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Determining the Value of a Financial Unit of Account Based on
Composite Currencies: The Case of the Private ECU 1/

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Abstract

Evidence from the past three years indicates that the exchange rate between the private ECU and the official ECU Basket can deviate substantially from par. The value of the private ECU is driven by expectations that a future European Central Bank will enforce par convertibility between the private ECU and the official ECU basket of currencies. Meanwhile, no existing institutional arrangement limits the private ECU's value in terms of the Basket. This paper addresses the question of what determines the values of the private ECU and of private ECU interest rates. We show that an anticipation of a future fixing of the private ECU's value, together with the interest rate setting mechanism of the large-value ECU payment and clearing system, are sufficient to determine its value. The determination of the private ECU exchange rate provides the template for how to determine the value of any private composite currency, such as, for example, a private SDR.

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Summary

The private European Currency Unit (ECU) has become the unit of account of a major international financial market, with the ECU comprising approximately five percent of European Union securities and bank balance sheets. Currently, however, no active official or private market mechanism guarantees that private ECUs can be exchanged for a like number of units of the officially defined Basket of component currencies. The holder of private ECU-denominated bank deposits cannot expect to convert them into the official Basket of currencies at par at all times; nor can the owner of a private ECU-denominated treasury bill or bond valued in ECU convert the asset into an equal value in units of the Basket. Indeed, recent market experience has shown that the value of the private ECU can deviate substantially from the value of the Basket, which has caused a reassessment of the foreign exchange risk relative to the Basket associated with holding ECU-denominated assets, including open private ECU positions on bank balance sheets.

That the exchange rate between the private ECU and the Basket can move substantially from par raises questions concerning the factors that influence its value and that determine the yield on ECU-denominated assets. This paper addresses the question of what determines the values of the private ECU and private ECU interest rates. The usual monetary mechanisms that impart determinate value to a nominal unit of account--the existence of a real demand for the unit, a limited supply of the realized unit, and the exogenous setting of some interest rate--are absent in the case of the private ECU. A determinate value could be imparted by a commitment of the banking sector or of some central bank to deliver the official Basket for private ECU, but no such commitment exists presently because of the risk that such a par exchange rate might experience a speculative attack.

Instead, the value of the private ECU is determined through a round-about mechanism: there is generally an expectation that the private ECU and the then current official basket will be merged by a future European Central Bank. Also, the current operation of the private ECU large-value payment and clearing system exogenously determines the private ECU overnight interest rate. The combination of an expected future fixing of the exchange rate and an exogenous ECU interest rate is sufficient to determine the current exchange rate between the private ECU and the official Basket.

The paper observes that the developments in the private ECU market provide valuable experience about the determination of the exchange rate between privately created composite currencies--that is, new units of account--and the component currencies. The possible development of additional private composite currencies, such as regional composite currencies or a private SDR, also adds interest to questions about the mechanism that ties the value of such currencies to that of their underlying baskets and determines the yields on assets denominated in such currencies. Though the paper considers these questions in the context of the private ECU, the conditions and institutional underpinning that activate a unit of account, giving determinate value and eventual use as a payment medium, transplant whole from the ECU to other units such as the SDR.

I. Introduction

In a decade marked by far-reaching developments in the world's financial industries, among the most extraordinary has been the rapid growth in claims denominated in a market-created unit of account based on a basket of currencies--the private European currency unit (ECU). The use by market participants of the ECU unit of account to denominate financial assets was stimulated when European monetary authorities began to use the official ECU--defined as a basket of fixed amounts of the twelve European Union (EU) currencies--to denominate some types of official transactions. Nevertheless, there is an important difference between the official and the private ECU. The official ECU is by agreement among these authorities exchangeable into the fixed basket of currencies (the Basket) at par or into an equivalent value of a single currency, while no active official or private market mechanism currently guarantees a one-for-one exchange of private ECUs into units of the ECU Basket. The holder of ECU-denominated bank deposits cannot expect to convert these into the Basket at par at all times; nor can the owner of an ECU-denominated treasury bill or bond valued in ECU convert the asset into an equal value in units of the Basket.

Although initially the private ECU exchanged for the Basket very near its par value, recent market experience has shown that the value of the private ECU can deviate substantially from the value of the Basket. Such deviations from parity have been significantly larger than is explainable in terms of bid-ask spreads. 1/ That the exchange rate between the private ECU and the Basket can move substantially from par raises fundamental questions: what factors influence the ECU's value and what institutional mechanism determines the yield on ECU-denominated assets?

An understanding of the determination of the ECU/Basket exchange rate and its volatility is necessary for an assessment of the foreign exchange risk relative to the Basket associated with holding ECU-denominated assets and for the management of the foreign exchange risk of open positions in private ECU, particularly on bank balance sheets. More generally, the developments in the private ECU market provide valuable experience about the value in component currencies of any private unit of account that adopts the name of a given currency melange. This experience is of particular relevance in engineering the development of additional potential private composite currencies, such as regional composite currencies or a private SDR. Though we consider such questions in the context of the private ECU, the conditions and institutional underpinning that activate a unit of account, giving determinate value and eventual use as a payment medium, transplant whole from the ECU to other units such as the SDR.

1/ Typical bid-ask spreads between the ECU and the Basket are four to five basis points, while deviations from parity have exceeded 200 basis points.

II. The Private ECU: What Is It Worth?

Private ECUs are ECU-denominated time or current deposit liabilities of the banking sector. 1/ Payments for financial transactions in ECU-denominated instruments--for example, private and public sector bonds, notes, futures contracts, and bank loans--are made in ECU-denominated deposit liabilities of designated banks.

The bulk of the ECU securities are issued by European governments, European Community institutions, or supranationals. Publicly-owned financial institutions also account for a large fraction of the number of ECU securities issues. Commercial corporations currently account for less than twenty percent of the number of issues. Banks acquire ECU securities to balance ECU denominated liabilities to customers. The growth in the size of issues, the development of benchmarks, and the increase in liquidity also made it possible for the two largest European futures exchanges--LIFFE in London and MATIF in Paris--to launch successfully a short- and a long-dated ECU interest-rate contract. The rapid growth of the ECU securities market has been matched by that of the ECU banking markets. By the end of 1991 the private ECU had become the unit of denomination for about 141 billion ECU of bonds and bills. ECU-denominated bonds also accounted for more than 15 percent of total secondary market turnover in the international bond market. 2/ ECU-denominated bank assets grew from ECU 64 billion at the end of 1985 to ECU 184 billion at the end of 1991. During the same period ECU-denominated liabilities grew from ECU 58 billion to ECU 193 billion. Of these 1991 liabilities, however, ECU 153 billion were interbank claims. The magnitude of ECU securities and bank balance sheets each represented approximately 5 percent of EU totals at current exchange rates.

