinational framework. The table is designed to highlight the Eurodollar activities of these agents and the way they impinge on various definitions of money supply and on external payments positions. The matrix distinguishes between the United States (US) and the rest of

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1/ For a presentation of the various theses concerning the nature and effects of Eurocurrency activities, see Stern (1976), Johnston (1981).

Table 1. Financial Asset-Sector Matrix 1/

Sectors	Markets in the U.S. Economy				Markets in the ROW Economy				Net worth
	Deposits in dollars (1)	Deposits in ROW currency (2)	Loans in dollars (3)	Loans in ROW currency (4)	Deposits in Euro-dollars (5)	Deposits in ROW currency (6)	Loans in Euro-dollars (7)	Loans in ROW currency (8)	
1. U.S. resident banks	$-M^*_{d_1}$	$-M^*_{f_1}$	$L^*_{d_1}$	$L^*_{f_1}$	-	M_{f_1}	-	$-L_{f_1}$	0
2. U.S. resident nonbanks	$M^*_{d_2}$	$M^*_{f_2}$	$-L^*_{d_2}$	$-L^*_{f_2}$	M_{d_2}	M_{f_2}	$-L_{d_2}$	$-L_{f_2}$	NW_2
3. ROW resident banks	$M^*_{d_3}$	-	$-L^*_{d_3}$	-	$-M_{d_3}$	$-M_{f_3}$	L_{d_3}	L_{f_3}	0
4. ROW resident nonbanks	$M^*_{d_4}$	$M^*_{f_4}$	$-L^*_{d_4}$	$-L^*_{f_4}$	M_{d_4}	M_{f_4}	$-L_{d_4}$	$-L_{f_4}$	NW_3
Interest rate determined by each market	rusd	rfd	rus	rf	rd	red	r	re	

1/ This asset-sector matrix is based on Tobin (1968), and Knight (1972).

the world (ROW). There are only two financial instruments: money, denoted (M), and bank credit, denoted (L). An asterisk denotes U.S. financial markets. Money is defined as cash, demand deposits and other short-term deposits. Credits, which are supplied by banks for short and long term maturities, are instruments that cannot be sold on a secondary market. This simplified framework neglects the market for corporate bonds.

The first subscript associated with each variable defines the currency in which (M) and (L) are expressed: (d) for the U.S. dollar and (f) for ROW currencies. On the assumption that a fixed exchange rate system is in force, the exogenous exchange rate between (f) and (d) is held constant and equal to unity. 1/ The second subscript defines the sector that holds the asset. There are four sectors: the U.S. and ROW domestic banking sectors (including the central bank) subscripted 1 and 3 respectively, and the U.S. and ROW non-bank sectors (including governments) subscripted 2 and 4 respectively. For instance, according to these conventions, L_{d2} and L^{*}_{d4} represent respectively the loans in d currency granted by the ROW banking sector to the U.S. nonbank sector and the loans in d currency granted by the U.S. banking sector to the ROW non-bank sector. Both the U.S. and ROW nonbank sectors hold deposits and borrow via loans in U.S. dollars and in ROW currencies, either at home or abroad. The U.S. and ROW banking sectors also hold financial liabilities and claims against each other in the d and f currencies.

In the simplified asset-sector matrix of Table 1, the rows are balance sheet identities of the four respective sectors and columns represent market clearing conditions for each type of asset. Instruments that are liabilities of a sector are preceded by a minus sign. Starting from this framework, let us define the external activities of banks resident in the U.S. and ROW 2/ and the way they affect the money stocks and the balance of payments positions of both countries.

As has already been noted, financial assets and liabilities are organized in Table 1 according to three criteria: the location of the asset (ROW and US), the currency (f or d), and the sector (banks or non-banks) which holds it. This system permits us to isolate the Eurodollar activities of ROW banks in terms of their assets and liabilities denominated in currency d and held by the ROW and U.S. nonbank sectors; that is, the deposit and credit markets depicted in columns (5) and (7) of Table 1, together with their clearing-market prices rd and r. By the same token, columns (2) and (4) define the external deposit and credit markets of the ROW currency.

1/ It is also this assumption which permits us to aggregate all foreign currencies into a single currency.

2/ It is worth noting that a U.S. bank branch or subsidiary located in the ROW economy is here defined as a ROW resident bank.

The relative sizes and rates of expansion of these external markets depend largely on the degree of international capital market integration; that is, on the degree to which domestic regulations 1/ imposed by central banks on the process of credit and money creation, either toward residents or non-residents, affect the size and growth rates of various markets. In this respect it is useful to consider the two following extreme cases:

(i) Assume that markets are perfectly integrated, so that external and domestic assets are perfect substitutes. In a world of certainty with a fixed exchange rate system, arbitrage will always maintain the equalities rusd = rd, rfd = red, rus = r, rf = re. In this case, the relative size of external financial markets will be independent of interest rate variations and will be determined by other factors, such as the real and cyclical movements affecting, respectively, the domestic activities and international transactions 2/ that are usually financed via these external markets.

(ii) Alternatively, assume either that there is uncertainty or that the authorities impose restrictions on portfolio behavior. In this case the relative size of the external asset market for a given currency will obviously depend on the origin and nature of regulations, on the respective risk and return of competing assets either in US or ROW currency, as well as on the factors previously cited in (i). If the ROW country implements controls on international capital transactions involving instruments denominated in domestic currency, the relative size of Eurodollar markets will be larger than in situation (i) where markets are perfectly integrated, and the use of the dollar as an international currency will be enhanced. Conversely, if US exchange controls or regulations limit the access of non-resident banks to the U.S. domestic market, the relative size of Eurodollar markets will be smaller than in situation (i). Thus, for given levels of real income and prices the relative size of Eurodollar markets will be larger the less regulated are U.S. capital markets relative to those of the ROW. However, for a given set of exchange controls and regulations, the expansion of Eurodollar markets will depend mainly on the development of international transactions, risks, and rates of return on other assets.

We now turn to the consequences of an expansion in Eurocurrency deposits on the domestic money supply. If we assume that the actions of

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1/ These include mainly, restrictions on lending to non-residents and different required reserve ratios on non-resident deposits than on resident deposits. On these points see, for instance, Hewson and Sakakibara (1975), Crockett (1976), Resler (1979).

2/ On the role of international trade in the growth of Eurocurrency markets, see Swoboda (1968).

each central bank are restricted to the resident banking sector in its own country, we may consider five possible definitions of the money stock held by nonbank sectors. For the ROW, these would be (from Table 1):

M_1 = domestic money held by residents only (M_{f_4}),

M_2 = domestic money held by both residents and non-residents ($M_{f_4} + M_{f_2}$),

M_3 = monetary assets denominated in both domestic and foreign currencies held by residents only ($M_{f_4} + M_{d_4}$),

M_4 = domestic and foreign monetary assets held by both residents and non-residents ($M_{f_4} + M_{d_4} + M_{f_2} + M_{d_2}$),

M_5 = domestic and foreign monies held by residents and domestic money held by non-residents ($M_{f_4} + M_{d_4} + M_{f_2}$).

It is clear from these definitions that only M_1 excludes Euro-deposits and this definition, as will be seen below, is generally not employed by the main industrial countries.

The choice of a particular definition of the money stock depends on the objectives of monetary policy. For example, in a pure fixed exchange rate system and with a coordinated policy by the two central banks, the authorities will be interested in the links between real activity and money at a world-wide level. In this case, the "correct" definition of money should encompass all deposits held by nonbanks, both resident and non-resident, irrespective of the currency in which they are denominated. Thus, taking the assets held by nonbanks in the U.S. and ROW economies, we are able to define national money stocks (M_4) which are compatible with the definition of a world money supply, in which Eurocurrency deposits have to be included:

$$M_4 \text{ (US)} = M^*_{d_2} + M^*_{d_4} + M^*_{f_2} + M^*_{f_4}$$

$$M_4 \text{ (ROW)} = M_{f_4} + M_{f_2} + M_{d_4} + M_{d_2}$$

In contrast if, as is more likely in an exchange rate system of managed floating, the authorities intend to focus on the relation between money and the growth of the real sector in the home economy, other concepts of money will be more relevant for the implementation of monetary policy. The definitions employed by the major industrial countries suggest that

the choice between these alternatives 1/ as targets of monetary policy is not as straightforward as it might seem. Table 2 presents the definitions of the targeted monetary aggregates in the seven major industrial countries in terms of the concepts adopted in Table 1.

Table 2. Definitions of Targeted Monetary Aggregates in Major Industrial Countries

Germany	$M_{f_4} + M_{d_4}$
Italy	$M_{f_4} + M_{d_4}$
United Kingdom	M_{f_4}
France	$M_{f_4} + M_{d_4} + M_{f_2} + M_{d_2}$
Japan	M_{f_4}
Canada	$M_{f_4} + M_{f_2} + M_{f_1}$
U.S.A. - before 1979	$M^*_{d_2} + M^*_{d_4} + M^*_{d_3}$
- after 1979	$M^*_{d_2} + M^*_{d_4} + M_{d_2}$

The M_3-type definition of money targeted by the first two countries above, when associated with a particular definition of external payment imbalances, displays some interesting properties which make more obvious the impact of offshore financial activities on the conduct of monetary policy. To illustrate this point, let us define the monetary survey of the U.S. and ROW economies according to the M_3 concept, using the consolidated balance sheet of the banking sectors (rows 1 and 3 in Table 1), as follows:

1/ On difficulties of defining a "correct" stock of money in an open economy, see Bryant, 1980.

