CURRENCY SUBSTITUTION and ITS IMPLICATIONS:
A SURVEY

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ÖZET


ABSTRACT

Monetary theory traditionally assumes that economic agents hold the domestic currency for transactions and speculative purposes. However the widespread financial innovation has made the movements of funds and transfer of information across markets more rapid and less costly, leading to an increased degree of currency substitution. Currency substitution has important implications for the conduct of monetary policy, exchange rate determination and stability of demand for money functions. This study aims to provide an elaborate survey of the implications of currency substitution.

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1. INTRODUCTION

Monetary theory traditionally assumes that economic agents hold domestic currency, and domestic and foreign currency denominated assets. They are not allowed to hold foreign currencies either for speculative or transactionary purposes; that is currency substitution is excluded. However, the widespread financial innovation, prompted by the adoption of new technologies, has made the movements of funds and transfer of information across markets more rapid and less costly. As a result of international integration in the economic and financial sphere, and the process of financial innovation, some financial assets, which are denominated in foreign currency, have been included in the portfolios of economic agents. These developments have led to remarkable growth in capital movements and cross border deposits, indicating the increased degree of currency substitution.

Currency substitution has important implications for the conduct of monetary policy, exchange rate determination and stability of demand for money functions. Although the determinants of currency substitution have not yet been precisely identified, the implications of currency substitution have been investigated extensively. The presence of currency substitution may lead to an unstable demand for money function (Monticelli and Papi, 1996). Furthermore, the independence of monetary policy under a floating exchange rate will not be possible any more. As the degree of currency substitution increases, monetary policies will be more interdependent and conducting a joint international monetary policy could become feasible, rather than controlling national monetary aggregates (Miles, 1978; McKinnon, 1982).

In this study, an overview of the implications of currency substitution is presented. In section 2 alternative definitions and measurement issues of currency substitution are discussed. The implications of currency substitution are surveyed as well as the empirical studies in section 3. It emerges that as the degree of currency substitution increases, monetary policies of countries become more interdependent. This could strengthen the links between the money demand
functions of closely integrated countries, such as EU countries. In that case it could be feasible to pursue a joint monetary policy. Finally, section 4 concludes.

2. WHAT IS CURRENCY SUBSTITUTION

2.1. Definition of Currency Substitution

Even though the implications of currency substitution have been investigated both theoretically and empirically, there is no agreement concerning the concept and the precise definition of currency substitution in the literature. The term currency substitution may be interpreted in two ways: Firstly, that foreign money is used along with the domestic currency in transacting; secondly, that a change in relative cost of holding one currency induces a change in the ratio of domestic to foreign money holdings demanded. For instance suppose an increase in domestic money growth causes inflation and a real depreciation of domestic currency then domestic residents' demand for foreign currency can be expected to increase leading to a currency substitution. Under the presence of currency substitution, the level of foreign currency balances changes in response to domestic economic variables. The economic significance of currency substitution stems from the fact that there exist economic agents who, given the current value of economic variables, hold both domestic and foreign currency balances and are indifferent at the margin between holding more domestic or foreign balances (Miles, 1978). In that sense currency substitution refers to the substitution between two monies, which is due to any change in domestic and/or foreign economic variables, or institutional changes. This is consistent with the usage of the term in Cuddington ((1983), (1989)) and Miles (1978).

McKinnon ((1982), (1985), (1996)), on the other hand, distinguishes between direct and indirect currency substitution. Direct currency substitution means that people switch between two or more currencies which compete as a means of payment within the same commodity domain. Indirect currency substitution refers to investors switching between currencies and nonmonetary financial assets, such as bonds, denominated in different currencies, which in turn indirectly influences the domestic demand for transaction balances. Mizen and Pentecost (1996) illustrate these different kinds of substitution by employing the following Table 1.
Direct currency substitution refers to switching between domestic and foreign currencies, $C_D$ and $C_F$, which is a vertical movement in the Table 1. Indirect currency substitution takes place when domestic residents attempt to become more or less liquid. This horizontal movement in the Table 1 is not indirect currency substitution but it induces indirect currency substitution. Suppose international investors decide to shift their desired portfolios from $B_D$ to $B_F$, in response to some political or economic news. Assuming that the government is committed to defend exchange equilibrium, domestic interest rates will tend to increase and foreign interest rates to decline. This will lead domestic residents to become less liquid and to buy domestic bonds, which in turn result in an incipient fall in the demand for non-interest-bearing domestic money, $M_D$. The excess supply of domestic money, will then, place new downward pressure on the domestic rate of interest, encouraging bond arbitrage. As economic agents shift to foreign bonds, there will be capital outflows from the home country which is exactly equal to the domestic residents’ lower demand for currency. The foreign monetary authorities will expand the money supply under a fixed exchange rate. In summary, the shift from $B_D$ to $B_F$ in the international bond market has the effect of indirect currency substitution, as if private agents collectively were reducing their demand for domestic money and increasing their demand for foreign money. McKinnon (1996) argues that the process of indirect currency substitution suggests the need for greater international coordination of domestic and foreign monetary policies to stabilize their common price level.