1/ The official ECU, created in a definition contained in a resolution of the European Council of December 5, 1978, is a unit of account consisting of fixed amounts of the currencies of all 12 member states of the EU. Its value in terms of another currency can be calculated by converting the fixed amounts of constituent currencies into a common currency at prevailing bilateral exchange rates. The official ECU is created as a liability of the European Monetary Cooperation Fund (EMCF) by swapping such ECUs for gold and international reserves held by central banks participating in the EMS. In July 1993, the EMCF had about ECU 51 billion in liabilities outstanding through swap operations. Official ECUs can be used only in transactions with EU central banks and a limited number of monetary institutions designated as Other Holders of ECUs. Official ECUs are also created through Very Short Term Financing Facility (VSTF) established in the Basle-Nyborg agreement to provide inter-central bank credit in the defense of the bands of the European Exchange Rate Mechanism.

2/ Since the exchange rate crisis of September 1992, ECU bank assets have been flat and securities issuance has declined substantially.

In 1989, central banks began to employ the ECU to manage reserves, thereby adding to the demand for ECU securities. Central banks acquired such large amounts of ECU-denominated claims that, by September 1991, total official holdings of private ECUs amounted to ECU 34.1 billion out of the ECU 40 billion of overall non-interbank deposits. Thus, ECU deposits are overwhelmingly official claims, mainly counted in the official reserves of central banks. 3/

1.   Is there a monetary mechanism to give real value to the ECU as
      unit of account?

To shed light on what is required to determine the real value of the private ECU unit of account, we review some basic monetary theory regarding the determination of the real value of a general unit of account. 4/ Consider first a real economy 5/ to which is added a nominal currency yielding zero interest and measured in a unit of account such as deutsche mark (DM).

To ensure that the DM unit has determinate prices in terms of goods and services, it is necessary that there be well-defined demand and supply functions for the currency. The use of currency, for example, might lower the cost of making transactions, and thus, generate a real demand for currency. The monetary authority can then exogenously set the supply of DM currency to ensure a well-defined equilibrium in the DM currency market, which yields the price of a DM in terms of goods and services.

Alternatively, bank deposits can also be used to define the real value of a nominal DM unit of account. Specifically, the monetary authority can require that banks hold reserves against deposits in the form of non-interest-bearing central bank obligations denominated in DM. As long as deposits have attributes that make them a low-cost transaction medium, there will exist a real demand for deposits (despite the reserve requirement tax) and hence for reserves at the central bank. By controlling the nominal supply of reserves and by setting the interest rate on these reserves, say at zero, 6/ the monetary authority determines the real value of the DM

3/ See M. Goldstein et al. (1993).
4/ See Patinkin (1961) or Fama (1980).
5/ A real economy is without a pure nominal commodity or unit of account to serve as numeraire, instead prices are stated in terms of a real good numeraire, e.g., in terms of steel ingots.
6/ It should be noted that in order to get a determinate real value of currency or reserves, it is necessary for the monetary authority to fix exogenously the interest rate on currency and reserves. Otherwise, no determinate price of reserves in terms of goods emerge, since a continuum of own currency interest rates and price levels could serve to equate demand and supply in the market for reserves (Patinkin, 1961).

unit of account. 7/ It has solved the problem of "giving content to a pure nominal unit of account (a DM) as a separate, well-defined economic good." 8/

Application of this analysis to the private ECU makes apparent that there does not yet exist such a monetary mechanism to impart a determinate value to the private ECU unit of account. In particular, ECU-denominated bank liabilities lack attributes, such as being a low-cost medium for transactions external to the system of ECU financial institutions, that could produce a well-defined stable demand. Furthermore, there does not exist a mechanism, such as a reserve requirement and a limited supply of ECU-denominated instruments for final settlement external to the private banking system, to control the growth of the ECU-denominated monetary liabilities of the banking system. We are thus left to look elsewhere for the mechanism that determines the real value of the ECU unit of account.

2.   Can the ECU/Basket exchange rate be fixed through the payments mechanism?

In the absence of a monetary mechanism, the value of the private ECU can instead be determined if a syndicate of banks or monetary authorities stands ready to exchange the private ECU for the Basket at par by fixing the private ECU/Basket exchange rate through some private or official guaranty.

Until October 1987, the value of the private ECU--ECU denominated bank liabilities--in terms of any other currency was firmly pegged to the value of the Basket by the daily clearing operations of the ECU clearing banks. In particular, clearing banks that emerged from the daily ECU-clearing owing ECUs were permitted to deliver the Basket. Hence any movement of the ECU/Basket exchange rate from par, say in the direction of an ECU premium, would have provided an opportunity for some banks to earn arbitrage profits by buying the Basket with private ECU and then using the Basket to settle any negative clearing balances in the private ECU clearing and settlement system at par. 9/ Similarly, if the ECU were at a discount, creditor banks could have forced the delivery of the Basket by not granting overnight ECU loans to net debit banks.

This mechanism to peg the value of the private ECU to the Basket fully determined the real value of the private ECU--it initially gave the ECU as unit of account determinate prices in terms of real goods and services

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7/ In actual practice, the monetary authority controls the sum of currency and reserves, allowing banks to exchange currency for reserves on demand at a fixed price.
8/ See Fama (1980).
9/ The ability to settle interbank clearing balances in either private ECUs or Baskets also meant that banks with short or long positions in private ECU did not incur much exchange risk and could make a two-way market in ECU against the basket with low risk.

indirectly through the value of the Basket currencies. The mechanism broke
down in October 1987, however, because the increased reluctance of some
clearing banks to accept Baskets in settlement for large ECU debit clearing
balances frequently put a day's clearing at risk. 10/

From October 1987 to November 1988, a single bank, the Kredietbank N.V.
of Belgium, continued to exchange private ECU for Baskets at par. During
this period the nonbank sector's holding of ECU bank loans continued to grow
faster than its ECU bank deposits. Most ECU banks passed on their net long
ECU positions to Kredietbank by selling ECU against the Basket and borrowing
their resulting net debit in ECU payments from the buyer, Kredietbank.
Kredietbank was eventually forced to discontinue exchanging the ECU against
the Basket at par once it recognized the risk of cumulating an unbalanced
ECU position. Thus, since November 1988, there has not existed any private
institutional arrangement or commitment to exchange the private ECU for the
Basket at par. 11/

Currently, most ECU banking activity is undertaken by the forty-four
clearing members of the ECU Bankers Association (EBA). The BIS, as agent
for the EBA, operates an ECU clearing and settlement system, which functions
on an end-of-day net settlement basis. 12/ Since settlement of a day's
ECU balances no longer occurs in the Basket or in any medium provided by a
source external to the private banks, banks that are net debtors on a day's
ECU payments must borrow ECU from the day's net creditor banks. Lack of
required settlement in an external medium has slammed the door to
determining the value of the private ECU unit of account in the course of
settlement and, except for the exchange market, has made the private ECU a
self-referential system. 13/