Table 3. Monetary Survey of the U.S. and ROW Countries

	1. U.S. Economy	
	Assets	Liabilities
vis-à-vis residents	$L^*_{d_2} + L^*_{f_2}$	$M^*_{d_2} + M^*_{f_2}$
vis-à-vis non-residents (net foreign assets)		
(i) banks	$A^* = [L^*_{d_3} + M_{f_1}] - [M^*_{d_3} + L_{f_1}]$	
(ii) non-banks	$B^* = [L^*_{d_4} + L^*_{f_4}] - [M^*_{d_4} + M^*_{f_4}]$	

	2. ROW Economy	
	Assets	Liabilities
vis-à-vis residents	$L_{f_4} + L_{d_4}$	$M_{f_4} + M_{d_4}$
vis-à-vis non-residents (net foreign assets)		
(i) banks	$A = [M^*_{d_3} + L_{f_1}] - [L^*_{d_3} + M_{f_1}]$	
(ii) non-banks	$B = [L_{d_2} + L_{f_2}] - [M_{d_2} + M_{f_2}]$	

In the above presentation, the credits and deposits of the banking sectors have been split between residents and non-residents, in order to introduce a distinction which is necessary for external payments analysis. With such a reorganization the money stocks (defined as $M_{f_4} + M_{d_4}$ for ROW and $M^*_{d_2} + M^*_{f_2}$ for the U.S.) appear to be, by virtue of the balance sheet constraint of the financial intermediaries, the strict counterpart of credit granted either to residents ($L_{f_4} + L_{d_4}$ for ROW and $L^*_{d_2} + L^*_{f_2}$ for the U.S.) or net credit to non-residents (A + B for ROW and A* + B* for the U.S.).

Keeping in mind this property of M_3, let us consider now the case of an increase in Eurodollar credit to a ROW resident (ΔL_{d_4}). First, an increase of the same amount is registered in M_{d_4} and consequently in M_3, according to the balance sheet constraints of the banking sector. Second, the ROW resident can choose between four possibilities. He may:

(i) sell his dollar denominated asset against ROW currency to another resident non-bank, and thus leave 1/ M_3, M_{f_4} and M_{d_4} unchanged;

(ii) sell to the ROW banking sector, which will create domestic money in counterpart. In this case M_3 is not affected, since the increase in M_{f_4} is matched by a decrease in M_{d_4}. Note that, in the traditional textbook presentation, an increase in the money supply (implicitly define as M_{f_4}) is induced by the sale of foreign currency to the central bank. In this case, by contrast, the increase in the money supply stems from the initial expansion of credit in foreign currencies.

(iii) sell to a non-resident; the effect on the composition and level of M_3 is the same as in (ii). A reverse movement will be registered in the M_{d_2} and M_{f_2} accounts of non-residents. Finally, if the non-resident transfers his Euro-deposit to the US banking sector, there will be a symmetrical reduction in $M^*_{d_3}$ and M_{d_2} which does not affect the money stocks in ROW, but increases that in the US (increase in $M^*_{d_2}$ and decrease on the asset side of $M^*_{d_3}$).

(iv) transfer the proceeds to a US resident account in the US banking sector in order to pay for imports. In this situation, the money stock will decrease in ROW and will increase in the US.

Thus, with such a definition of money, it appears that an increase in Eurodollar credit to ROW residents can have different effects, depending on the way the loan is used. As long as the Eurocurrency is employed between ROW residents, only the ROW money supply is involved. 2/ If the

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1/ Only balance sheet constraints are considered. In particular, the possible effects of price variations and consequent portfolio adjustments among all sectors are neglected.

2/ We ignore here the necessity for Eurobanks to hold minimum cash balances in domestic dollars. After 1979, this omission is legitimate, since liabilities of home financial intermediaries to foreign banks are not included in the US money stock (see Table 2).

proceeds of the Eurodollar loan are used to settle a purchase of US goods, only the US money stock is affected. Finally, an increase is registered in both the US and ROW money stocks when the Eurodollar credit is used to initiate a capital transfer between the ROW and US banking sectors. This double counting results from the fact that liabilities toward the non-resident non-bank sector are excluded from the M_3 definition of the money supply. This result is consistent with the underlying assumption of this definition: namely that from the point of view of the growth of nominal domestic product, only money held by residents matters. If the deposits of non-resident non-banks were included (M_4), the transfer of a Eurocurrency deposit in the domestic banking sector of the issuing country would have offset the initial measured increase in ROW money stock and would have increased that of the US (i.e., the situation of France, Canada and the United States after 1979). Moreover, if all non-resident deposits (banks and non-banks) were part of the money supply (as in the United States before 1979), neither the US nor ROW would have been affected.

The asset-sector matrix in Table 1 can also be used to study the effect of Eurodollar activities on the balance of payments. The cumulated current account surplus of the ROW countries (BOP) determines their net claims on the U.S. economy: these claims are depicted in the balance sheets of the US and ROW banking sectors. The external position (NF) of ROW countries is built up by taking the net position of the non-residents (bank and nonbank positions are referred to by the letters A and B for ROW and A*, B* for US in Table 3) in the ROW banking sector, and the net position of the ROW residents in the US banking sector (B*).

Thus, the ROW and US external positions, respectively, can be defined as follows:

$$NF = A+B-B^*$$

$$NF^* = A^*+B^*-B$$

and since $A = -A^*$, we have necessarily $NF = -NF^*$. The imbalance on the current account corresponds directly to the variation of this external position, which implies that: $BOP = \Delta NF = \Delta(A+B-B^*)$. It appears clearly that the financing of BOP disequilibrium can be channelled either through the domestic banking sector (B), that is, in Eurodollars and domestic currency, or directly via the foreign banking sector in domestic dollars (B*) or external ROW currencies.

However, it is possible to adopt a more restrictive concept of the external position (NFA) of a country by keeping on the right hand side of the identity only the financial relations with non-residents registered in the domestic banking sector. In that case the basic balance position is defined as follows:

$$BOP + \Delta B^* = \Delta NFA = \Delta(A+B)$$

This definition is particularly useful when it is associated with the M_3 money supply concept 1/ (see Table 3). It indicates that variations in the money supply are the strict counterpart of variations of credit granted to residents, and of the basic balance position.

In order to clarify the impact of Eurodollar operations on the basic balance so defined, the assets and liabilities of non-residents must be reorganized according to their currency denomination. Dividing NFA according to this criterion permits us to define the following two net positions:

(i) the net dollar lending to or borrowing from US residents: $NFA_d=[(M^*_{d_3} + L_{d_2}) - (L^*_{d_3} + M_{d_2})]$, which represents the net assets held by the ROW banks in domestic dollars plus net lending in Eurodollars to US residents;

(ii) the net ROW currency lending to, or borrowing from, US residents: $NFA_f = [(L_{f_1} + L_{f_2}) - (M_{f_1} + M_{f_2})]$.

Using these definitions, we analyze the impact of a Eurodollar credit to a ROW resident on the basic balance, with the four hypotheses of the example discussed earlier.

(i) In the first and second cases, the proceeds of the Eurodollar loan are used to settle transactions between ROW residents. Thus, the basic balance is not involved and the US economy is not affected by the use of the dollar as a means of payment between non-residents. However, this assertion is relevant only under the assumptions of a fixed exchange rate system. 2/

(ii) In the third case, the capital flow that occurs between ROW residents and US residents does not alter the basic balance; a modification will simply be registered in the distribution of NFA between NFA_d and NFA_f; the increase in the former will be offset by a decrease in the latter;

1/ It is worth noting that with such a definition of the external position, the money stock can be altered by the change in the basic balance, even in the absence of central bank intervention.

2/ In the alternative case, the sale of a dollar-denominated asset against ROW currency would have prompted an exchange rate variation which could result in an alteration of the currency distribution of portfolios held by US residents and non-residents, and thus, could affect the basic balance position.

(iii) In the fourth case, the settlement of imports from the USA with the proceeds of the Eurocredit results in a decrease in NFA_d, owing to the reduction in M_{d_4} through the change in the domestic dollar assets held by the ROW banks ($M^*_{d_3}$), which makes up for the basic balance deterioration. 1/

Thus, the use of a Eurodollar credit by a ROW resident will affect the US/ROW basic balance position only if the loan is employed to buy goods or services (ΔBOP) or net assets (ΔB^*) in the US economy.

It is worth noting that, in the last example, the change observed in the US money stock is consistent with the variation registered in the balance of payments position, for we have adopted consistent definitions of money and balance of payments. Let us assume, for instance, that the balance of payments position had been expressed on an 'official settlements' basis. Since an import payment financed with the proceeds of a Eurodollar credit does not involve variations in the net foreign assets of central banks, the balance of payments situation so defined is not affected, but M_3 money stocks would have been altered.

In sum, from the simple analytical framework presented in this section, one can draw the following conclusions:

(i) For a given level of activity, the relative size of an external financial market is a function of the degree and nature of financial regulations. But its development depends on other factors, mainly the real growth of international demand;

(ii) A clear understanding of the effects of external financial markets on domestic money stocks and balance of payments positions requires the use of consistent definitions of these variables. The domestic and foreign currency deposits held by residents in the domestic banking system (M_3) and the basic balance are, for most purposes, the relevant concepts. According to these definitions, a Eurodollar loan to a ROW resident will affect both the balance of payments and US money stocks only if the proceeds are used in the US economy. Otherwise, the development of Eurodollars transactions between ROW residents does not affect the US economy. This conclusion, however, is always valid only in a pure fixed exchange rate system with perfect certainty. If not, the international use of the Eurodollar between ROW residents could result in exchange rate variations which will alter in turn the US balance of payments position and money supply.

1/ For an opposite view on the interrelations between the development of transactions in Eurocurrencies and the balance of payments position see Basevi (1973) and Niehans and Hewson (1976).