**Table 1: Types of Currency Substitution**

<table>
<thead>
<tr>
<th></th>
<th>Currency</th>
<th>Bonds</th>
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</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>$C_D$</td>
<td>$B_D$</td>
</tr>
<tr>
<td>Foreign</td>
<td>$C_F$</td>
<td>$B_F$</td>
</tr>
</tbody>
</table>

Even though direct and indirect currency substitution can be distinguished in theory, in practise the two processes may occur simultaneously. Then it will be very difficult to distinguish between the concepts of capital mobility and direct and indirect currency substitution. Mizen and Pentecost (1996) argue that this practical ambiguity underlies McKinnon’s definition of indirect currency substitution. Cuddington (1989) argues that the
concept of currency substitution should focus on the transactions demand for monies, not solely assets and portfolio balances motives. Only this feature of money makes the phenomenon of currency substitution separate from the more general phenomenon of capital mobility.

Giovannini and Turtelboom (1994) distinguish between currency substitution, which is a complete replacement of one currency with another, and currency substitutability, which is the process of one currency becoming a substitute for another. According to Giovannini and Turtelboom (1994) it is not clear from the term substitution whether it refers to a characteristic of currencies, in which case substitutability is to be preferred, or to an equilibrium outcome in which case substitution could be acceptable (Giovannini and Turtelboom, 1994).

Mizen and Pentecost (1996) add further to the definitions of currency substitution by distinguishing between currency substitution as an equilibrium state, where one currency is substituted, either partially or completely, for another, and currency substitution as a dynamic process, which represents the adjustment of portfolios between equilibria. They argue that there are two ways in which currency substitution can exist: either as a stock of wealth in foreign currency held in the portfolio, or as a flow of wealth into the foreign currency as portfolios are adjusted. "The former takes into account currency substitution which has already taken place and the latter the currency substitution which is now taking place." (Mizen and Pentecost, 1996:13).

2.2. Measurement of Currency Substitution
Along with the growing integration of capital markets and abolition of exchange controls, there has been a sharp increase in cross-border deposits (CBDs), which reflects the increased degree of currency substitution as a stock of wealth between currencies. The general term of cross-border refers to any banking instrument for which there is no coincidence between the residency of the non-bank holder, the currency of denomination, and the location of the bank
that undertakes it. Angeloni et al. (1991) and Giucca and Levy (1992) summarize all possible combinations of CBDs according to the residency of holder, the currency of denomination or the location of the bank by means of an eight-cell diagram which is reproduced here as Table 2.

Table 2. CBDs in a Two Country Example

<table>
<thead>
<tr>
<th>Residents with</th>
<th>Residents with</th>
<th>Nonresidents with</th>
<th>Nonresidents with</th>
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<tbody>
<tr>
<td>domestic banks</td>
<td>banks abroad</td>
<td>domestic banks</td>
<td>banks abroad</td>
</tr>
<tr>
<td>In national currency</td>
<td>CBD1</td>
<td>CBD2</td>
<td>CBD3</td>
</tr>
<tr>
<td>AAA</td>
<td>AAB</td>
<td>BAA</td>
<td>BAB</td>
</tr>
<tr>
<td>In foreign currency</td>
<td>CBD5</td>
<td>CBD6</td>
<td>CBD7</td>
</tr>
<tr>
<td>ABA</td>
<td>ABB</td>
<td>BBA</td>
<td>BBB</td>
</tr>
</tbody>
</table>

In Table 2 A represents domestic and B foreign, so that the CBDs can be categorized. For example CBD1 (AAA) refers to the deposits held by residents of country A (first index), in their own currency (second index) and in their own country (third index); while CBD6 refers to the deposits held by residents of country A, in the currency of country B and in the foreign country. Deposits represented by CBD1 are always included in the money stock and normally are by far the largest component. Conversely, CBD8 is always excluded, since the corresponding deposits are money of the rest of the world. Thus, according to the previous definition, the term cross-border deposits refers to all deposits included in cells CBD2-CBD7 (Angeloni et al., 1991).

Generally, some traditional monetary aggregates include only holdings of foreign currency deposits by domestic residents in domestic banks (CBD5, ABA), which is one of six possible component parts of what could be considered currency substitution. But, they neglect other types of CBDs, which could reflect currency substitution, such as foreign currency deposits held by domestic residents in banks abroad (CBD6, ABB). One reason for considering a
restricted number of CBDs could be concerning the availability of the data. However, the availability and reliability of CBD data have increased significantly since the late 1970s, and the virtual exclusion of CBDs from official monetary statistics cannot be justified anymore. The Bank for International Settlements (BIS), in its International Banking and Financial Market Developments, regularly publishes statistical information on cross-border deposits held by non-bank residents of European countries. The series are produced on a quarterly basis and provide for classification on the basis of country of residence of the holder, the country of location of the issuer and the currency of denomination.

The growing size of CBDs has several policy implications, one of which is related to the effects exerted on monetary aggregates. As mentioned above, the money stock statistics compiled by almost all central banks exclude CBDs. “The recent growth of these deposits, therefore, reduces the coverage, and may ultimately undermine the significance, of the monetary aggregates as indicators of policy. As CBDs became quantitatively important, failure to account for them may result in an inflationary bias” (Angeloni, Cottarelli and Levy, 1991:2).

Therefore, it is proposed to define extended monetary aggregates which include CBDs based on the currency of denomination, residency of holder or location of the intermediary service criteria.