3. Can Monetary authorities fix the ECU/Basket exchange rate?

There never existed any official mechanism or guarantee to convert
private ECUs one-for-one into the Basket. A commitment by an individual
central bank, or a group of central banks, to fix the ECU/Basket exchange

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10/ A further technical difficulty contributed to the breakdown of the
clearing arrangements. The delivery of some component currencies occurred
too late during the clearing day to be lent out overnight.
11/ Two banks make a two-way market in ECU against the Basket and a
further three banks make a two-way market in ECU against single currencies.
We will refer to these as core banks. Most other banks have a matched ECU
book.
12/ Average daily turnover on this system grew from ECU 21.4 billion in
January 1990 to ECU 43.2 billion in May 1992, reaching a peak of ECU 156
billion in September, and declining back to a more normal ECU 45 billion in
October 1992, a level that persisted through September 1993.
13/ In national currencies settlement of end-of-day balances in the
banking system is usually done in claims on the central bank, i.e., in a
good funds medium from outside the private banking system.

rate would have the same monetary consequences as fixing the exchange rate between any two currencies: it would require that the central banks stand ready to convert ECU-denominated bank liabilities into claims on themselves. Since there is currently no effective way to control the expansion of such ECU-denominated bank liabilities, e.g., through a reserve requirement on ECU deposit liabilities, any attempt by a single central bank to fix the ECU/Basket exchange rate could result in a serious loss of monetary control. Specifically, a central bank defending its own currency through a squeeze would have the policy undermined by a banking system creating ECU deposits and exchanging them for domestic currency.

4. Can market arbitrage fix the ECU/Basket exchange rate?

The opinions of many market participants are based on an assumption that there exists an arbitrage possibility that can move the ECU/Basket exchange rate toward parity. 14/ No such arbitrage is available, however--only a speculation on the future value of the ECU. If, for example, the private ECU trades at a discount against the Basket, a bank could fund ECU assets with Basket liabilities. However, the bank would then have an open position in ECU. As in any other currency market, a bank or even a syndicate of banks cannot risk assuming an unlimited open position on a belief that market sentiment will change. While such a transaction may temporarily be successful in affecting the exchange rate, it cannot in a longer run counteract changing market expectations regarding the future value of the ECU in terms of the Basket. The bank would continually cumulate a long ECU position until it found the exchange risk excessive. At this point, it would trim its ECU position, as in any currency market.

We conclude therefore that currently there does not exist an active mechanism--private or public--to determine the real value of the private ECU

14/ As an example of the belief in the professional market literature that the ECU value was pinned down by arbitrage, see J.P. Morgan (April 1991). Starting in 1991, the literature on the ECU produced by major market institutions started to discuss the divergence between the ECU and the Basket and began to argue that there was no means of effecting an arbitrage, although some hinted that there might be some central bank intervention to stabilize the exchange rate. See, for example, ECU Banking Association (June 1991); Paribas (1991b); Louw (1992), Bishop (1991, 1992). Nevertheless, in assessing the divergence, there was still a frequent misuse of the word "arbitrage". See, for example, Paribas (1991a).

unit of account nor to fix the exchange rate of the private ECU to the Basket at parity. 15/

III. The First Step Toward Determining ECU/Basket Exchange Rate: An Interest Parity Condition

The efforts to move from the ERM towards EMU have generated expectations 16/ that during Stage III the private ECU will be fixed irrevocably to national EU currencies (not necessarily to the Basket as currently constituted). Such expectations of a future fixing constrain the current value of the private ECU, and are part of the mechanism that determines the ECU/Basket exchange rate. However, well-defined expectations regarding the future value of the private ECU alone are not sufficient to determine the ECU/Basket exchange rate. An additional requirement, as reviewed above, is that the term-structure of ECU interest rates be tied down through the exogenous fixing of some ECU interest rate. These two conditions--well-defined expectations regarding a future fixing of the ECU/Basket exchange rate and an exogenously set ECU interest rate--together

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15/ The emergence of the private ECU as a unit of account in its own right temporarily generated a lack of clarity in the meaning of a promise to deliver ECU contained in ECU securities. The typical prospectus of an ECU security initially defines the ECU as the official basket, but then promises delivery in private ECU bank deposits. If these two units of account trade at par until the maturity of the security, no problem can arise. When they cease to trade at par, however, the promise of the securities becomes less clear. The exchange rate uncertainty can be removed quite easily from the market for nonbank securities if issuers were prepared to service such debt either in ECU or in Basket according to the demands of the holder. This would implicitly fix the ECU/Basket exchange rate applicable to nonbank markets but would add a multiple currency option risk to the security issuer. Since the official sector is the main issuer of ECU-denominated bonds, notes, and bills such an initiative could easily be implemented by amending the prospectuses for such issues.

16/ The Maastrich Treaty formally provides for this in Article 109g and Article 1091(4).

turn out to be sufficient to produce a determinate ECU/Basket exchange rate. [17]
Analytically, well-defined expectations regarding the future fixing of the
private ECU/Basket exchange rate allow us to derive an uncovered interest
parity condition of the private ECU against the Basket. This interest
parity condition then yields all equilibrium combinations of ECU interest
rates and ECU/Basket exchange rates.

In addition to uncertainty regarding the future fixing of the
ECU/Basket exchange rate, there also exists uncertainty about the future
currency composition of the Basket and about the future spot bilateral
exchange rates among the 12 ECU currencies.[18]

To describe these results analytically, let

$$W(t) = [W_1(t),\ldots, W_{12}(t)] \tag{1}$$

represent the official currency composition of the ECU at time t. For
example, let the first entry $W_1(t)$ be the quantity of DM in the Basket at
time t. W(0) is the official current composition of the ECU. The future
composition of the Basket at time t, i.e., W(t), is uncertain. Let the spot
exchange rates between the DM and the currencies in the Basket be
represented by

$$e(t) = [1, e_2(t),\ldots, e_{12}(t)] \tag{2}$$

in the same order as the currency shares in W(t). Thus

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[17] The Maastricht agreement of December 1991 generated a surge of
activity in the ECU securities market. This agreement made the convergence
to monetary union and the creation of a European Central Bank (ECB) more
likely, and with that the private ECU was more likely to become the unit of
account in a monetary union. At the end of 1991, the market included ECU
193 billion of banking liabilities, ECU 124 billion of bonds, and ECU 17
billion of Euro notes and treasury bills; in the first half of 1992, ECU
primary bond issues totaling ECU 26 billion (compared to ECU 33 billion in
all of 1991) were brought to the market. The currency turmoil put nearly a
complete halt to new issues from August 1992 until February 1993. New
issues have revived somewhat in 1993, but they remain far below the levels
attained in the first half of 1992.