III. Credit and Money Creation: The Situation After 1974

The simplified world described in Section II ignores such complications as the role of high-powered money, the distinction between demand and term deposits, and specific aspects of national financial regulations. In such a world it makes little difference whether the ROW banks create credit and money in domestic or foreign currencies. In the real world, the capacity to supply credits in Eurodollars ultimately depends on the Eurobanks' ability to hold dollar-denominated transactions balances with the US banking system, in the same way as they hold reserves at their national central bank as the basis for domestic deposits and loans.

For example, assume that a Brazilian importer uses a Eurodollar loan to settle his imports from Germany. His Eurobank will have to make a transfer from its demand deposit account in US bank A to the German exporter's account in US bank B, or to another Eurobank in which the German exporter holds his liquid assets. It is well known that the smaller are the leakages from the Eurodollar market, 1/ the lower is the Eurobanks' refinancing requirement in the U.S. domestic market and the higher the multiplier effect. 2/ Irrespective of the amount of redeposits and the stability of the multiplier, it remains a fact that the Eurobanks' ability to expand their Eurodollar credits depends, in the last resort, on their capacity to acquire claims on U.S. banks. 3/

If sales of other US securities are excluded, Eurobanks, taken in the aggregate, essentially have three ways to do this:

(i) borrowing domestic dollars from a US resident or from a US bank;
(ii) borrowing domestic dollars from a private or public nonresident;
(iii) borrowing a foreign currency and buying dollars either on behalf of their customers or in a deliberate attempt to speculate in favor of the dollar.

If the first possibility is not allowed because of exchange restrictions then the Eurodollar market is isolated from the US domestic market. Consequently, the resources of the offshore banks will be restricted to

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1/ There is a symmetric increase in L_{d_4} and M_{d_4} and no change in $[M^*_{d_3} - L^*_{d_3}]$.

2/ Various more or less sophisticated versions of the multiplier approach, usually applied to fractional reserve systems, have been proposed to explain the growth of the Euromarket. The most elaborate version of this thesis is found in Willms (1976).

3/ On the non-applicability of the money-multiplier hypothesis to the analysis of the workings of the Eurocurrency market see Masera (1971).

the cumulated dollar balances - originating from the US BOP deficit - that non-US residents are willing to maintain abroad. Interest rates on loans and deposits will result from clearing the market between the demand for credit and the supply of Eurodeposits by non-residents, the spread between the two rates being a reflection of the profit margin of the offshore banks.

This outline depicts roughly the conditions that prevailed on the Eurodollar market prior to 1974 in a regulatory climate of "voluntary foreign credit restraint in the U.S." However, following the removal of most of these restrictions in January 1974, the Euro- and domestic dollar markets were reintegrated; 1/ arbitrage tended to equalize their interest rates, and differences in reserve requirements imposed on resident and non-resident deposits accounted for the remaining spread. It does not follow, however, that the interest rate on the dollar and Eurodollar are both determined simultaneously by the global demand for credits and supply of deposits in dollar and Eurodollar. U.S. interest rates ultimately depend on the monetary policy of the Federal Reserve. If a quantitative objective is adopted for the monetary base, the money market interest rate becomes endogenous, and vice versa with a policy of pegging the interest rate. In the latter case, which is characterized by a sluggish adaptation of the interest rate instrument, monetary policy is highly procyclical and banks are not prevented from increasing their supply of credit by the lack of high-powered money. Furthermore, if loans are booked with variable interest rates, or if the maturities of credits and resources are matched, even the interest rate variations will not impinge on bank profits and thus will leave their capacities to supply credit unimpaired. Banks, under these assumptions, are able to satisfy any demand for credit at the money market interest rate plus a spread related to the risk attached to these assets.

Such a situation prevailed on the domestic and Eurodollar markets up to October 1979. Thus it is acceptable to assume that during the 1974-1979 period, Eurobanks were not hindered in their lending activity by limits on their borrowings on US domestic financial markets. Consequently, they were willing to satisfy all of the demand that was present at the rate exogenously determined by the policies of the Federal Reserve. 2/ This is the basic hypothesis adopted in the partial equilibrium model presented in Section VI.

1/ In Hartman (1980) a test on weekly data shows that the interdependence between Euro- and domestic-dollar interest rates is significantly stronger after 1974 than before.

2/ For a detailed discussion of the hypothesis of demand-determined Eurodollar credit, see Heller (1979).

The extent to which Eurodollar activities were responsible for the expansion in national or world money supplies during the period 1974-1980, and possibly for excess inflationary pressures raises two questions: a methodological question concerning the operative definition of money, and an empirical question concerning the growth of Eurodollar balances measured in real terms, relative to expansion of the volume of international transactions that are assumed to be settled with them. The first question was covered in Section II. The financial data needed to tackle the second question directly are not available. Nevertheless, an analysis of maturity transformation can provide some indirect insights on the subject. 1/ This is not to say that financial transformation is in itself inflationary; but very often, a high level of transformation is an indication that banks are allowed unrestrained direct or indirect access to the monetary base of the central bank, thus threatening its ability to control the money supply.

The data presented in Table 4, covering roughly 50 per cent of gross assets in the Euromarkets, gives a qualified positive answer to the second question. These data call for the following observations:

(i) The classification based on the original maturity results in an overestimation of the actual degree of maturity transformation. However, the amount of maturity transformation is so large that elimination of this bias would be unlikely to change the basic conclusion significantly.

(ii) The existence of this high degree of transformation supports the previous argument relating to the absence of limits on the supply of credit by offshore banks. It means that Eurobanks are able to refinance themselves on a short-term basis without restraints, by adjusting debtor interest rates on medium-term credits to the cost of their resources. The only limits which could affect the credit supply would be created by possible losses stemming from the default of highly indebted customers. Eurobanks, of course, try to protect themselves against such uncertainties through syndication of loans among large groups of intermediaries.

IV. Sources and Uses of Funds in the Eurodollar Market: The Non-Banks' Behavior in the Recent Period

The consolidated balance sheet of Eurobanks, 2/ after netting out the interbanking relations between ROW countries and consolidating non-banks and central banks, has the following form:

1/ An analysis of the maturity transformation in the English banking system for the year 1973 was first presented in Niehans and Hewson (1976). A comparison of their results with those of Table 4 shows that the degree of financial transformation has severely increased since 1973.

2/ For an exhaustive presentation of the accounting mechanism of the Eurodollar market, one can refer to G. Aubanel (1975).

Table 4. Maturity Analysis of the Liabilities and Claims in Foreign Currencies of the French and English Banking Systems (*) to Non-Banks (Original Maturity Classification)

	Assets		Liabilities	
	U.K.	French	U.K.	French
Table 4.1				
Less than 6 months	36.2%	43.8%	94.3%	92.0%
6 months to 1 year	6.4	6.7	2.5	4.5
1 year and over	52.4	49.5	3.2	3.5
	100	100	100	100
Table 4.2 (Disaggregation of the first line of Table 4.1)				
Less than 8 days	9.6%		37.8%	
8 days to 1 month	9.4		22.9	
Less than 3 months		32.7%		75.0%
1 month to 6 months	17.2		33.6	
3 months to 6 months		11.1%		17.0%
	36.2	43.8	94.3	92.0

* Data on UK banks originate from the quarterly bulletin of the Bank of England and are restricted to British and American banks. Record date is November 19, 1980. Data on French banks originate from unpublished sources of the Banque de France and are restricted to 145 banks. Record date is end of December, 1980.

Table 5. Consolidated Balance Sheet of Eurobanks

Assets	Liabilities
(1) Claims on US banks ($M^*_{d_3}$)	(2) Liabilities to US banks ($L^*_{d_3}$)
(3) Loans to non banks (US and ROW residents: $L_{d_4} + L_{d_2}$), and official monetary institutions.	(4) Deposits of non banks (US and ROW residents: $M_{d_4} + M_{d_2}$), and official monetary institutions.
	(5) Exchange position of the ROW banks.

To relate this framework to Section II, one notes that ROW central banks now hold deposits and receive credits in Eurodollars, and that a new item (5) has been introduced to balance the dollar assets and liabilities of the ROW banking sector: the spot exchange position of the Eurobanks. The determination of the actual position would require the introduction of the net forward cover taken by the banks either for their own account or on behalf of the non-banks. 1/ Finally, the imbalance between items (1) and (2) determines the net position of the ROW banks toward the US banking system: the "unborrowed reserves" of the Eurodollar market.

In order to ascertain the role of the dollar as an international currency, let us consider the evolution of Eurodollar activities during the period 1974-79. 2/ As illustrated in the table presented in Appendix I, loans and deposits exhibited similar rates of growth (19.3 per cent and 21.4 per cent respectively) on an average annual basis. It can thus be inferred that the fluctuations of net position in domestic dollars by the

1/ The actual exchange position of the Eurobanks is usually negligible, for they act generally as covered interest arbitrageurs. See Knight 1977. Therefore item (5), here is assumed to depend on the behavior of non-banks and will be merged with item (4) later.

2/ BIS data concerning the 14 main industrial countries, plus the activities of the branches of US banks in the Caribbean area. Adding other offshore centers (Asia and Middle East) would increase the market size by roughly 15 per cent.