The sum of different combination of CBDs in Table 2 gives rise to various definitions of extended money based on the three different criteria mentioned above. If the extended monetary aggregate is defined on the basis of the criterion of the holder’s residence, the relevant aggregate should include CBD1, CBD2, CBD5 and CBD6. The extended monetary aggregate based on the currency of denomination comprises of CBD1, CBD2, CBD3 and CBD4. Finally, the third extended monetary aggregate based on the bank’s location should include CBD1, CBD3, CBD5 and CBD7. The application of the various criteria does not give rise to the same measure of money and each criterion identifies a particular component which
is relevant only for that particular definition. Several empirical studies have considered the informativeness, the economic properties and the stability of demand for extended monetary aggregates in European Union countries, and compared them with the traditionally defined monetary aggregates (The empirical survey of these studies are presented in Yıldırım, 1997).

As regards the choice of the most significant concept of money with respect to currency substitution, aggregates defined according to currency of denomination and location of the intermediary service are not relevant (Giucca and Levy, 1992; Monticelli and Papi, 1996).

Although, the definition based on the issuer’s location is easier to implement, it chiefly relates to the expansion of bank credit and is likely to be difficult to interpret from an economic point of view, especially when international financial centres attracting deposits from abroad are located within the country. But if we were studying the behaviour of banks, then the location of those banks might be important. The monetary aggregate based on currency of denomination criterion might be related to the potential pressure on the exchange rate of the country in question. It includes, in addition to the other components, non-residents’ domestic currency deposits held with banks abroad which has little significance for the currency substitution in the domestic country. Furthermore, it excludes foreign currency deposits held by domestic residents with domestic banks, which reflects pure currency substitution. The monetary aggregate based on the residency of holder criterion, on the other hand, includes this component as well as foreign currency deposits of residents with banks abroad. This aggregate reflects residents’ total amount of demand for money, either in domestic or foreign currency. Thus any currency substitution by domestic residents between domestic and foreign money will be accounted for, so that any change in expected interest or exchange rates, resulting in currency substitution, will not lead to fluctuations in this monetary aggregate. As a consequence, the EU central banks appear to be oriented in favour of adopting the definition of money based on the concept of residency of holder criterion (Giucca and Levy, 1992) as economic agents cannot be residents in more than one country and there is no risk of double counting of their holdings.
3. IMPLICATIONS OF CURRENCY SUBSTITUTION AND EMPIRICAL EVIDENCE

3.1. Monetary Policy Implications

In traditional international economic models, it is widely argued that flexible exchange rates insulate a country's monetary policy from the developments occurring in the rest of the world. A system of flexible exchange rates would allow individual countries the liberty of using independent monetary policy for domestic purposes. Exchange rates that are allowed to adjust freely to market forces, provide an adjustment mechanism that insulates the domestic money supply from external influences, that would, under fixed exchange rates, dominate its own monetary policy decisions. It is assumed that, under flexible exchange rates, each domestic monetary authority controls the supply of its own currency that is not a substitute for others. When there is an excess demand for a currency, it will be eliminated by the exchange rate and price level changes, and purchasing power parity establishes the equilibrium relationship between the two. The balance of payments is always zero and there is no net flow of money between central banks. Thus under flexible exchange rates currencies are perfect nonsubstitutes on the supply side.

Under fixed exchange rates, on the other hand, differences among countries' excess demands for money are generally eliminated through the balance of payments, changing the physical distribution of world money among countries. That is under fixed exchange rates monetary independence is impossible because by pegging the value of domestic currency to foreign currency, the domestic monetary authorities make foreign currency a perfect substitute for domestic money on the supply side. When there is an increase in the domestic money supply, money would immediately flow out through the balance of payments. The domestic balance of payments deficit would be matched by a balance of payments surplus abroad. Then, money supplies abroad must also increase and a common rate of inflation would be observed among the countries. Hence under fixed exchange rates, countries are not insulated: any change in economic variables of foreign countries affects domestic money supply.
Consequently it has been argued that elimination of the substitution of currencies on the supply side results in complete monetary independence. However, this monetary independence argument relies implicitly on the assumption that currencies are also nonsubstitutes. But in the world of global integration this assumption appears inappropriate. Once the assumption of currency substitution on the demand side is introduced, the conclusion that flexible exchange rates imply an independent monetary policy begins to weaken. In a two country world where currency substitution exists, when the foreign country employs an expansionary monetary policy and foreign interest rates fall, the opportunity cost of holding domestic currency relative to foreign currency increases in both countries. This in turn makes holding relatively more foreign currency more attractive. The demand for foreign currency increases in both countries. In that case foreign price increases to eliminate the excess supply of foreign currency in the foreign country, would not eliminate the excess demand in the home country. However, as currencies are substitutable, some of the adjustment can occur through a rise in domestic prices. Thus currency substitution on demand side produces flows of money and changes in price levels that are not consistent with the flexible exchange rate models.

When the foreign money supply increases, rather than the entire increase remaining within that country and the price level adjusting to eliminate the excess supply of real balances, some part of foreign money is redistributed to the domestic country by domestic investors. Then, the effects of the monetary policy are not internalized within the foreign country and the nominal money supply in the home country also increases unless there is any intervention by the governments. “Thus inflation is transmitted between countries without having to assume any government intervention in the foreign exchange market (Miles 1978:432)”.