[18] Prior to Maastricht, the ECU was reconstituted every five years. The
Maastricht Treaty froze the composition of the Basket, but since it is
generally accepted that many of the countries will not meet the convergence
criteria by 1997 or 1999, there is some doubt in the markets about how the
ECU will be defined for those core countries that may satisfy the criteria.

$$B(t)_{DM} = e(t) \cdot W(t) \equiv \sum_{i=1}^{12} e_i(t) \, W_i(t) \tag{3}$$

is the DM value of the Basket at time t.

As a first approximation, assume that it is expected with certainty that the exchange rate between the private ECU and the Basket, as officially defined at that time, will be fixed at par at the known time t = T--that is, a promise to deliver one ECU at time T is equivalent to a promise to deliver W(T) at time T. The DM value of one ECU at time T will then be equal to the DM value of the Basket at time T, i.e., equal to e(T) W(T).

Since at time T both the composition W(T) of the Basket and the future spot exchange rates, e(T), are uncertain, the DM value of the private ECU at time T is uncertain. The present DM value of a private ECU deliverable at time T can be found by discounting the expected DM value $E[e(T)\ W(T)]$ by the appropriate risk-adjusted DM discount rate $i(T)_{DM}$ applicable to payments that mature at time T:

$$E[e(T)\ W(T)]/(1+i(T)_{DM}) \tag{4}$$

Alternatively, if $i(t)_{ECU}$ is the ECU discount rate now applicable to ECU deliverable at time t, then the present value of one ECU deliverable at time T is

$$\frac{1}{(1+i(T)_{ECU})} \tag{5}$$

Taking the ratio of (4) to (5), the current market spot rate of ECU in terms of DM (DM per ECU) then is [19]

$$S(0)_{ECU} = \frac{\left(1+i(T)_{ECU}\right)}{\left(1+i(T)_{DM}\right)} E(e(T)\ W(T)) \tag{6}$$

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[19] Instead of explicitly discounting the expected future DM value of one ECU by the risk-adjusted DM interest rate to obtain the present DM value of an ECU deliverable at time T, we could have replaced E (e(T) W(T)) with the ECU/DM Forward exchange rate and discounted by the observable DM interest rate of appropriate maturity. In this case, the risk-premium generated by the uncertainty about e(T) and W(T) would have been embedded in the forward rate.

This expression for the ECU spot rate applies to the case where the ECU/Basket exchange rate is fixed at parity at the known time T. If the fixing can occur at any time t, between now and time T, with probability $\Pi(t)$ then the ECU spot exchange rate in terms of DM is the probability weighted average of the solutions for the certain future fixing:

$$S(0)_{ECU} = \sum_{t=1}^{T} \frac{\left(1+i(t)_{ECU}\right)}{\left(1+i(t)_{DM}\right)} E[e(t)\ W(t)]\Pi(t). \tag{7}$$

The current spot exchange rate between the Basket, as currently defined, and the DM (DM per Basket) is

$$B(0)_{DM} = e(0)\ W(0) \tag{8}$$

The current spot price of the ECU in terms of the Basket is then given by

$$\frac{S(0)_{ECU}}{B(0)_{DM}} = \frac{\left(1+i(T)_{ECU}\right)}{\left(1+i(T)_{DM}\right)} \cdot \frac{E\ e(T)\ W(T)}{e(0)\ W(0)} \ \underline{20/} \tag{9}$$

20/ If the time of fixing is uncertain, then

$$\frac{S(0)_{ECU}}{B(0)_{DM}} = \sum_{t=1}^{T} \frac{\left(1+i(t)_{ECU}\right)}{\left(1+i(t)_{DM}\right)} \cdot \frac{E\ e(T)\ W(T)}{e(0)\ W(0)} \cdot \Pi(t).$$

The cross-market arbitrage conditions in (6) or (9) resemble the traditional uncovered interest parity condition--i.e., it determines the relationship among spot and future expected exchange rates and discount rates. 21/ However, these condition do not produce a solution for the private ECU/DM nor for the ECU/Basket spot exchange rate in terms of individual currency exchange rates and interest rates. Rather, we have an expression for how the private ECU/DM spot rate and the interest rate of the private ECU should align in equilibrium. Any combination of $S(0)_{ECU}$ and $i(T)_{ECU}$ satisfying (6) defines a market equilibrium. Hence the market equilibrium ECU/DM exchange rate, $S(0)_{ECU}$, as well as the market equilibrium ECU/Basket exchange rate, $S(0)_{ECU}/B(0)_{DM}$, are indeterminate. Equations (6) and (9) confirm a conclusion from the discussions in Section II, namely that it is necessary to determine an ECU interest rate if we want to obtain a determinate ECU/Basket exchange rate. We shall describe in the next section the mechanism that exogenously determines an ECU interest rates and thus removes the indeterminacy of the equilibrium spot exchange rates in equation (6) and (9).

IV. The Second Step Toward Determining the Real Value of the Private ECU: Setting the ECU Interest Rates

This section explores the mechanism for setting an interest rate for the private ECU. The interest parity condition derived in the previous section yields all possible equilibrium combinations of ECU/Basket exchange rates and ECU interest rates. If there exists a mechanism that exogenously sets an ECU interest rate, then equation (9) will fully determine the private ECU/Basket exchange rate. Such a mechanism to set the ECU interest rates, in fact, currently exists as part of the ECU Clearing and Settlement System.

The ECU clearing system, centered around the ECU clearing banks, is organized by the ECU Banking Association (EBA). Same day clearing of ECU payments orders on this system has been in effect since March 28, 1988. The ECU clearing and settlement system is unusual in that it does not settle clearing balances in a medium external to the banking system, such as reserves held at a central bank. Since the right to settle in the Basket

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21/ The uncovered interest parity condition is given by $e = \left(\dfrac{1+i_d}{1+i_f}\right) Ee_f$

where e is the spot rate of exchange of domestic money exchange for foreign money, i_d and i_f are domestic and foreign interest rates and Ee_f is the expected future spot exchange rate.

was denied in October 1987, settlement has consisted of converting daylight net credit settlement positions into overnight interbank ECU loans. 22/

Since there are no private ECU other than bank IOU's, there is no way to settle a net debit position in the day's payments other than by converting it into an interbank overnight loan--that is, the debit bank remains a debtor to the remaining banks in the system. Until recently, the prearranged credit lines in the ECU system appear to have been sufficiently