Table 6. Evolution of Consolidated Eurodollar Balance Sheet of Commercial Banks 1974/1979

(End of year figures in billions of U.S. dollars)

	Assets				Liabilities			
	1974		1979		1974		1979	
Central banks	5.1	(5.6%)	17.8	(8.2%)	30.4	(38.0%)	78.0	(37.0%)
US residents	6.7	(7.4)	11.7	(5.3)	8.3	(10.3)	42.0	(20.0)
ROW residents	78.6	(87.0)	189.1	(86.5)	41.3	(51.7)	90.8	(43.0)
	90.4		218.6		80.0		210.8	

ROW banks - item (1) minus item (2) - were rather more influenced by the speculative behavior of non-banks towards the dollar than by the expansion of Eurocredits. Furthermore, a perusal of Table 6 reveals mainly:

(i) There is considerable stability in the distribution of loans, as opposed to a significant change in the breakdown of the resources between US and ROW residents;

(ii) The loans to US non-bank residents represent a small and decreasing part of the market. This implies that "roundtrip" operations are negligible with regard to the international use of the dollar. Accordingly, in the following, emphasis is placed solely on the use of Eurodollars by ROW residents.

Keeping these facts in mind, consider now the behavior of non-banks and its relation to the rapid growth of Eurocredit since 1974. To finance international trade or purchases of foreign assets, ROW non-bank residents have to make decisions among (i) currencies, (ii) banking sectors, (iii) and types of liability.

(i) The choice of the currency is determined by the structure of commercial contracts, which restricts the invoicing of international trade to the currencies offering the largest possibilities of refinancing, i.e.: the currencies of the main industrial countries. Data published by the Bank for International Settlements (during 1973/1979 the share of the dollar in Eurocredits fluctuated between 70 and 73 per cent) and the

invoicing structure in foreign currencies of French international trade (see Appendix II) emphasize the dominance of the dollar and the stability of the currency distribution. Moreover, it is worth noting that, in the main industrial countries, the predominant portion of export financing consists of loans in domestic currencies. They are frequently subsidized and, for long-term credit, granted on a discretionary basis and publicly guaranteed.

(ii) The choice of the banking sector is closely linked to the location and nationality of the exporter. A firm trading in several countries tends to reduce its banking costs by dealing with a limited number of banks, usually banks of the trader's nationality and well established on a world-wide basis. A recent survey 1/ points out that "banking relations already established within the national limits of the multinational corporations home country may be reproduced in host countries." In fact, export trade financing in foreign currencies is concentrated in a limited number of banks with a multinational structure 2/ involving branches and subsidiaries throughout the world. For instance, the predominant position of a few American, British, Swiss, French, German, and Japanese banks is well known.

(iii) Traders have access to three forms of financing: short- and medium-term credits, and bonds. The short-term loans in foreign currencies are delivered to settle imports or for the speculative purpose of traders who are expecting a depreciation of the borrowed currency. 3/ Thus, expected speculative profits account for the essential part of the substitution between the short-term assets in foreign currencies. The dominance of short-term over long-term financing (two thirds of international trade is settled on a short-term basis) exacerbates the consequences of this phenomenon for the exchange market. Conversely, for the medium and long term, the possibilities of substitution are far more limited, since access to international bond markets is restricted mainly to major multinational corporations and long-term credits in domestic currency are most often granted on a discretionary basis.

For these reasons, one can view long-term Eurocredits as part of an international market that is highly segmented, particularly along locational and national criteria. This implies that demand for Eurodollar credits depends mainly on the evolution of international trade among ROW

1/ See Olivier Pastre, (1981).

2/ See J.M. and A.P. Gray, (1981).

3/ In the balance sheet of the Eurobanks (Table 5) this behavior will translate into an increase in item (3) matched by a decrease in item (1). They can also sell forward this currency, in which case, there will be a decrease in items (5) and (1), assuming that Eurobanks are not taking an open position.

countries and between the United States and ROW countries, on the expected profits resulting from short-term assets substitution, and on the dollar real interest rate. This factor accounts for the substitution in the borrowing countries, between assets and real goods (current account surplus or increasing indebtedness).

The liability side of the Euromarket, net of interbank claims held between ROW banks, is composed essentially of short-term resources (see Section III) originating from four agents: the ROW central banks and non-bank US residents and ROW residents (item 4) and US domestic banks (item 2). The view is taken here that after the removal of restrictions on lending to non-residents in 1974 the deposits of the above mentioned agents became virtually perfect substitutes 1/ from the point of view of Eurobanks. Therefore, in expanding their indebtedness toward US residents (bank or non-bank), the offshore banks were always able, until 1980, to replenish their resources at a level which meets the demand for Eurocredits at an interest rate exogenously determined by the Federal Reserve (see Section III).

Concerning liabilities to non-residents, the importance and stability of the central banks' share (see Table 6) is worth noting. In spite of the increase in exchange rate variability after 1973, central banks as a group do not seem to have significantly altered their portfolio behavior with respect to the dollar, which remains the main international currency.

V. A Model of the Eurodollar Market

The model presented in this section is not designed to deal with the questions arising from the overall impact of the Eurodollar credits on the United States and world money supplies and balance of payments disequilibria. 2/ This is a partial adjustment model restricted to the analysis of the expansion of the banking activities in foreign currencies, under the budget constraint presented in Table 5. With respect to this framework the only simplification consists in the aggregation of the spot exchange position of the Eurobanks (Table 5, item (5)), to the Eurodeposits of the non-bank sector (Table 5, item (4)).

The model appears in two versions, according to whether Eurodollar interest rates rd and r are assumed to be exogenous (version A) or endogenous (version B). It is composed of one budget constraint and five behavioral equations in the first case, and one budget constraint and four equations in the second.

1/ At least for time deposits of more than $100,000.

2/ For more comprehensive models, see Fratiani (1970), Freedman (1977), W. Levy-Garboua (1978) and H. Ghesquiere (1980). For a recent empirical study employing the partial adjustment framework, see Knight (1977).

The definitions of the variables are given below:

(i) Symbols

EA = Eurodollar credits (short and long term) to non-banks and official monetary institutions (Table 5, item (3)).

EL = Eurodeposits of non-banks and official monetary institutions, including the exchange position of Eurobanks (Table 5, item (4) + item (5)).

EAB = Claims of Eurobanks on U.S. banks (Table 5, item (1)).

ELB = Borrowings of Eurobanks from U.S. banks (Table 5, item (2)).

MW = World imports expressed in billions of dollars.

PW = World import unit value.

r = Three-month interest rate on Eurodollar loans to non-banks.

rd = Three-month interest rate on Eurodollar deposits of non-banks.

rus = U.S. money market interest rate (three-month Treasury Bill rate).

re = Weighted average of the three-month interest rates (I) of Euro-mark, Euro-sterling, and Euro-Swiss franc with the respective weights (w) 0.64, 0.11, 0.25:

$$(1 + re) = \prod_{k=1}^{3} (1+I_k)^{w_k}$$

$\tilde{e}$ = expected value of the weighted effective exchange rate of the dollar against the deutsche mark, sterling and Swiss franc by non-bank borrowers. An increase in $\tilde{e}$ means that the borrowers are expecting a depreciation of the dollar.

$\tilde{p}$ = expected return on speculative behavior; consisting of borrowing dollars and buying foreign currencies, with:

$$(1 + \tilde{p}) = (1 + \tilde{e}) \frac{(1 + re)}{(1 + r)}$$

DPUS = The annual rate of inflation of the US GNP deflator.

RQR = U.S. reserve requirements regulation on non-resident deposits (existence of reserve requirements: RQR = 0; non-existence of reserve requirements: RQR = 1).

RT = U.S. required reserve ratio on non-residents deposits.

(ii) Equations:

Version A of the Model:

In this version, Eurobank borrowings from the US domestic market (ELB) 1/ are assumed to be exogenous. This situation occurs when the US authorities limit or forbid the lending of U.S. dollars to non-residents. To simplify, it is assumed that ELB covers the holdings of both the private and banking U.S. sectors. Under this hypothesis interest rates on deposits (rd) and loans (r) are simultaneously determined in the Eurodollar market by the supply and demand functions for credits (EA_s, EA_d) and deposits (EL_s, EL_d). Since the interest rate in the U.S. domestic market (rus) is assumed to be exogenously given, one equation is sufficient to account for the demand for U.S. domestic assets (EAB) by the offshore banks. If one includes the equation explaining the expected return on uncovered arbitrage ($\tilde{P}$), model A is designed to ensure the simultaneous determination of six endogenous variables: EA, EL, EAB, $\tilde{P}$, r, rd.

The model is specified as follows:

(1) $\frac{EA_d}{PW} = f_1\left[\frac{MW}{PW}, r, \tilde{P}\right]$

(2) $\frac{EL_d}{PW} = f_2\left[\frac{EA}{PW}, rd, \tilde{P}\right]$

(3) $\frac{EAB}{PW} = f_3\left[\frac{EL}{PW}, rus, re\ RQR\right]$

(4) $\tilde{P} = f_4\ [r, re]$

(5) $rd = f_5\left[\alpha r, \frac{EAB + EA}{EL}\right]$

Variables	
Endogenous	Exogenous
EAB	ELB
EL	MW
EA	PW
$\tilde{P}$	rus
r	re
rd	RT
	RQR
	DPUS

1/ In fact, the fraction of EL held by US non-banks must be exogenous too.

(6) $EAB + EA = ELB + EL$

With $rd < rus\ (1 - RT)$ and where equation (5) is derived from the optimization of the profit function of the Eurobanks, assuming that their production function has a Cobb-Douglas form:

(7) $Y = Y_0\ EL^{\alpha}\ ELB^{1-\alpha}$

where $\alpha < 1$ and Y is the value added by the offshore banking operations. 1/

Version B of the model:

Endogenous variables	Exogenous variables
ELB	MW
EAB	PW
EL	rus
EA	re
$\tilde{P}$	RT
	RQR
	PUS
	r
	rd

In version B of the model, equation (5), (which can be considered as a supply function for Eurodollar loans) is removed, since it is assumed that, in the absence of regulation, the interest rates (r, rd) are determined on the domestic U.S. money market. As we are interested in the growth of the Eurodollar market since 1974, the stress will be put on the specification of the equations of model B. First consider the equation of the demand for credit. It is a reduced form of the global international demand for credit (IC).