In that case, under perfect currency substitution, monetary authorities face similar types of constraints under both flexible and fixed exchange rates and the theory of how a flexible exchange rate system works needs to be altered. The degree to which inflation would be transmitted would be proportional to the degree of substitution between the currencies. If the currencies are perfect substitutes, it would be equivalent to a world of one currency, just as
when monetary authorities make currencies perfect substitutes on the supply side by fixing exchange rates.

Rogers (1990) analyses the transmission effects of higher foreign inflation under currency substitution and flexible exchange rates. When currency substitution is introduced into the model, an increase in foreign inflation would produce real effects on holdings of foreign balances, on the demand for domestic real balances and domestic inflation. The transmission of foreign inflation to domestic inflation depends on the elasticity of demand for foreign currencies. If it is sufficiently elastic, there is a positive relationship between the domestic and foreign inflation. However, if the demand for foreign currency is inelastic, the foreign inflation may be transmitted negatively under flexible exchange rates and currency substitution. In that case, the accumulation of domestic real balances lowers the velocity of money, and with output and nominal money growth unchanged leads to a lower rate of domestic inflation. Thus, as the degree of currency substitution increases, the flexible exchange rate system becomes closer to a fixed exchange rate system in the sense that higher inflation is positively transmitted.

Similarly, Brüllembourg and Schadler (1979) argue that in the extreme case of perfect currency substitution, the relative attractiveness of the strong currency will eliminate the demand for the weak currency, which is expected to depreciate*, and the exchange rate between the two will be indeterminate. They estimated a model for eight industrialized countries and it is found that there is a close complementarity among European currencies and the US dollar is the substitute currency for them. Thus, Brüllembourg and Schadler (1979) conclude in favour of policy coordination among European countries on the grounds that any coordinated action on the part of European countries would be expected to have longer impact on each currency than the same action taken by an individual country.

* Gresham’s law can apply where different currencies coexist in an integrated economy under fixed exchange rates. Fluctuations of their relative valuation affect their circulation, which could lead to instabilities in the demand for money functions.
McKinnon (1982) explores empirically and theoretically the phenomenon of international inflation transmission in a currency substitution framework. He questions how far one can define meaningful monetary aggregates in the presence of currency substitution and argues that this leads to a loss of monetary control with the result that the world money supply may be more relevant for the determination of the domestic price level rather than national money supply. Spinelli (1983), focusing on the work of McKinnon, investigates the proposition that individual countries should not pursue a monetary policy of their own, rather they should cooperate and conduct monetary policy at ‘a world’ level. He employs a rational expectations version of the Mundell - Fleming model of an open economy. The solution of the model points out that foreign nominal shocks affect domestic variables. Hence flexible exchange rates cannot insulate the domestic economy from developments which occur in the rest of the world. The adjustments in exchange rates to counter unexpected world price shocks result in shifts in money demand functions which, in turn, cause changes in output and price levels. This analysis shows that currency substitution can cause instability in domestic money demand functions. The domestic economy may no longer have full monetary autonomy. It is shown that an open economy can insulate itself from foreign nominal shocks under an extreme set of assumptions but that currency substitution leads to a link between domestic and world prices even under a flexible exchange rate regime. That is, currency substitution is seen as a source of loss of monetary independence. Spinelli argues that both domestic money and world money affect the domestic price level. Therefore, McKinnon’s argument for solely controlling a world monetary aggregate and relinquishing national monetary policies is not supported. Yet cooperation between countries aiming to control a world aggregate is reasonable. However, when discussing the kind of possible coordination, Spinelli criticizes McKinnon’s argument in that McKinnon assumes a stable world demand for money. But it is not clear that the stability of world money demand is a sufficient condition for monetary cooperation. McKinnon assumes that the main cause of the monetary interdependence is currency substitution. But there may be other reasons for monetary interdependence such as capital mobility.
It is proposed by several writers that individual countries should give up the independent control of their own monetary aggregates, rather they should cooperate and seek to control a joint monetary aggregate (McKinnon, 1982; Miles, 1978; Brillembourg and Schadler, 1979). Miles (1978) states that although flexible exchange rates ensure a degree of monetary autonomy, this autonomy is lost in the presence of currency substitution. Most studies have been concerned with the bilateral relationship between the US and Canada. The first study on this issue was the pathbreaking study by Miles (1978) which emphasized the instability of money demand under the presence of currency substitution. He regressed the relative demand for domestic and foreign currency by Canadian residents on the ratio of US to Canadian interest rates. His findings indicated that as the opportunity cost of holding US dollars rises, the demand for Canadian dollars rises. He concluded that there was evidence of currency substitution which could undermine monetary autonomy, even with floating exchange rates. Hence, he argued that the proper model for monetary policy should be one of monetary dependence even when perfectly flexible exchange rates are assumed.

Bordo and Choudhri (1982) criticize Miles (1978) arguing that the models used are incorrectly specified. Instead, they add output to the maximization problem and specify domestic and foreign money demand functions, including real income as an explanatory variable. Currency substitution is measured by the cross elasticity of domestic money demand with respect to the rate of return of foreign money holdings. Their model is estimated for Canada. It is found, in contrast to Miles (1978), that the coefficient on the interest rate differential is insignificant with a wrong sign, implying that there is no currency substitution in demand for M1 and M2. Furthermore, Cuddington (1983) argues that the indeterminacy of exchange rates and the instability or misspecification of demand for money functions might be caused by capital mobility rather than currency substitution per se. He examines the US - Canadian relationship using the portfolio balance model. His results are generally supportive of currency substitution.