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22/ The daily ECU clearing operation proceeds in three separate stages. Until the preliminary cut-off time of 2 p.m. (Brussels time) all payments messages between the clearing banks go through the SWIFT network. A netting computer provides each bank with its own preliminary debit or credit netting balance and makes available to each bank the nature (debit/credit) of the balance of every other clearing bank (also entered into a Reuters page by the BIS). The netting center also transmits these final netting balances to the BIS. The BIS maintains a daily clearing account for each clearing bank, which is credited or debited with the final netting balances of each bank. If at 3:15 p.m. some banks' net positions still exceed 1 million ECU, a further half-hour is allowed for an interbank market among the reduced set of participants--so-called special transfers. After this period, to deal with the remaining "small change" transactions required to bring the clearing accounts to a zero balance, the BIS, acting as an agent, arranges loans from the net credit banks to the net debit banks. To do this the BIS maintains an ECU "sight account" for each clearing bank with a balance that cannot exceed 1 million ECU. These accounts pay zero interest and no overdrafts are permitted. The BIS can, at its discretion, transfer up to 1 million ECU in any one day from the account of one bank to the account of the other banks and log the transfer as an interbank loan between the two banks at the BIS overnight interest rate. Effectively, this is a housekeeping operation to eliminate frictional ECU clearing balances. If a clearing bank is unable to obtain sufficient ECU credit to settle its clearing balance, then the rules (never yet invoked) prescribe that the day's clearing will be unwound and all payments orders given and received by the nonperforming bank will be canceled. The remaining payment orders are automatically value-date adjusted to the next day.

extensive to avoid problems in effecting this kind of settlement. 23/ In practice there appears to be a balanced distribution of ECU payments, so that no group of banks will continue to acquire claims on other banks, otherwise there would need to exist a mechanism to settle claims in some other medium, such as ECU-denominated securities. If a creditor proved reluctant to extend further credit, the day's clearing operation could be jeopardized. To prevent this and potential manipulation of overnight ECU interest rates, the EBA has implemented a system of brokering overnight lending and administratively setting overnight ECU interest rates.

Since no actual ECU for settlement exist, such as the ECU obligations of a European monetary authority, a net creditor bank cannot demand delivery of "ECU"--it must accept settlement in interbank ECU debt for the clearing to succeed. The net credit bank can always attempt to squeeze the net debit banks by refusing to make ECU loans, thus threatening the clearing. Similarly, a net debit bank can settle its accounts only by borrowing from a net credit bank. If it refuses to acquire a loan at a rate deemed unreasonable it can also cause the settlement to fail. In this sense any one bank can cause a settlement failure and can squeeze the others to the extent that they wish to avoid the cost of such a failure. As a result, it has generally been accepted that the interest rate payable on overnight loans arising out of the clearing operation should be set externally to the ECU banking system. 24/ The BIS, as agent of the private ECU clearing

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23/ Nevertheless, because of growing recognition of the risk of difficulties in clearing a day's payment operation, several lending facilities have recently been established to provide credit to net debit banks. The BIS Intermediation Facility can lend funds to a bank short of funds by taking up to ECU 5 million from each of the clearing banks and lending to banks that are short. In this way, it can spread the risk of the overnight credit among the clearing banks. The Bank of England, the Banque de France, and the Banca d'Italia have also introduced separate liquidity recycling facilities. These operate either as collateral management facilities, with the pledging by short ECU clearing banks of ECU sight balances held at the central bank as collateral for lending by a long ECU clearing bank, or as credit management facilities, with direct intermediation between long and short banks by central banks lending against ECU or national currency securities held in centralized securities depositories. At the writing of this paper, these facilities had not yet been used.

24/ Since the total net debit position of the clearing banks is always equal to their total net credit position on payments it has been argued that any overnight interest rate will clear the interbank market (Jean (1990)) and that, therefore, the interest rate must be set externally. It is always true, however, that net debits equal net credits on a day's payments. In the ECU system, they also equal net interbank lending because of the lack of other media to settle. Nevertheless, in the absence of a market manipulation, the market should clear through the emergence of credit risk premia charged to individual debit banks.

and settlement system, sets this overnight interest rate according to well-defined rules. 25/ In doing so it also removes the indeterminacy of the ECU/Basket exchange rate in the interest parity equation. 26/

1. The setting of overnight ECU rates

Suppose that an ECU clearing takes place on day D. To set the interest rate to be charged on overnight ECU lending between day D and day D + 1, the BIS acquires data on EIBOR (ECU Inter Bank Offer Rates) and EIBID (ECU Interbank Bid Rate) interest rates from the clearing banks as of about 12:00 p.m. on day D - 1. The BIS eliminates the high and low EIBOR rates supplied by the banks and takes an arithmetic average of the remaining rates to determine the EIBOR rate applicable for interbank loans between day D and day D + 1. A similar procedure is used to determine the EIBID rate.

To construct the EIBOR rate information that it supplies to the BIS, an individual bank collects its Basket currency tomorrow/next (interest rate on overnight loans made tomorrow and repayable the next day) offered rates at 12:00 p.m. on day D - 1. It then computes the weighted average of these rates, using the current weights of the currencies in the official ECU. The bank's EIBID rate is similarly computed using the tomorrow/next bid rates for the Basket currencies.

The actual rate that applies to debit balances on Day D depends on the "imbalance" between the supply and demand of the ECU on the exchange market between ECU and currencies in the Basket. Since the exchange markets between ECU and Baskets and major currencies in the Basket operate as standard foreign exchange markets with two business days until settlement, the imbalance is determined on day D - 2. If the ECU banking system is in an aggregate net long position in ECU to be delivered to it in exchange for component currencies exceeding 100 million ECU in value--that is, it has bought private ECU in exchange for component currencies worth more than 100 million ECU for delivery on day D--the BIS sets EIBOR as the day D overnight interest rate. If the ECU banking system is in an aggregate net short position in ECU exchanged for component currencies exceeding 100 million ECU in value, the BIS sets EIBID as the day D overnight interest rate. Otherwise, it sets the overnight interest rate at the arithmetic mean between EIBOR and EIBID.

25/ That the banks must occasionally clear this position through "special transfers," however, indicates that either there are some additional rate payments or that a set of unwritten rules exists for allocating risks among the creditor banks that are reluctant to lend to the debit banks.

26/ The exogenous interest rate setting rule also satisfies the requirement that the interest rate of some nominal instrument, such as required reserves, be set exogenously for the unit of account to have determinant real value. Note that any exogenous rate setting rule would do to make the value determinate, regardless of the theoretical rationale for choosing it.

Fixing the overnight rates effectively fixes $i(t)_{ECU}$ in equation (9) through the term structure 27/ and makes $S(0)_{ECU}/B(0)_{DM}$ a determinate function of the present and future underlying Basket composition, cross-currency exchange rates, individual currency overnight interest rates, and the BIS's weighing scheme for fixing the interbank ECU rates.