1/ Eurobanks maximize a profit function of the following form: $\bar{P} = [r.EA + rus.EAB - rd.EL - rus.ELB]$ under their balance sheet constraint (equation 6) and their production function (equation 7). Then the lagrangian function becomes: $P = [r.EA + rus.EAB - rd.EL - rus.ELB] + \lambda[EA + EAB - y_o\ EL^{\alpha}\ ELB^{\alpha-1}]$. Using the derivatives of the lagrangian against EL and EA, we obtain an equation linking the interest rates on loans (r) and deposits (rd): $rd = \alpha r.\frac{Y}{EL}.Y_0$

$$(8) \quad IC = EA + DA$$

$$(9) \quad \frac{IC}{PW} = \left[\frac{MW}{PW}\right]^{a_1} \left[\frac{1 + r}{1 + DPUS}\right]^{b_1} \text{ 1/}$$

$$(10) \quad \frac{EA}{IC} = (1 + \tilde{p})^{c_1}$$

where DA represents all the other international forms of financing in domestic dollars and other foreign currencies. It follows that the equation of demand for credits on the Eurodollar market can be expressed as:

$$(11) \quad \frac{EA}{PW} = \left[\frac{MW}{PW}\right]^{a_1} \left[\frac{1 + r}{1 + DPUS}\right]^{b_1} (1 + \tilde{p})^{c_1}$$

where the partial derivatives have the following expected signs:
$a_1 > 0$, $b_1 < 0$, $c_1 > 0$

and where a_1 and b_1 constitute the elasticities of the global international demand for financing with respect to world trade and the real interest rate, respectively. The c_1 coefficient measures the substitutability between credit in Eurodollars and financing in other currencies. According to our hypothesis (see Section III), this substitutability concerns mainly the short end of the market.

Equation (12) of liabilities to non-banks has the following form:

$$(12) \quad \frac{EL}{PW} = \left(\frac{EA}{PW}\right)^{a_2} (1 + r)^{b_2} (1 + \tilde{P})^{c_2}$$

with $0 > a_2 > 1$, $b_2 > 0$, $c_2 < 0$.

It can be considered analogous to the demand for money, in which real Eurodollar balances demanded $\left(\frac{EL}{PW}\right)$ depend on transactions, precautionary, and speculative motives. The transaction variable (MW), however, has been replaced by Eurocredit (EA) in order to compute directly the intensity of the redeposit effect on Euromarket. Speculative behavior is proxied in the above equation by the expected profit on uncovered arbitrage $(1 + \hat{P})$. The nominal interest rate is usually introduced in the demand for money

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1/ It is assumed that the real interest rate is the same among the countries.

to account for the distribution of wealth between money and saving. In the case of the Eurodollar market, the data in Table 4 point to the fact that Euromoney is mainly made up of short term deposits that earn interest. Thus the sign of b_2 is expected to be positive, meaning that the higher is the real interest rate in the Euromarket, the larger will be the deposits of non-banks in this market. To close the balance sheet of the Eurobanks another function is needed; that for claims on the US banks EAB has been chosen, the hypothesis being that the resources always adapt to demand.

$$(13)\quad \frac{EAB}{PW} = \left(\frac{EL}{PW}\right)^{a_3} (1 + rus)^{b_3} \text{ EXP } (c_3 \text{ RQR}) (1 + re)^{d_3}$$

with the expected partial derivatives:

$$0 > a_3 > 1,\ b_3 > 0,\ c_3 > 0,\ d_3 < 0$$

The parameter a_3 plays a central role in the analysis of the Euromarket through the simplest approach to the money multiplier (M) defined by the ratio $\frac{EL}{EAB}$ (see Johnston, 1981). The general form of the multiplier that is obtained by combining equations (11), (12), and (13) is:

$$M = \frac{1}{a_3} [-a_1a_2 (a_3 - 1) \text{ logMW} - (b_1a_2 + b_2) (a_3-1) \log \left(\frac{1 + r}{1 + \text{DPUS}}\right)$$

$$- c_1a_2 (a_3-1) \log (1 + \tilde{P}) - b_3 \log (1 + rus) - d_3 \log (1 + re)$$

$$- a_1a_2 (1 - a_3) \text{ logPW} - c_3 \text{ RQR},\ \text{constant}]$$

with the expected signs:

$$-a_1a_2 (a_3 - 1) > 0$$

$$-(b_1a_2 + b_2)(a_3 - 1) \quad ?$$

$$-c_1a_2(a_3 - 1) > 0$$

$$-b_3 < 0$$

$$-d_3 > 0$$

$$-c_3 < 0$$

$$-a_1a_2(1 - a_3) < 0$$

If one assumes that Eurobanks tend to increase their reserves in domestic dollars (EAB) proportionately with the deposits they receive, the value of a_3 must be close to unity. Under this assumption, the evolution

of the multiplier mainly depends, in the short-run, on the fluctuations of the domestic dollar (rus)and foreign (re) interest rates and their respective parameters b_3 and d_3 . The higher are their absolute values, the higher is the instability 1/ of the multiplier, in response to the variability of short-term interest rates. In the long run, the evolution of the multiplier is dominated by the real growth in international trade $\frac{MW}{PW}$ if a_3 is not strictly equal to one. For a value inferior to unity, the multiplier tends to increase, meaning that the power of monetary creation by Eurobanks tends to rise with the development in international transactions. It is more sensible, however, to assume $a_3=1$. This implies that the multiplier is a negative function of the interest differentials between U.S. and foreign assets and of the reserve requirements on non-residents' deposits.

The other variables used in equation (13) are supposed to take into account the speculative attitude of the Eurobanks --(1 + rus) and (1 + re)- and the specific behavior of the U.S. banks which attempt to reduce their required reserves by inducing a transfer of resident deposits submitted to reserves requirements, to their branches abroad when they are not submitted to such regulations.

The fourth equation determines the expected return on uncovered arbitrage $(\tilde{p})$

$$(15) \quad (1+\tilde{p})=(1+\tilde{e})\frac{(1+re)}{(1+r)}$$

where $(\tilde{e})$ the expected exchange rate is expressed, following Solnik (1975), as a function of the interest rate differential:

$$(16) \quad (1+\tilde{e})=(1+re)^{\alpha}\beta$$

The combination of equations 15 and 16 gives the final relation :

$$(17) \quad (1+\tilde{p})=\frac{(1+re)^{(1+\alpha)}}{(1+r)}\beta$$

1/ "However, the point is not whether reserve holdings are unstable but rather whether the instability can be systematically explained by movements in some independent variables," R.B. Johnston, (1981

where the sign of $(1 + \alpha)$ is expected to be negative for borrowers of dollar (equation 11) and positive for lenders (equation 12).

The last equation is an accounting identity which determines the level of indebtedness of the Eurobanks towards the U.S. banking system.

(18) $ELB = EAB + EA - EL$

VI. The Empirical Results

The model was estimated on a sample of 28 quarterly observations for the period Q1 1974 to Q1 1980, using the two stage least squares method. The claims (EAB) and liabilities (ELB) of Eurobanks vis-à-vis U.S. banks were generated from the balance sheet of the U.S. banking system. Data concerning the loans and deposits of non-banks in Eurobanks are not comprehensive. They were extracted from the reports of the fourteen industrial countries to the Bank for International Settlements. Activities of U.S. bank branches outside the reporting area (e.g. in the Caribbean) have been added to the BIS data.

Because expected rates are obviously not observable, the parameters α and β of equation (16) were estimated by successive simulations of the model. In equations 11 and 12, Table 7.1 the variable $(1 + \tilde{p})$ has been replaced by its proxy $\frac{(1 + re)}{(1 + r)}$. The final function of the expected return $(\tilde{p})$ on speculative borrowing, stemming from the value of α and β has the following form:

(19) $(1 + \tilde{p}) = \left(\frac{(1 + re)}{(1 + r)}\right)^{-3.82} .1.0797$ for borrowers (equation 11, Table 7.1)

(20) $(1 + \tilde{p}) = \left(\frac{(1 + re)}{(1 + r)}\right)^{+.76} .9847$ for lenders (equation 12, Table 7.1)

which means that on a short-term basis the higher the interest rate on the Eurodollar market the higher the expected return is for borrowers of dollars, and the lower for lenders. The estimation results are presented in the following table and the charts of the simulation may be found in Appendix III.