Imrohoroğlu (1991) and Bufman and Leiderman (1992) employ a dynamic equilibrium model of a monetary economy. In a money in the utility function model, Hansen's Generalized
Method of Moments estimator is applied to the orthogonality conditions implied by the Euler equations to estimate elasticity of substitution between currencies. Imrohoroğlu (1991) finds modest currency substitution between the Canadian dollar and the US dollar. Bufman and Leiderman (1992) incorporate nonexpected utility to disentangle parameterization of behaviour toward risk and behaviour toward intertemporal substitution. They report that the evidence for Israel supports the notion that liquidity services produced by domestic and foreign money enter as arguments in the representative consumer’s objective function. Rogers (1992) finds that dollarization in a high inflation economy such as Mexico is quite strong and significant.

More recently, Ratti and Jeong (1994) examine the dynamic evidence for currency substitution between the US and Canadian dollar, using the dynamic money services model, which was outlined in the previous section. They found, within the context of a cointegrated relationship, that if the real exchange rate value of the Canadian dollar falls then US dollar deposits of non-bank Canadians rise; confirming the implications of their theoretical analysis. They also included the net trade balance between the US and Canada, as a scale variable and the uncovered interest rate differential. Their findings showed that in the long-run the ratio of domestic to foreign money balances responds elastically to the changes in the real exchange rate, indicating the existence of currency substitution between the US and Canadian dollar. The empirical literature on US and Canadian dollar substitution, suggests that there is evidence of currency substitution between the two currencies, even though its statistical significance is sensitive to the functional specification. However, all the alleged currency substitution is by Canadians and there is no evidence of US citizens substituting currencies.

3.2. Gresham’s Law

Gresham’s law considers the effects of the existence of different monies under a bimetallic standard, where gold and silver coins circulate. With a bimetallic standard the central bank freely exchanges at a fixed nominal price the two metals for money. Gold and silver are traded in the nonmonetary market as well, where the new supplies of both metals are sold. A condition for equilibrium between the monetary and nonmonetary markets is that the official
parity that the central bank sets should equal the relative price of the two metals in the non-monetary market.

However, when there is, say, an increase in silver ore production, which makes silver cheaper in the non-monetary market, the relative price of two metals will differ from the official parity. Economic agents can make profit when they buy gold from the central bank at the official parity to resell it in the non-monetary market. Then, the bad money will drive out the good, as the superior coins, gold, are taken out of circulation.

In a world of fiat currencies, however, the opposite tendency would prevail. Stronger fiat currencies would tend to drive out weaker ones, which McKinnon (1996) terms as Gresham's Law II. The main implication of Gresham's law II for fiat currencies is that, whenever different currencies coexist in an integrated economy under fixed exchange rates, fluctuations in their relative value affect their circulation. At this in turn can give rise to instabilities, usually caused by the inability of monetary authorities and the banking system to accommodate these demand fluctuations fully: there is always a limit beyond which central banks cannot run down their reserves or cannot increase their borrowing from other central banks and the banking system (Giovannini and Turtelboom, 1994:403).

Several authors (Girton and Roper, 1981; Kareken and Wallace, 1981; Weil, 1990) have emphasized Gresham's Law II, while they investigate the determination of exchange rate under the presence of currency substitution. They find serious problems of exchange rate instability, when economic agents hold two different currencies, which circulate in parallel. A few examples to this unstable situation can be given: US dollars circulate in parallel with the domestic currency in certain Latin American countries such as Peru and Argentina, and did circulate in parallel with shekels in Israel in the late 1970s and early 1980s. The main reason for the dollarization in these countries has been the extremely high rates of inflation which has made the domestic currency unattractive as a store of value. The dollarization process generally begins when the foreign currency replaces the domestic currency as a store of value, as agents hold most of their financial savings in the form of foreign currency denominated...
deposits. In cases of hyper inflation the domestic currency is generally replaced by a foreign one, often the US dollar, which reduces transaction costs as the real cost of holding domestic currency becomes extremely high. At that stage many prices begin to be quoted in a foreign currency, making it a medium of exchange. Cuddington (1989) called this phenomenon currency displacement to distinguish it from currency substitution.

McKinnon (1996) argues that when governments pursue an inflation tax policy, dollars should not be permitted to circulate in parallel with the weak domestic currency as a medium of exchange. Because economic agents will tend to abandon the taxed domestic currency which is depreciating in favour of the untaxed foreign currency thereby reducing the inflation tax base. For any given level of inflation tax rate, the revenue from the inflation tax would be lower in the presence of currency substitution as the demand for domestic currency would be sensitive to the inflation tax rate. Then the government would need a higher level of inflation tax in order to finance its otherwise uncovered fiscal deficit. McKinnon (1996) suggests that government should impose exchange controls to prevent such currency displacement and erosion of the government’s tax base.

Alternatively, governments can institutionalize direct currency substitution by allowing domestic residents to hold foreign monies freely while standing ready to purchase the most important one at a fixed rate of exchange. In that case, the outstanding domestic money supply is endogenously determined, as domestic money is injected into the economy in response to private demand for it at a fixed exchange rate. Thus the monetary authorities give up pursuing an independent monetary policy and cannot rely on inflation tax to finance the fiscal deficit. Then the domestic economy can benefit from the operation of Gresham’s Law II.