2. Equilibrating properties of the interest setting rule

Since EIBOR always exceeds EIBID, this interest rate setting rule has certain equilibrating properties. For example, if the banking system moves from an aggregate flow long to an aggregate flow short position in the ECU exchange market, the selling of ECU by the banking system results in a reduction of Basket deposit liabilities and an equivalent increase in ECU deposit liabilities held by the nonbank sector. This expansion of demand for ECU deposits triggers a decrease in the overnight rate from EIBOR to EIBID and a fall in the deposit rate. From equation (9), such a change from EIBOR to EIBID in the overnight rate has the effect of depreciating the ECU against the Basket. If the market anticipates a permanent short ECU position for the banking sector, so that the lower overnight rate will continue to apply, then this would be reflected in the entire ECU interest rate term structure and the depreciation would be more marked. Such a depreciation and lower yields relative to the Basket would tend to reduce the private demand for ECU deposits. 28/

3. Arbitrariness of the interest setting rule

The choice of the rule for setting the ECU interest rate is arbitrary, in the sense that any rule would result in an equilibrium ECU/Basket exchange rate. As an example of the arbitrariness in the choice of the bank ECU own interest rate, suppose that the BIS's current method of setting interest rates in overnight bank ECU loans generates an interest rate of 7 percent for bank ECU deposits maturing at time t. $i(t)_{ECU}$ is then 1.07. This establishes a spot exchange rate between bank ECU and DM of

$$S(0)_{ECU} = i(t)_{ECU} \, E[e(t)W(t)] \, / \, i(t)_{DM} = 1.07 \, E[e(t)W(t)] \, / \, i(t)_{DM} \quad (11)$$

Suppose that today the EBA and the BIS suddenly decide permanently to calculate the overnight bank ECU rate by multiplying its previous

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27/ For example, in the simplest case, if the expectations hypothesis of the term structure is valid, $i(t)_{ECU}$ is the arithmetic average of future expected bank ECU tomorrow/next rates through time t. More generally, the expectations hypothesis yield would be adjusted by liquidity premia and discounts.

28/ The equilibrating features of this rule for the setting of the overnight interest rate applies only to the flow disequilibrium in the exchange market during the day. It is likely that there will be occasions when the banking sector has a positive net asset position in ECU while there exists an excess supply of ECU in the exchange market.

calculation by two. This would also double the interest rates in the rest of the term structure, changing $i(t)_{ECU}$ to 1.14, and increasing $S(0)_{ECU}$ by 6.5 percent. Note that the time t expected DM value of the bank ECU is unchanged in this exercise. The increase in the bank ECU own interest rate increases the amount of DM equivalent that a depositor expects to have at time t. Therefore, a depositor will pay more DM now for a bank ECU.

For any bank whose ECU position is balanced, it does not matter what own rate is established by the BIS for interbank overnight loans. The choice affects only the bank ECU spot exchange rate. For a borrower or lender with an unbalanced ECU position, however, such shifts in convention would create an exchange risk.

4.   Some alternative approaches

Recent ECU research efforts have either relied on observed shifts in the flow demand and flow supply for ECU-denominated bank assets and liabilities or on market imperfections to explain simultaneously historical deviations from parity of the ECU/Basket exchange rate and the deviations of the ECU yields from the synthetic Basket yields. 29/

The demand and supply arguments consider two scenarios. In the first scenario the ECU assets of the banking sector grow faster than its ECU liabilities. This occurred from 1985 through 1987, as indicated in Table 1. The small group of core ECU banks willing to run net positions in ECU will lend ECU to the rest of the banking system while funding themselves by selling Basket liabilities. The yield at which the core banks are prepared to lend ECU to the rest of the ECU banking system must exceed the yield they pay on their Basket liabilities. 30/ Thus, during such periods the ECU yield will exceed the synthetic Basket yield. 31/

It is also correctly noted that in this scenario, where total bank ECU assets rise faster than bank ECU deposits, the nonbank sector recipient of ECU bank credit must also be a net seller of ECU against currency on the

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29/   See, for example, Girard and Steinherr (1989); Louw (1991, 1992); Bishop (1991); EBA (1991); or Lund (1991).

30/   Indeed, the rule for setting the interest rate for overnight loans engendered in the clearing operation emerged from the notion that the Basket and the ECU were the same. If the two units were the same, there was a need to give a markup to the core banks in the exchange market when they were buying in ECU, relending the ECU overnight to the net debit banks, and funding the acquisition with Baskets; hence, the interest rate rule prescribed that they charge the offer rate on overnight lending in the Basket currencies.

31/   In other words, when ECU bank assets exceed ECU bank liabilities, then the marginal funding cost for ECU assets is the Basket interest rate.

Table 1. Size of ECU Banking Market

(In billions of ECU)

	1985	1986	1987	1988	1989	1990	1991	March 1992
Total ECU bank assets	63.9	70.3	80.7	100.6	128.2	148.6	194	196.4
Interbank	49.7	53.8	59.2	74.2	97.4	114.3	133	136.1
Non-interbank	14.2	16.5	21.5	26.4	30.8	34.3	61	60.3
Total ECU bank liab.	58.1	60.4	66.5	88.3	116.9	149.8	193.1	202.6
Interbank	49.7	52.9	57.2	75.5	92.4	118.2	152.8	158.2
Non-interbank (incl. official deposits)	8.4	7.5	9.3	12.8	24.5	31.6	40.3	44.4
ECU net bank assets	5.8	9.9	14.2	12.3	11.3	1.4	0.9	-6.2
Interbank	0	0.9	2	-1.3	6.7	-1.5	-19.8	-22.1
Other	5.8	0	12.2	13.6	6.3	2.9	20.7	15.9
$US per ECU	0.888	1.07	1.303	1.173	1.197	1.363	1.34	1.24

Source: Louw (1992).

ECU/Basket exchange market. Hence, the core bank becomes a net buyer of ECU and a net seller of the Basket. Thus it is concluded that the ECU should be at a discount against the Basket.

In the second scenario, which has prevailed between 1988 the end of 1991 as indicated in Table 1, the ECU liabilities of the banking system grow faster than its ECU assets. Core ECU banks borrow ECU deposits from the rest of the ECU banking system, and lend Baskets of deposits of the currencies. Thus ECU yields will be below Basket yields. Furthermore, in this scenario the nonbank sector is a net ECU buyer on the ECU/Basket exchange market, rather than a net ECU seller, as in the previous scenario. The core banks sell ECU to the other ECU banks against the Basket. Hence the ECU/Basket exchange rate should show a premium in favor of the ECU.

Notwithstanding these arguments, this literature suffers from the shortcoming of trying to explain movements in the ECU/Basket exchange rate and in the ECU interest rates with recourse to only one equation--the interest parity condition. To see this let i_b be the Basket interest rate, i_{ECU} the ECU interest rate, $x = B(t)_{DM}/S(t)_{ECU}$, the ECU/Basket exchange rate (ECU per Basket) at time t, and Ex the expected future ECU/Basket exchange rate. Then

$$1 + i_b = x(1+i_{ECU})/Ex \tag{10}$$

is a simplified version of the uncovered interest parity condition in equation (9). The observed interest phenomenon $i_b < i_{ECU}$ is associated with flow borrowing of Baskets and flow lending of ECUs by the banking sector. This portfolio behavior of the banking sector is consistent with the usual arbitrage activities that bring about the interest parity result, i.e., if $i_b < i_{ECU}$ then the arbitrating bank will sell Baskets liabilities and buy ECU assets until $i_b = i_{ECU}$, providing that x = Ex = 1. The observed exchange rate phenomenon x > 1 is associated with the selling of Basket liabilities and the buying of ECU assets. Again, this behavior is the result of arbitrage supporting the interest parity until $i_b = i_{ECU}$ and Ex = 1. While the explanation for the movement in ECU interest rates and the explanation for the movement in the ECU/Basket exchange rate are each consistent with maintaining the interest parity condition, they cannot determine both variables--ECU/Basket exchange rate and ECU interest rate-- simultaneously.