All estimated parameters have the expected signs, except for the real interest rate on the Eurodollar in equation (11). In order to obtain reliable empirical results, the nominal interest rate was used. This variable appears to be highly significant. This implies either that our hypothesis concerning the low substitutability between long-term international assets is wrong, or that the evolution of the nominal interest rate

Table 7.1. Parameter Estimates (*)
(Quarterly Data 1974-I/1980-I)

Equation 11:

$$\log\left[\frac{EA}{PW}\right] = \underset{(25.0)}{1.408}\log\left[\frac{MW}{PW}\right] - \underset{(-32.3)}{5.05}\log(1+r) - \underset{(-12.9)}{3.827}\left[\log\left[\frac{1+re}{1+r}\right] + \log(.98)\right] - \underset{(-19.0)}{.7633}$$

$R_2 = .993$ DW = 1.39 S = 1.59%

$$(**)\ \log\left[\frac{EA}{PW}\right] = \underset{}{1.}\log\left[\frac{MW}{PW}\right] - \underset{(20.7)}{4.61}\,\mathrm{Log}(1+r) - \underset{(-6.1)}{3.13}\left[\log\left[\frac{1+re}{1+r}\right] + \log(.98)\right] + \underset{(5.2)}{.0065}\,\mathrm{Trend} - \underset{(-34.43)}{.506454}$$

$R_2 = .977$ DW = 1.05 S = 1.96%

Equation 12:

$$\log\left[\frac{EL}{PW}\right] = \underset{(14.3)}{.769}\log\left[\frac{EA}{PW}\right] + \underset{(4.3)}{1.61}\log(1+r) + \underset{(1.2)}{.76}\left[\log\left[\frac{1+re}{1+r}\right] + \log(.98)\right] - \underset{(-2.8)}{.0543}$$

$R_e = .977$ DW = 1.37 S = 2.1%

$$(**)\ \log\left[\frac{EL}{PW}\right] = \underset{}{1.}\log\left[\frac{EA}{PW}\right] + \underset{(8.8)}{2.4}\log(1+r) + \underset{(1.5)}{.99}\left[\log\left[\frac{1+re}{1+r}\right] + \log(.98)\right] - \underset{(-3.5)}{.0053}\,\mathrm{Trend} - \underset{(-4.6)}{.0832}$$

$R_2 = .916$ DW = 1.2 S = 2.38%

Equation 13:

$$\log\left[\frac{EAB}{PW}\right] = \underset{(5.7)}{.912}\log\left[\frac{EL}{PW}\right] + \underset{(9.5)}{9.06}\log(1+rus) + \underset{(2.5)}{.123}\,RQR - \underset{(-3.4)}{3.544}\log(1+re) - \underset{(-32.8)}{1.618}$$

$R_2 = .973$ DW = 1.70 S = 4.55%

$$(**)\ \log\left[\frac{EAB}{PW}\right] = \underset{}{1.}\log\left[\frac{EL}{PW}\right] + \underset{(6.8)}{8.89}\log(1+rus) + \underset{(2.5)}{.122}\,RQR - \underset{(-2.8)}{3.26}\log(1+re) - \underset{(-.2)}{0.0007}\,\mathrm{Trend} - \underset{(-35.2}{1.63}$$

$R_2 = .93$ DW = 1.7 S = 4.52%

* Numbers in parenthesis beneath the parameters are t values.
** Constrained estimates with $a_i = 1$, $\forall i$.

Table 7.2. Lags and Weights

	t	t-1	t-2	t-3
$\frac{MW}{PW}$	.5	.2	.15	.15
r	.5	.3	.2	.2
re	.5	.3	.2	
p	.5	.3	.2	
rus	.4	.3	.3	

Dummy Variables

- RQR is equal to 0 from Q1 1974 to Q2 1978
- RQR is equal to 1 from Q3 1978 to Q1 1980

This variable takes into account the removing of the reserve requirements in 1978 on Eurodollar borrowings of U.S. banks.

- A dummy eliminates the Q4 1978 point in equation 12.
- A dummy eliminates the Q3 1979 point in equation 13.

is picking up other factors like the specific risk on off-shore lendings, or that the importers are subject to monetary illusion. However, the assumption of portfolio behavior seems the most likely. The reliability of these econometric results is supported by the fact that an estimation of the model in absolute variations of logarithms produces similar long-term elasticities, accompanied by a normal deterioration in the statistical tests. Thus, the parameters for equation (11) are the following (see in Appendix IV the graph of actual and estimated values):

Table 8. Parameter Estimates of Equation (11)

Elasticities	a_1(t value)	b_1(t value)	c_1(t value)	d_1(t value)*	R2	DW
Short term	1.169 (6.6)	-4.09 (-6.9)	-3.6 (4.6)	.125 (.9)	.84	2.25
Long term	1.337	-4.69	-4.11			

* Parameter of the endogenous variable lagged by one quarter.

Turning now to the two main parameters of the model, the estimated value of a_1 is 1.4 and the estimated value of a_3 is 0.91. The estimates appear to be fairly precise, despite the small size of the sample. The fact that the first coefficient is significantly higher than unity implies that, for the 1974-79 period, the volume of international demand for credits increased faster than the volume of transactions. This result is consistent with the existence of increasing balance of payments disequilibria 1/ among most of the countries since 1973. For the same level of world imports, the larger the imbalance of the deficit countries, the larger the need for international credit.

As indicated above the value of a_3, which is smaller than unity, seems to mean that the multiplier tends to increase with the volume of international trade. The standard error of the coefficient, however, is too large to support this result. Thus the hypothesis that $a_3 = 1$ cannot be rejected. 2/ The average value of the multiplier calculated with the

1/ An attempt to test this hypothesis is found in Ghesquiere and Katz (1980).

2/ In order to ensure that the model exhibits consistent long-run properties, it is necessary to impose restrictions on the a_i parameters ($a_i = 1$, $\forall i$) and to introduce time trends ($e^{\alpha i}$ trend with $\Sigma\alpha_i = 0$) to account for structural changes. It is worth noting that constrained and unconstrained equations (see Table 7) give very similar estimates for the b_i, c_i, and d_i parameters, and that the sum of trend coefficients is, as expected, not significantly different from zero.

estimated value of a_3 is equal to 2.09, a coefficient higher than those issued from earlier empirical studies before 1974. 1/

Looking at the factors which explain the demand for Eurodeposits, it appears that the coefficient c_2 of the speculative variable is not highly significant. The rationale for this result stems from the fact that EL includes non-banks and central banks deposits; the speculative behavior of the former tends to increase the reserves of the latter, who redeposit on the Euromarket, thus offsetting partially the initial outflow.

Finally, a careful examination of the simulations in Appendix III does not reveal any statistical bias; this is a crucial point especially in the case of the ELB variable which, stemming from an accounting identity, is more liable to statistical bias, due to the small size of the sample used for the estimation.

The conclusion of this econometric work is that the empirical results do not contradict the thesis put forward, which assumes that Eurodollar credit has been totally demand-determined since the Eurobanks were able to access freely the US domestic money market.

VII. Conclusion and Policy Issues

Devoted to the analysis of the Eurodollar market, particularly since 1974, this paper contains three arguments. The first concerns the necessity to choose suitable concepts of money supply and balance of payments in order to ascertain the effects of the development of Eurodollars on the world economy. The second, based on statistical data originating from France and the United Kingdom, supports the evidence that Euromarket expansion resulted in an important transformation of short term resources into long term credit which could be an aftermath of the pegging interest rate policy of the Federal Reserve which added to the world inflationary pressures. The third tends to demonstrate that the expansion of Eurodollar credit has been totally demand oriented in 1974/1979 period, owing to the suppression of the U.S. exchange controls, the interest rate policy adopted by the Federal Reserve and the generalization of variable interest rate on credit. The results obtained from an empirical model do not contradict this assumption.

In response to concern about this potential for credit creation on the Eurodollar market, central bankers in the major industrial countries have collaborated in studying the possible implementation of a system of reserve requirements. It is clear that the main consequence of such

1/ In Hewson and Sakakibara (1974), the average value of the multiplier is 1.6 on the 1968-72 period.

requirements, if implementation were feasible all over the world, would be a decrease in the profitability of financial intermediation in the Euromarket, since the interest rates on loans and deposits can be considered determined in the US domestic market in the absence of exchange controls. The transfer of activities toward the national banking systems which could result from such measures would depend on the level of the reserve requirements in the Euro-market, and would be hampered by the existence of captive resources: exchange control in many countries prevents residents from holding bank accounts abroad, and some governments, for political reasons, prefer to hold their international reserves in dollars outside the United States.

Another possible approach, which would affect the competitiveness of onshore and offshore banking equally, would be to forbid the practice of granting credits which have variable interest rates; The Federal Reserve interest rate policy would be able to increase the riskiness of long-term international credit financing for the financial intermediaries and would prompt a decrease in the existing financial transformation. Obviously the implementation of such proposals would not be easy, since their efficiency presupposes an agreement among all countries, including the most exotic offshore centers.

Other proposals 1/ aim at imposing a quantitative limit on the amount of Eurodollar deposits that Eurobanks would be entitled to accept. It is clear that such measures are unsuitable if the free circulation of capital, and convertibility of currencies, are to be maintained. Therefore, leaving aside this last hypothesis, it is likely that these regulations will not be sufficient to cope with the Eurocredit expansion. Consequently, the control of money creation will depend, in the last analysis, on the central banks of the issuing countries (mainly United States, Germany, Switzerland and the United Kingdom) which are able to use for that purpose either quantitative measures in order to insulate the Euromarket for their currency from the domestic one, or the interest rate as a global instrument of monetary policy. The results of the model, which exhibit a high interest rate elasticity for Eurocredit, with the usual caveats about econometric work, 2/ have pointed out that such a policy could be very effective.

Since such domestic measures might have restrictive consequences for international trade, a more radical and less politically feasible solution to this problem might be the creation of an international institution which would have the task of regulating international liquidity. The resources

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1/ G.W. McKenzie, (1981).

2/ In Coutiere (1975), the interest rate elasticity for the French domestic demand for credit is -.053 which is equivalent here roughly to -5.0, after allowing for differences in specifications.

needed to initiate this international Central Bank (ICB) could be set up by a transfer of part of the foreign reserves of the participating countries, in favor of the new institution. In counterpart, the ICB would issue certificates of deposit denominated in an International Currency Unit (ICU) bearing initially a value and a return equivalent to the weighted average of the currencies compounding its assets, thus avoiding to start with a possible exchange position.

During a transitory period, the ICB would ensure the refinancing in last resort of the Eurobanks in the present Eurocurrencies and foster the growth of loans denominated in ICU. The momentum of the substitution between the Eurocurrencies and this international money would be enhanced to the extent that the governments would encourage their firms to invoice their international trade in ICU.