3.3. Exchange Rate Determination
Several models have been developed to analyse exchange rate determination capturing the effects of currency substitution. It is assumed that residents of any country can allocate their monetary holdings across various currencies. When a currency depreciates substantially,
portfolio holders can be expected to replace it with a stronger currency, and this leads, in case of perfect currency substitution, to exchange rate indeterminacy. Furthermore, in the presence of perfect currency substitution, the response of the real exchange rate to changes in domestic and foreign monetary policy is not clear. As currency substitution increases, the exchange rate becomes unstable since the movements in the exchange rate necessary to maintain monetary equilibrium become larger. Girton and Roper (1981) presented within the framework of an asset demand model the first comprehensive study of exchange rate determination under the presence of currency substitution. The model of currency substitution contains two money demand functions which, together with exogenous money supplies, are used to analyse the exchange rate. Currency substitution can be modelled by the inclusion of real returns on both monies in both money-demand functions. Defining \( r^1 \) and \( r^2 \) as the anticipated real returns on monies one and two, the demand for real balances can be expressed as

\[
\frac{M^k}{P^k} = L^k(r^1, r^2, r, w), \quad (k = 1, 2)
\]  

where \( M^k \) is the money supply of currency \( k \), \( P^k \) is the price level in terms of currency \( k \), \( r \) is the anticipated real return on nonmonetary asset and \( w \) is the wealth. They assume that the money demand functions of home and foreign country have exponential specifications. The equilibrium condition for currency one is,

\[
\frac{M^1}{P^1} = \theta_1(w) \exp\left[ \alpha_1(r^1-r) + \sigma_1(r^1-r^2) \right] \left[ \alpha_1 + \sigma_1 \right]^-1
\]  

where \( \sigma_1 \) is the coefficient of substitution between the two monies and \( \alpha_1 \) is the coefficient of substitution between money one and the nonmonetary asset. The monetary equilibrium conditions in logarithmic form are

\[
\ln M^1 - \ln P^1 = \ln \theta_1 + \alpha_1(r^1-r) + \sigma_1(r^1-r^2)
\]  

\[
\ln M^2 - \ln P^2 = \ln \theta_2 + \alpha_2(r^2-r) + \sigma_2(r^2-r^2)
\]

The implications of currency substitution can be obtained by focusing on the relative values of the two monies. To find the expression determining the relative value of the monies, subtract equation (4) from equation (3), and rearrange terms to obtain

\[
\ln\left( \frac{P^1}{P^2} \right) = \ln\left( \frac{M^1}{\theta_1} / \frac{M^2}{\theta_2} \right) - \alpha(r^1-r^2) = -2\sigma(r^1-r^2)
\]
where the following restrictions are imposed: $\alpha = \alpha_1 = \alpha_2$ and $\sigma = \sigma_1 = \sigma_2$.

By using the PPP assumption that $e = \ln(p^q / P^Q)$, equation (5) can be represented as

$$e = e^* - (\alpha + 2\sigma)(r^1 - r^2)$$  \hspace{1cm} (6)

where $e$ is the logarithm of exchange rate. The exogenous money supplies and demand factors are contained in term $e^*$. Assume that the real anticipated returns are the differences between nominal returns, $i^1$ and $i^2$ respectively, and anticipated inflation rates; and that the rate of change in exchange rate, $x$, equals, in accordance with PPP, the differential between the anticipated inflation rates of the two monies. Then equation (6) can be rewritten as

$$e = e^* - (\alpha + 2\sigma)(i^1 - i^2 - x)$$  \hspace{1cm} (7)

Equation (7) implies that currency substitution causes exchange rate instability and perfect currency substitution leads to indeterminacy of the exchange rate. Firstly, the changes in supplies of monies have a proportionate effect on exchange rates for all finite degrees of currency substitution. As $\partial e / \partial e^* = 1$ indicates. Furthermore, when the effect of a change in the anticipated rate of change of the exchange rate is considered, $\partial e / \partial x = \alpha + 2\sigma$, which means that as the degree of currency substitution increases, the change in the exchange rate to maintain equilibrium also increases. Currency substitution increases the impact of the rate of change in exchange rate, $x$, on the exchange rate, e, but leaves the impact of money supplies on the exchange rate unaffected, so that exchange market intervention in order to offset the shifts in the anticipated changes in the exchange rate becomes less effective. That is currency substitution is found to produce instability because changes in the expected rate of depreciation of the currency lead to larger movements in exchange rates.

Following this line of argument, Calvo and Rodriguez (1977), Engel (1989), Guidotti (1989), Weil (1991), Woodford (1991) and Canzoneri, Diba and Giovannini (1992) investigate theoretically the effects of currency substitution on exchange rates. Calvo and Rodriguez (1977) show that the real exchange rate depends on the rate of monetary expansion in the short run but it is determined by real variables in the long run. They demonstrate that an increase in domestic money growth causes an immediate real depreciation of the currency. Weil (1991) argues that the likelihood of hyperinflation will increase with perfect currency
substitution. He also shows that high currency substitution can lead to multiple rational expectations equilibria.