The approach taken in the literature falls short in two ways. First, it fails to recognize that current institutional arrangements in the private ECU markets alone are not sufficient to establish a determinate real value for the private ECU. Second, even if there is a recognition that an anticipated future pegging of the private ECU to the Basket affects the ECU/Basket exchange rate today, in light of the parity condition (6) or (9), this would only determine a relation between the ECU/Basket exchange rate

and the ECU interest rate. 32/ To obtain the ECU/Basket exchange rate, it is still necessary to identify the mechanism that exogenously sets the interest rate on the private ECU. Although the demand and supply approach reviewed above appears to produce independent conclusions about the movement of ECU yield and the ECU exchange rate, these are only two different ways of expressing the same phenomenon: the movement of interest rates and spot exchange rates as constrained by the interest parity equation.

V. Deviations of the Private ECU/Basket Exchange Rate From Parity and of the Private ECU Yields From Synthetic Basket Yields

The previous two sections showed that expectations regarding the future pegging of the ECU/Basket exchange rate combined with an interest rate setting mechanism has taken the place of the traditional monetary control mechanism in determining the ECU/Basket exchange rate and positioning the ECU yield curve. In this section we explore the sources of volatility in the exchange rate and yields.

1. Spread between ECU interest rates and synthetic rates

We showed in the previous section that the ECU overnight interest rate is set by the BIS as EIBID or EIBOR depending on whether there is excess supply or excess demand in the ECU/Basket exchange market. Thus a change in market conditions in the ECU/Basket exchange market will move the ECU overnight rate by the spread between EIBID and EIBOR, or by about 25 to 35 basis points, and a sustained change in the ECU/Basket exchange market conditions will shift the term-structure by the bid-ask spread. These changes will then also appear as changes in the spread between ECU interest rates and synthetic rates. Hence, developments in EU money markets and in the ECU/Basket exchange market determine the short ECU interest rates and the premium/discount against the Basket. Knowledge of D - 1 tomorrow/next Euro-deposit rates in national currencies and knowledge of the demand and supply imbalance in the ECU bank market on D - 2 implies knowledge of the ECU rate for overnight loans from D to D + 1 .

Moreover, divergences of the ECU term-structure from the synthetic term-structure are also due to uncertainty regarding future reconstitutions of the Basket 33/, greater liquidity of the ECU than some constituent currencies, anticipated shifts in the overnight interest rate setting convention, and differential tax treatment. Also, one clause in most ECU security prospectuses prescribes that the security will pay in Baskets if

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32/ Lund (1991) explicitly recognizes that expectations about a future pegging of the ECU rate influence the pricing of the ECU today. But he relies on the demand/supply argument to explain immediate fluctuations in the ECU/Basket exchange rate.

33/ See Girard and Steinherr (1989).

the EU ceases to use the ECU. Fluctuating probabilities of these events also affect the deviation from Basket rates.

2. Deviations of the ECU/Basket exchange rate from parity

Once the term-structure of ECU interest rates has been determined, then expectations concerning the future value of the ECU, the term $E[e(T)W(T)]$ in Equation (9) determine the spot ECU/Basket exchange rate. Three sources of uncertainty affect the future value of the private ECU:

(a) the composition of the Basket at the time of the fixing,
(b) the future bilateral spot exchange rates, and
(c) the timing of the future pegging of the ECU to the Basket.

Prior to the recent attacks on the ERM, the first and second type of uncertainty were to some extent limited by the existing institutional arrangements. In particular, as long the ERM was in effect, movements in spot exchange rates were limited to less than 6 percent against any member currency, unless there was a realignment; and the composition of the Basket was not likely to change radically. Since the widening of the ERM bands to 15 percent movements above or below central parities, this uncertainty has increased dramatically. The uncertainty surrounding the timing of the fixing has been reduced through the ratification of the Maastricht Treaty, but the timing now hinges on a set of countries' meeting the convergence criteria.
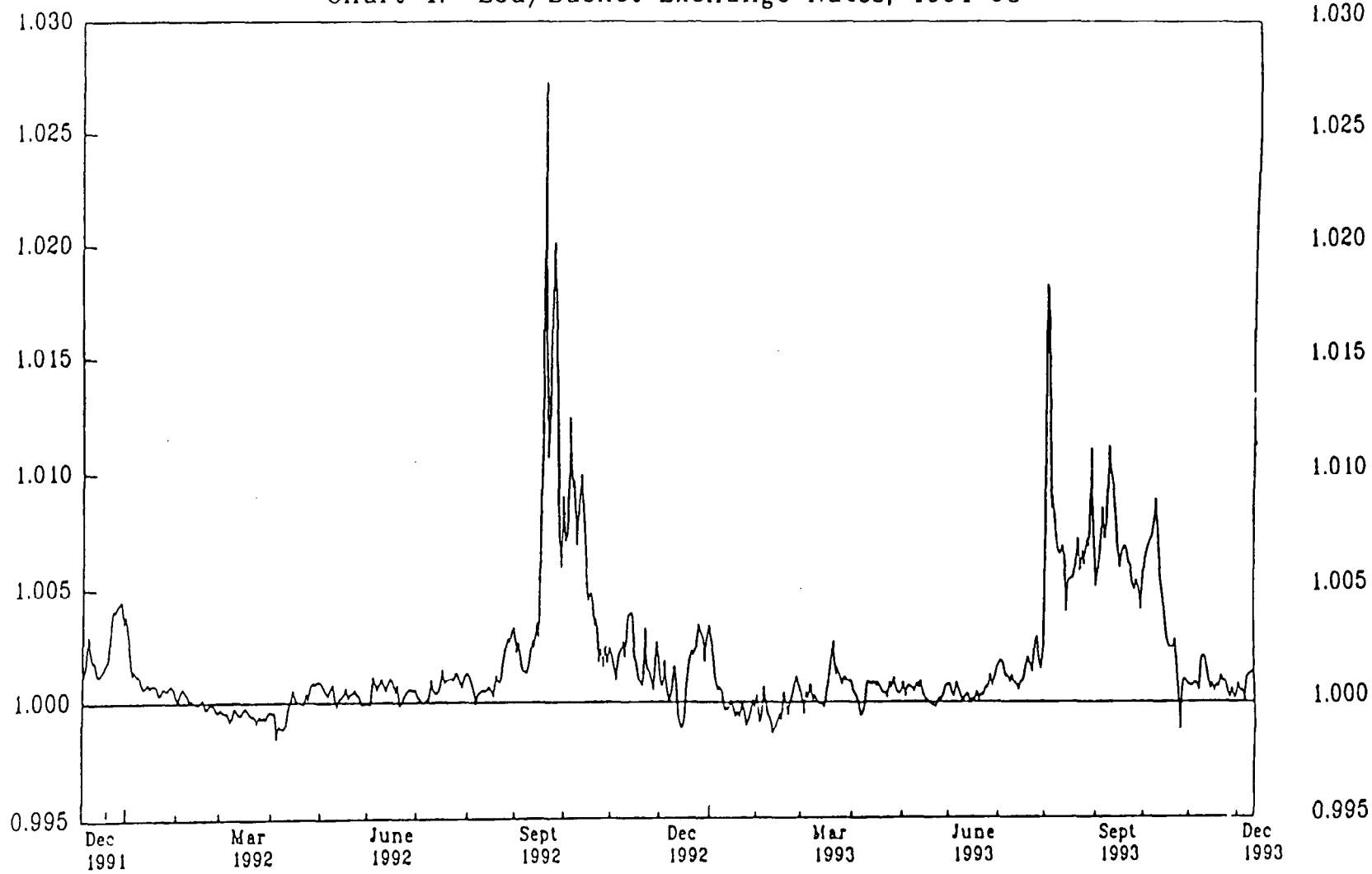
The ECU/Basket exchange rate will also be affected by changes in risk regarding its future DM value. Greater risk will increase the risk-adjusted DM discount rate and cause a depreciation of the ECU against the Basket. Changes in the expected composition and in future spot exchange rates will also result in changes in the ECU/Basket exchange rate. If weights are expected to remain constant $(W(0) = W(t))$, then the ECU can be perfectly hedged in DM at pre-determined forward exchange rates.