Estimated Balance Sheet of the Eurodollar Market *

(In billions of dollars)
(Data at the end of the year)

	Assets								Liabilities						
	1974	1975	1976	1977	1978	1979	Average annual increase		1974	1975	1976	1977	1978	1979	Average annual increase
(1) Claims on U.S. banks	29.7	29.4	36.6	41.7	57.4	88.3	24.3%	(2) Liabilities to U.S. banks	17.9	28.5	44.3	49.6	81.3	88.3	37.6%
(3) Loans to non-banks and official monetary institutions	90.4	107.7	135.5	163.4	192.4	218.6	19.3%	(4) Deposits of non-banks and official monetary institutions	80.0	93.5	117.6	133.9	158.8	210.8	21.4%
								(5) Exchange position of the Euro-banks	22.2	15.1	10.2	21.6	9.7	7.8	-18.8%

* - Items (3) and (4) concern the data of the Eurobanks of the fourteen industrial countries reporting to the Bank of International Settlements, plus the activities of the branches of the U.S. banks outside this reporting area.

- Items (1) and (2) are originated from the balance sheet of the U.S. banking system.

- Item (5) guarantees the equilibrium of assets and liabilities.

APPENDIX II

Currency Denomination of the French International Trade

(In per cent of the total)

	Export					Import				
	French franc	Dollar	German mark	Other currency	All foreign currency	French franc	Dollar	German mark	Other currency	All foreign currency
1972										
1st quarter	58.9	10.9	11.0	19.2	41.1	30.6	16.0	18.1	35.3	69.6
2nd quarter	58.1	10.7	11.0	20.2	41.9	31.9	14.5	17.7	35.0	68.1
3rd quarter	58.2	9.2	9.0	22.7	41.8	31.0	14.2	18.0	34.8	69.0
4th quarter	62.2	10.4	10.3	17.1	37.8	32.3	15.6	18.3	33.8	67.7
1973										
1st quarter	63.3	10.1	11.5	15.1	36.7	33.6	16.5	18.5	31.6	66.6
2nd quarter	65.8	8.8	10.7	14.7	34.2	33.4	16.7	18.4	31.5	66.6
3rd quarter	67.2	8.2	11.0	13.6	32.8	35.3	16.0	18.6	30.1	64.7
4th quarter	60.2	7.3	7.6	13.7	30.8	35.5	15.8	18.4	30.3	64.5
1974										
1st quarter	69.5	7.8	9.1	13.6	30.5	35.3	17.7	17.3	29.7	64.7
2nd quarter	67.9	8.3	10.0	13.3	32.1	34.0	17.3	15.5	33.2	66.0
3rd quarter	67.1	9.9	9.6	13.4	32.9	34.1	21.0	15.5	29.4	65.0
4th quarter	68.5	9.0	7.2	13.3	31.5	34.1	25.3	14.5	26.1	65.9
1975										
1st quarter	68.5	8.4	9.9	13.2	31.5	34.6	21.2	15.1	29.1	65.4
2nd quarter	70.1	7.9	8.8	13.2	29.9	35.2	21.7	15.5	27.6	64.8
3rd quarter	71.1	8.7	8.5	11.7	28.9	29.1	27.7	17.0	26.2	70.9
4th quarter	66.3	8.8	8.5	16.2	33.5	33.2	23.1	16.3	27.4	66.8
1976										
1st quarter	70.1	8.0	8.7	13.2	29.9	33.1	26.3	15.8	24.8	66.9
2nd quarter	69.4	8.8	8.9	12.9	30.6	32.2	28.6	15.6	23.6	67.8
3rd quarter	68.4	10.0	9.1	12.5	31.6	30.5	30.9	14.7	23.9	69.5
4th quarter	65.1	10.8	9.9	14.2	34.9	30.3	30.7	14.9	24.1	69.7
1977										
1st quarter	65.5	10.0	9.8	14.7	34.5	33.0	28.1	14.9	24.0	67.0
2nd quarter	65.1	10.8	9.9	14.2	34.9	32.4	30.9	14.0	22.7	67.6
3rd quarter	65.3	11.4	9.7	13.6	34.7	30.8	32.9	14.2	22.1	69.2
4th quarter	65.5	11.3	9.7	13.5	34.5	29.8	31.9	14.4	23.9	70.2
1978										
1st quarter	64.1	10.8	10.3	14.8	35.9	34.3	27.0	13.1	23.6	65.7
2nd quarter	64.3	11.0	9.7	15.0	35.7	34.8	28.9	14.1	22.2	65.2
3rd quarter	64.0	12.0	9.5	14.5	36.0	34.3	29.0	14.2	22.5	65.7
4th quarter	63.9	11.1	10.1	14.9	36.1	35.3	27.4	15.1	22.2	64.7
1979										
1st quarter	62.3	11.1	10.6	16.0	37.7	36.2	27.4	14.6	21.8	63.8
2nd quarter	63.0	11.9	10.2	14.9	37.0	35.5	29.2	13.7	21.6	64.5
3rd quarter	61.9	11.5	10.6	16.0	38.1	36.3	28.3	14.1	21.3	63.7
4th quarter	62.3	11.9	9.5	16.3	37.7	35.3	29.9	13.8	21.0	64.0
1980										
1st quarter	60.7	13.4	9.9	16.0	39.3	36.2	30.1	13.1	20.6	63.8
2nd quarter	61.8	13.1	9.6	15.5	38.2	33.7	34.8	12.4	19.1	66.3
3rd quarter	63.3	12.9	9.3	14.5	36.7	32.5	35.4	12.5	19.6	67.5
Mean	64.8	10.2	9.7	15.3	35.2	33.4	24.8	15.5	26.3	66.6
Standard deviation 1/	3.4	1.6	.9	2.8	3.5	1.9	6.4	1.9	4.9	1.9

Source: Ministère de l'Economie et des Finances - Direction Générale des Douanes et des Droits Indirects.

1/ The fact that oil import contracts are denominated in dollars and that oil prices increased sharply after 1973-74 and again at the end of 1979, probably accounts for the higher variability of the shares of the dollar and other currencies in French total imports.

CHART 1

NET CLAIMS OF THE EUROBANKS ON THE U.S. BANKING SECTOR

(In billions of U.S. dollars)

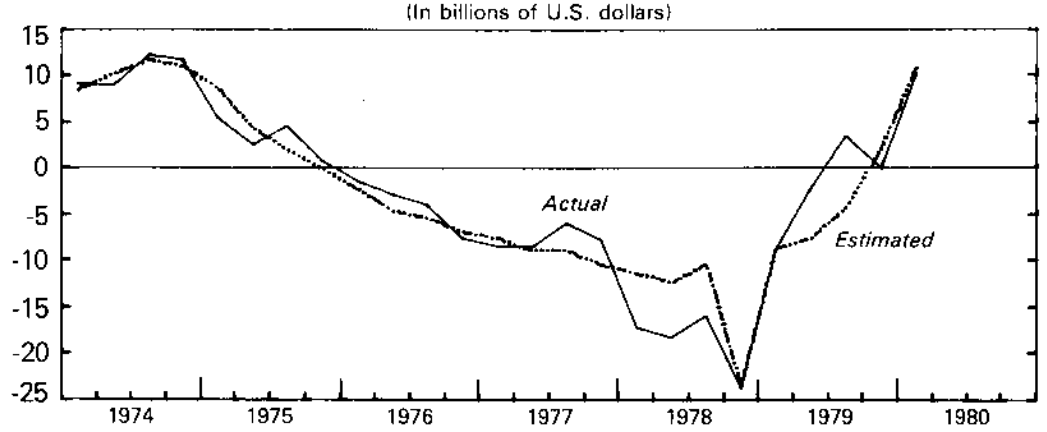


CHART 2

LIABILITIES OF THE EUROBANKS TO THE U.S. BANKING SECTOR

(In billions of U.S. dollars)

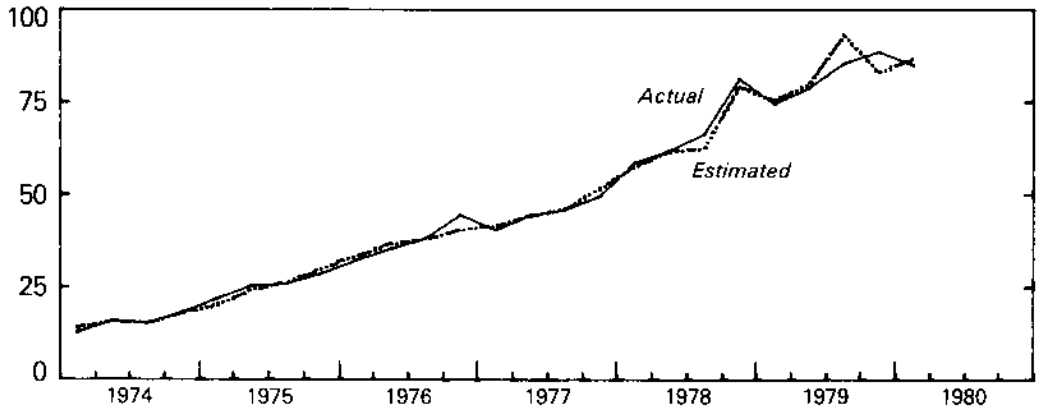


CHART 3

CLAIMS OF THE EUROBANKS ON THE U.S. BANKING SECTOR

(In billions of U.S. dollars)