Canzoneri, Diba and Giovanini (1992) report that regardless of the degree of substitutability of currencies, as long as it is less than perfect, the only equilibrium would be the symmetric stationary equilibrium where real foreign and domestic money balances are equal to each other. However, with perfect currency substitution, a perfect foresight equilibrium would be indeterminate, and equilibrium would not exist under either a fixed or a flexible exchange rate regime. Moreover, they agree with Weil in that the likelihood of hyperinflation increases as the degree of substitution between currencies increases, because then no currency will ever be essential for transactions.

3.4. The Demand for Money
The concept of currency substitution first attracted attention in the late 1970s. Although, money demand functions had been assumed to be stable, this had seemed to break down in the 1970s as empirical evidence which exhibited instability in the demand for money functions was obtained both in the UK and in the US. Instability refers to three interrelated features. First, errors of prediction occurred when the data for the 1950s and 1960s were used in predictions of money demand in the 1970s (Artis and Lewis, 1991). Secondly, in partial adjustment models, when data for the 1970s were included in the sample, the coefficient of the lagged dependent variable changed, implying that there had been some change in the nature of the adjustment process. Finally, in order to accommodate additional data from the 1970s, some studies resorted to including variables which were not previously included in similar studies, or adding dummy variables (Grice and Bennett, 1984 and Taylor, 1987).

For the US, the instability in the money demand function first emerged in the years 1972-1974 when the demand for money began to grow much more slowly than would have been expected on the basis of previously satisfactory formulations of the demand for money functions; and this was followed by an upward shift of the demand for money in 1981-1982. These developments were termed as the case of missing money where instability in previously
satisfactory specifications of demand for money functions were observed. In the UK, there was a large expansion of money in 1972-1973 (and subsequently in the late 1980s), which was termed as the great velocity decline. The decline in velocity in the early 1970s coincided with the release of lending controls and alterations to the required reserve ratios.

There have been several attempts to explain the instability in the demand for money functions. One line of argument was misspecification of the demand for money functions. Some authors attributed the observed instability to the inadequacy of the available techniques to cope with the data generated in the 1970s and 1980s. Others suggested that, although the relationships might have been properly specified in the 1950s and 1960s, there had been institutional changes in the 1970s and 1980s which should have been taken into account. Some authors, like Brittain (1981) and McKinnon (1982), on the other hand, attributed this instability to currency substitution and called for co-operation to target a ‘world’ monetary aggregate rather than focussing solely on national aggregates.

In the 1980s, especially in ERM countries, financial innovations and deregulations accelerated, increasing both the liquidity of and the returns on financial assets. Information and transaction costs were lowered due to the strong development in computer technology during the last two decades. As international integration increases, economic agents can hold their money balances across various currencies. “The exchange rate stability ensured by the ERM, together with the progress towards EMU, enhances the scope for currency substitution within the area. Apart from the limited use of foreign currency to carry out domestic transactions (currency substitution stricto sensu), exchange rate stability fosters the holdings of transaction balances in foreign currencies for spending abroad and, more generally, the holding of (monetary) assets denominated in foreign currency” (Monticelli and Strauss-Khan, 1993:347).

Additionally, financial integration results in foreign economic variables, such as foreign interest rates or money, affecting domestic money demand functions, and making policy interdependence among countries more important. Thus currency substitution and increased
policy interdependence strengthen the links between the money demands of closely integrated countries, and will tend to make estimated national money demand functions unstable as national money demands are influenced by foreign economic variables which are seldom included in the money demand specifications. Monetary authorities operate in a context of imperfect information and thus cannot precisely identify the nature and the extent of currency substitution, which would become a source of instability in national money demand functions. However, as shocks caused by currency substitution are negatively related, while individual money demands are more unstable, the total or area-wide money demand should not be affected by the shocks and will become more stable relative to individual country money demands.

Several empirical studies have investigated currency substitution in the context of policy coordination in EU countries. The indirect measurement of currency substitution through the relative stability of supranational versus national monetary aggregates has attracted a lot of attention recently. Among others, Angeloni et al. (1991), Kremers and Lane (1990), Lane and Poloz (1992), Monticelli and Strauss-Kahn (1992), Artis, Bladen-Hovell and Zhang (1993) and Cassard, Lane and Masson (1997) have investigated whether in the light of currency substitution an EU wide money demand function could be more stable than the national money demand functions. An account of these studies is given in Table 3. Rather than going into the details of these studies, we just report here that most conclude in favour of a stable and well-specified European money demand function. Then, if the currency substitution hypothesis is true, the case for EMU, which requires the adoption of a common monetary policy by a European Central Bank and provides a basis for an EU wide policy targeting, will be strengthened.

A second line of literature argues that as traditionally defined monetary aggregates neglect cross-border deposits, EU-wide monetary aggregates ignore a potentially large source of currency substitution which may exist. It is argued that the exclusion of CBDs may introduce misspecifications and constitutes a major difficulty in the investigation of regionally broader definitions of money. The empirical studies of Angeloni et al (1991), Giucca and Levy (1992)
and Monticelli (1993) examine the informativeness of extended monetary aggregates compared to traditional monetary aggregates, for EU countries. They argue that the increasing degree of currency substitution between European currencies could produce higher volatility in aggregates which may impair the usefulness of monetary aggregates as policy indicators. Angeloni et. al. (1991) examine empirically whether CBDs affect the role of monetary aggregates as policy indicators. They argue that CBDs are relevant for the stability of money-income relationship, since currency substitution leads to the instability of traditional monetary aggregates. Therefore, they suggest to redefine the traditional monetary aggregates so as to include CBDs. However, Giuca and Levy (1992) report that it is difficult to discriminate between traditional and extended monetary aggregates on the basis of their informational content. Furthermore, Monticelli (1993) investigated the economic properties of extended monetary aggregates and compared them with traditional ones within the context of EU countries. He found that extended monetary aggregates perform differently according to the definition. Very broad measures are found to be poorly linked with EU income. On the other hand, extended aggregates defined on the basis of currency of denomination performed well. However, none of the extended aggregates outperformed the traditional monetary aggregate, contrary to the findings of Angeloni et. al. (1991).