Uncertainty regarding the future fixing itself will be reflected in the expectations about the future value of the ECU. This has potentially the largest effect on the exchange rate. Doubts about a successful outcome of the current efforts to move to Stage III will be translated into a lower expected value of the ECU and into a discount against the Basket. In this regard it is important to note that it is unlikely that a single country or a subset of the EU Member States would want to accept the monetary implications of fixing the ECU/Basket exchange rate in the absence of an EC-wide agreement.

VI. The Experience of the Private ECU in the Market Place

Private ECUs can be purchased and sold in exchange for the Basket at market-clearing rates of exchange in a market made by some of the major ECU

Chart 1. Ecu/Basket Exchange Rates, 1991-93

Source: Kredietbank.

clearing banks. The experience to date in the ECU foreign exchange market has broadly confirmed the conclusion that there does not exist a mechanism that ties the private ECU to the Basket and that expectations regarding the prospects for a future fixing of the value of the ECU in terms of the Basket determine the exchange rate (together with the exogenously set interest rate).

From mid-1990 onward, a period of increasing optimism about the successful move towards EMU, the ECU began to command a significant exchange rate premium over the Basket, which reached a peak of 100 basis points in January 1991. 34/ The value of a private ECU in terms of any given currency had come to exceed the value of a Basket in terms of the same currency.

During the ERM crisis in September 1992, however, the exchange rate between the private ECU and the Basket depreciated up to 250 basis points from par because of a combination of exchange controls in some of its component currencies, large sales of ECU from official reserves as official holders made "substantial withdrawals of deposits," and a general flight from ECU securities. The market did not operate for a week after September 16, 1992--that is, holders of ECU claims found that they were inconvertible with the basket. Not until the end of October 1992 did the private ECU begin once more to exchange at close to par. 35/ Again, in the second ERM crisis in July and August 1993, the ECU depreciated up to 180 basis points from par, remained 50 to 100 basis points from par until October 1993, and returned close to par only at the end of October.

The above discussion implies that it is erroneous to believe in the existence of some arbitrage opportunity that keeps the ECU near par. If such beliefs permeate the market so that the foreign exchange risk of the private ECU against the Basket is not yet fully reflected in the current discount of the private ECU against the Basket or in the ECU yields, this discount could widen further in the absence of official support.

VII. Summary and Conclusion

Since November 1988, there has not existed any official or private institutional arrangement or commitment to exchange private ECU for the official ECU/Basket at par. Instead, the private ECU/Basket exchange rate has fluctuated freely, with the private ECU trading at times at a premium up to 100 basis points or discount against the Basket in excess of 200 basis points. The value of ECU-denominated financial assets (in excess of $250 billion ECU) is uncertain not only in terms of single currencies but

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34/ Recall that the normal bid-offer spread is about five basis points.
35/ Bank for International Settlements, International Banking and Financial Market Developments (Basle: Bank for International Settlements, February 1993), p. 5.

also in terms of the Basket. Since the traditional monetary mechanism that gives real value to a currency has not yet evolved for the private ECU, the real value of the private ECU--the value of the private ECU in terms of the Basket--has been determined by the market's expectations about a future fixing of the ECU/Basket exchange rate in the context of EMU. An interest parity condition, based on the expectations regarding the future fixing of the ECU's value then determines possible combinations of ECU/Basket exchange rates and ECU interest rates. The ECU term-structure in turn is tied down exogenously by the BIS as part of the private ECU payments clearing mechanism. 36/ In particular, the BIS sets the overnight rate as a weighted average of overnight rates in constituent currencies. The term-structure and the expectations regarding a future fixing of the exchange rate are then combined in the interest parity condition to yield the current ECU/Basket exchange rate. The currently available theoretical and statistical literature on the formation of expectations, the term-structure of interest rates, and risk-premia in forward foreign exchange markets can now readily be applied to develop a quantitative approach to the pricing of ECU-denominated assets.

Fluctuations in the ECU/Basket exchange rate are partly due to changing expectations regarding the future fixing, i.e., regarding the progress towards the EMU. In addition, changes in bilateral exchange rates of currencies in the Basket and the composition of the Basket will impact on the ECU/Basket exchange rate. Hence, any uncertainty concerning the creation of a single European currency translates directly into exchange rate uncertainty for the private ECU.

Although this analysis has been with reference to the private ECU it is readily applicable to the problem of determining the exchange rate of any other privately created composite currency in the absence of intervention to require or engage in exchange at par with its namesake basket. A mechanism to fix an interest rate and an expectation of future fixing of the exchange rate are sufficient conditions.

36/ We emphasize that the combination of the interest parity condition with the exogenous setting of the ECU interest rate are sufficient conditions for making the exchange rate determinate. McCallum (1992), in commenting on an earlier version of this paper, argues that the interest setting mechanism used by the BIS is a lagged endogenous variable because it depends on flows in the exchange market two days prior to a day's clearing. Using a model in which the overnight rate is a lagged endogenous variable (although not identical to the BIS's rate mechanism) McCallum shows that a determinate exchange rate solution can emerge.

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