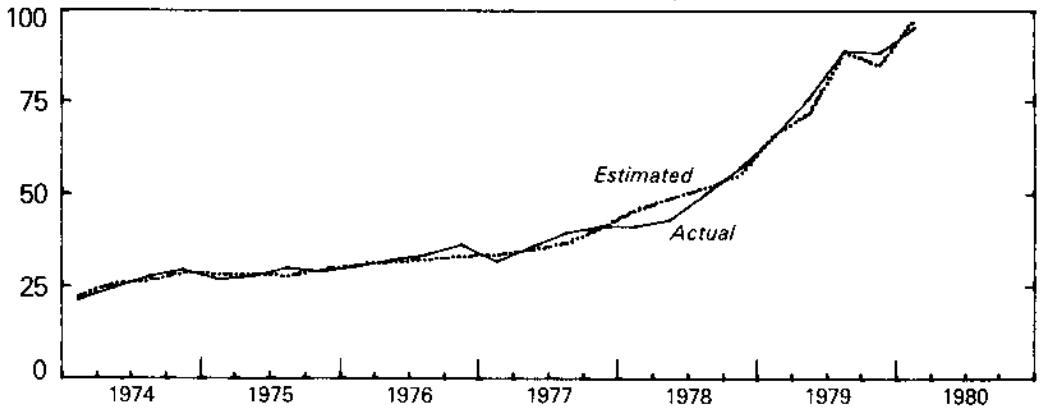


CHART 4

EURODOLLAR DEPOSITS

(In billions of U.S. dollars)

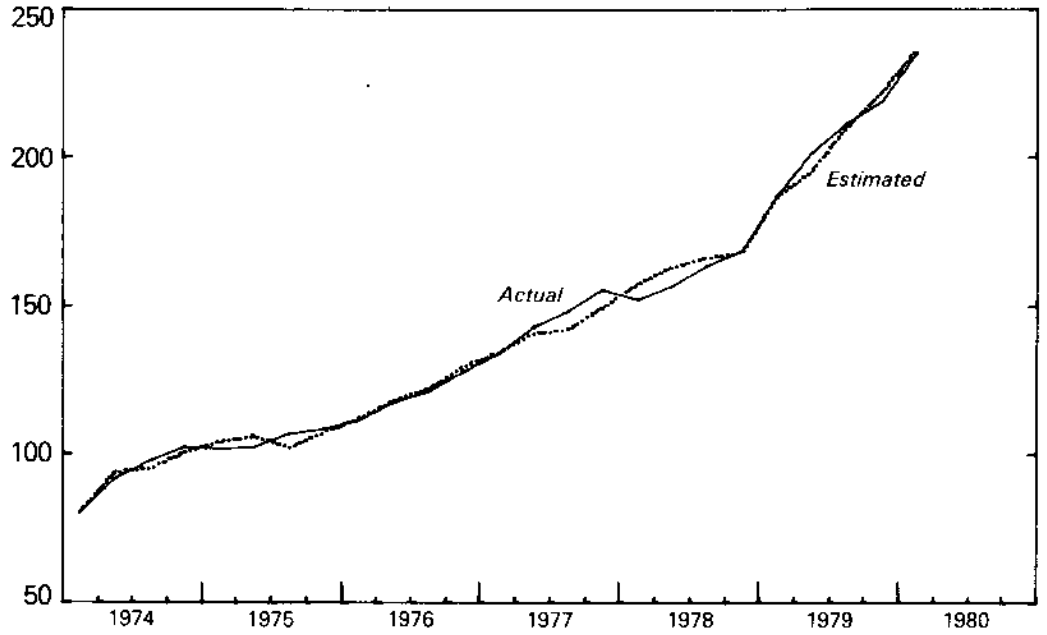
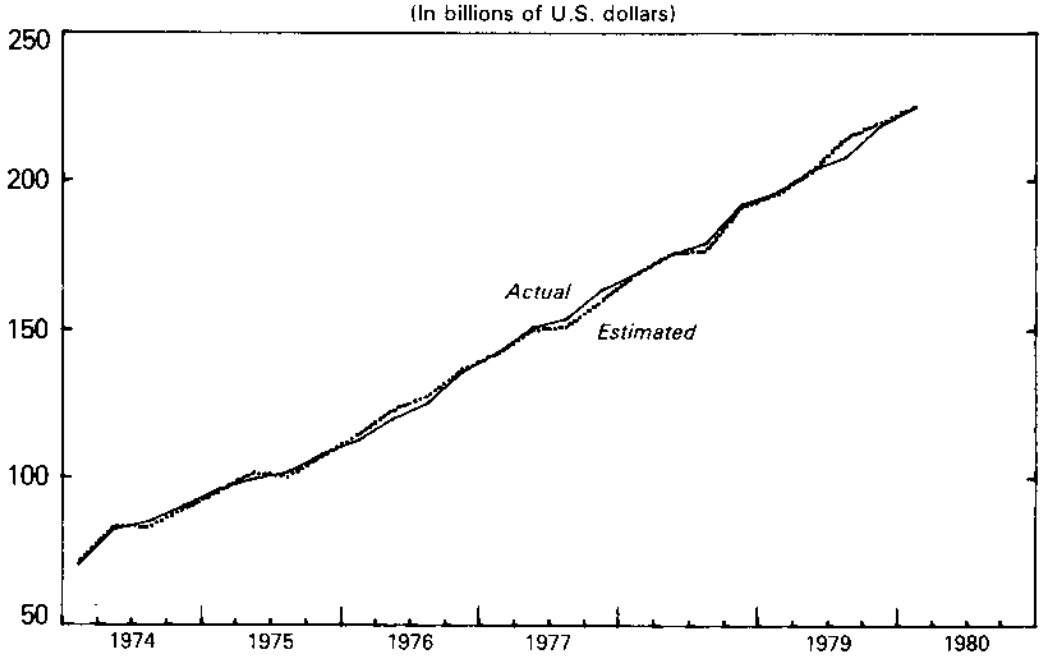


CHART 5

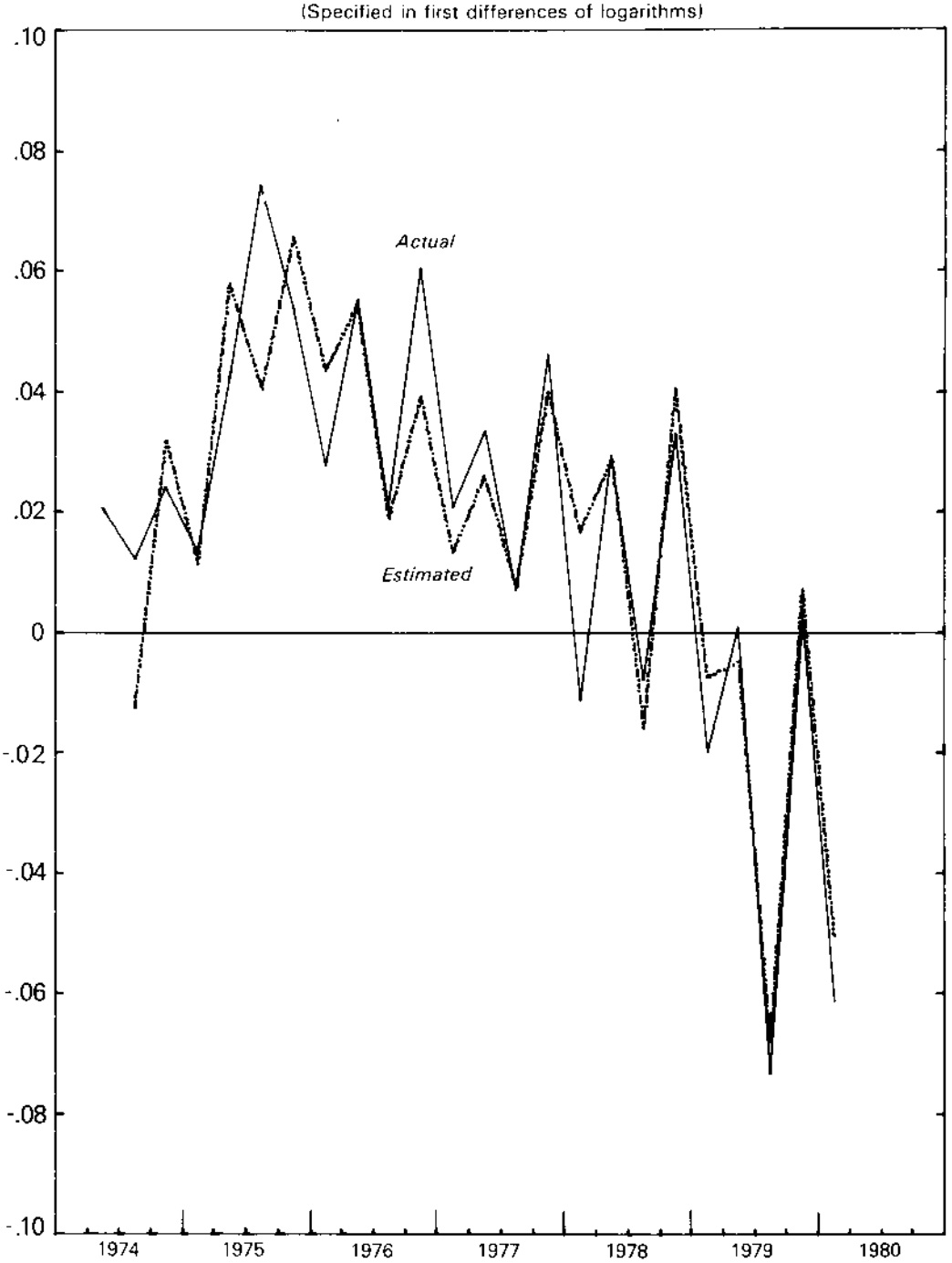
EURODOLLAR CREDITS

(In billions of U.S. dollars)



ESTIMATION OF EURODOLLAR CREDITS

(Specified in first differences of logarithms)



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