Although empirical studies give contradictory results about the importance of CBDs, it still seems reasonable to include them in the definitions of monetary aggregates to avoid double counting or exclusion of some items when monetary aggregates are summed. Furthermore, the extended monetary aggregates can be expected to become stable when compared to the traditionally defined monetary aggregates as they include foreign currency deposits of residents which tend to fluctuate when there is a change in the foreign economic variables.

4. CONCLUSION

The concept and definition of currency substitution and some measurement issues are addressed in this study. Furthermore, after giving an account of the theoretical models of currency substitution the implications of currency substitution on the conduct of monetary
policy, exchange rate determination and the stability of money demand are surveyed. It emerged that there is little consensus about the definition of currency substitution, but it is generally agreed that certain categories of cross-border deposits, which could represent currency substitution, should be included in the traditional monetary aggregates in order to prevent any misspecification.

As far as policy implications are considered, under the presence of currency substitution, flexible exchange rates do not insulate the domestic money supply from developments occurring in the rest of the world, and the independence of monetary policy becomes impossible. In terms of exchange rate determination, currency substitution will cause exchange rate instability and perfect currency substitution will lead to indeterminacy of exchange rates. Furthermore the likelihood of hyperinflation increases as the degree of currency substitution increases.

Currency substitution and financial integration, especially among EU countries, strengthens the links between the money demand functions of closely related EU countries, affecting both the specification and the stability of money demand functions. In the context of EU countries, since currency substitution brings instability to national money demand functions, a common EU-wide money demand function could be stable. Therefore, a common monetary policy for EU countries could be reasonable as financial markets integrate and financial liberalisation takes place.
Table 3: Studies on Area-Wide Demand for Money for EU

<table>
<thead>
<tr>
<th>Authors</th>
<th>Monetary Aggregates</th>
<th>Group of Countries</th>
<th>Aggregation Method</th>
<th>Long-Run Parameters</th>
<th>ECM</th>
<th>Standard error[^1]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Price level</td>
<td>Real income</td>
<td>Short-term interest rate</td>
</tr>
<tr>
<td>Kremers and Lane</td>
<td>M1</td>
<td>ERM-7</td>
<td>PPP 1985</td>
<td>1.00</td>
<td>1.00</td>
<td>-0.67</td>
</tr>
<tr>
<td>(1990)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fase and Winder</td>
<td>M1</td>
<td>EU-11</td>
<td>current</td>
<td>0.89</td>
<td>1.00</td>
<td>-1.51</td>
</tr>
<tr>
<td>(1992)</td>
<td>M2</td>
<td></td>
<td></td>
<td>0.96</td>
<td>1.00</td>
<td>1.67</td>
</tr>
<tr>
<td></td>
<td>M3</td>
<td></td>
<td></td>
<td>0.97</td>
<td>1.00</td>
<td>1.48</td>
</tr>
<tr>
<td>Artis et. al. (1993)</td>
<td>M1</td>
<td>ERM-7</td>
<td>nominal 1980</td>
<td>1.00</td>
<td>0.99</td>
<td>-1.21</td>
</tr>
<tr>
<td></td>
<td>M2</td>
<td></td>
<td></td>
<td>1.00</td>
<td>1.20</td>
<td>-0.70</td>
</tr>
<tr>
<td>Monticelli and Strauss-Kahn (1992)</td>
<td>M3</td>
<td>ERM-9</td>
<td>current</td>
<td>1.00</td>
<td>1.29</td>
<td>-0.72</td>
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<tr>
<td>Monticelli and Papi (1996)</td>
<td>M1</td>
<td>EU-9</td>
<td>current</td>
<td>1.00</td>
<td>1.29</td>
<td>-0.90</td>
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<tr>
<td></td>
<td>M3</td>
<td></td>
<td></td>
<td>1.00</td>
<td>1.25</td>
<td>-0.49</td>
</tr>
<tr>
<td></td>
<td>Extended M3</td>
<td></td>
<td></td>
<td>1.00</td>
<td>1.51</td>
<td>-0.29</td>
</tr>
<tr>
<td>Cassard et al. (1997)</td>
<td>M3</td>
<td>ERM-6</td>
<td>PPP-1985</td>
<td>1.00</td>
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<td>Yildirim (1998)</td>
<td>Extended M3</td>
<td>EU 5</td>
<td>fixed 1989</td>
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<td></td>
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<td></td>
<td>Moving average</td>
<td>1.00</td>
<td>1.77</td>
<td>-0.015</td>
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</table>

[^1]: Standard error (H100) of the residuals in the short run money demand equation.
REFERENCES


89


