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How does EMU affect the Dollar and the Yen as International Reserve and Investment Currencies?

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Abstract

Since EMU represents a currency area with a GDP level and a world market share comparable to the United States, it is widely expected that the euro will become an important international currency. This paper suggests simple methods how to quantify the effects that EMU may exert on the roles of the dollar and the yen as the other major international currencies. Estimates presented indicate that the euro may indeed lead to a significant decline in the market share of the dollar as an official reserve currency of central banks and as an investment currency of private portfolios. These effects hinge on the assumption that the euro will achieve a reputation similar to that of the deutschmark before EMU. The projected shifts can be expected to materialize only in the medium term so that no immediate abrupt changes in the demand for dollars will occur.

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Keywords: International Economic Integration, Long-Term Capital Movements, Financial Aspects of Economic Integration

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I. Introduction

European Economic and Monetary Union (EMU) and the introduction of the euro offer central banks and international investors, for the first time after World War II, a real alternative to the US dollar as an international reserve and investment currency. This is the case because Euroland represents a currency area with a GDP nearly as high as that of the United States and a share in world trade exceeding the share of the United States. Since the size of the underlying economy and the volume of global trade flows are important factors determining whether or not a currency develops into an international currency, EMU can eventually lead to a role of the euro exceeding by far the combined role of the currencies the euro replaces.

The role of a currency as an international reserve and investment currency is related to the store of value function of a currency. However, four functions of an international currency can be distinguished (Table 1). For international transactions, a currency can serve as a unit of account, a means of payment, a store of value, and a peg in exchange rate arrangements. As shown in Table 1, within the various functions of an international currency two major users can be distinguished. They comprise the private sector and the public sector. Since the objective of this paper is to evaluate asset holdings in different currencies, the focus is on the international store of value function of the dollar, the yen and the euro for both the public sector (reserve currency) and the private sector (investment currency).

Table 1: The Roles of an International Currency

| Function | Private Sector | Public Sector |
|-----------------------------------|--|---|
| Unit of account | Currency used to invoice foreign trade and denominate international financial instruments | Currency used in expressing exchange rate relationships |
| Means of payment | Currency used to settle international trade and to discharge international financial obligations | Intervention currency in the foreign exchange markets and currency used for balance of payments financing |
| Store of value | Currency used to denominate deposits, loans and bonds | Reserve asset held by monetary authorities |
| Peg in exchange rate arrangements | - | Currency to which the exchange rate is pegged (as a single currency or in a currency basket) |

Source: Tavlas (1991) and own extensions.

A number of authors have studied the factors that make a currency an international currency. Heller and Knight (1978), Dooley, Lizondo, and Mathieson (1989), and Lizondo and Mathieson (1987) were among the first to study the role of individual currencies as international reserve currencies of central banks. Gros and Thygesen (1992), Johnson (1994), Leahy (1994), Alogoskoufis and Portes (1997), and Masson and Turtelboom (1997) discuss possible effects of EMU on official reserve holdings. McCauley (1997) and McCauley and White (1997) stress that the euro will also play a major role as an international investment currency given the broader, deeper, and more liquid financial market in the EMU area.

According to Bergsten (1997), the strong external economic position of the EU could indicate the euro's potential as a major international currency. Bergsten puts in doubt the future stability and value of the dollar given the fact that the United States has run current account deficits for many years and accumulated high foreign liabilities. The EU, by contrast, has a balanced international creditor position. As a result, the question arises to what extent the euro could indeed challenge or replace the role of the US dollar. There may also be implications for the role of the Japanese yen, the third most important international currency in the 1980s and 1990s.

This paper aims at quantifying the effects EMU is likely to have on the level and the currency composition of the portfolio of central banks and private investors. It extends earlier work of Frenkel and Søndergaard (1997) and focuses on the three major currencies under EMU, i.e., the dollar, the euro, and the yen. The paper estimates demand functions for international currencies and applies the results to the new structure of international currency areas. Regarding reserves, the demand of the European Central Bank (ECB) and of non-EMU central banks is examined separately. Regarding private portfolios, we focus on international bonds and bank deposits because they represent the portfolio components which can easily be shifted between currencies.

In quantifying the effects of EMU on the demand for international currencies, this paper uses two crucial simplifying assumptions. First, it assumes that the euro will be as stable as

the deutschmark and thus may basically achieve the same reputation as the deutschmark. Second, despite the change in the international monetary system resulting from EMU, it is assumed that the induced changes in the structure of the demand functions for international currencies will not be too extensive. This means that the Lucas critique is ignored for the estimates of the asset demand changes. Otherwise, no quantification of the portfolio effects would be possible. Therefore, the results should be interpreted with caution. In order not to restrict the analysis to the initial EMU members, the effects of EMU on the demand for international currencies are examined for the initial member countries (EMU-11) and for the group of all EU countries at the end of the 1990s (EMU-15).

The remainder of the paper is structured in five parts. Section II projects the effect of EMU on the level and currency structure of foreign exchange reserves of the ECB and compares the results to the foreign exchange holdings of the central banks of the member countries before EMU. Section III estimates the effects of EMU on the level and composition of international reserves of non-EMU central banks. Section IV examines the impact of EMU on the use of international currencies in international bond issues. Section V projects the same effects on international bank deposits. Section VI contains the summary and some conclusions.

II. International Reserve Demand of the European Central Bank

In mid-1998 foreign exchange reserves of all member countries of the IMF amounted to more than \$1.6 trillion (Table 2). There are considerable differences between the reserve levels of individual industrial countries. While Germany and Japan hold relatively high levels of international reserves, traditionally both the United States and the U.K. have maintained fairly small levels. Taken together, EU countries account for about 23 percent of all official foreign exchange holdings.

Table 2: Distribution of Foreign Exchange Reserves, 1998 Q2. (in millions of US\$)

| | |
|----------------------|-----------|
| All Countries | 1,636,825 |
| United States | 31,168 |
| Japan | 192,857 |
| EU-15 | 371,486 |
| Germany | 70,906 |
| Spain | 64,702 |
| Italy | 43,282 |
| France | 34,354 |
| United Kingdom | 27,408 |
| Netherlands | 19,650 |
| Other | 111,184 |
| Asia | 535,164 |
| China P.R. Mainland | 140,505 |
| China P.R. Hong Kong | 96,480 |
| Singapore | 70,490 |
| Korea | 40,763 |
| Thailand | 25,354 |
| India | 23,932 |
| Indonesia | 17,521 |
| Other | 120,119 |

Source of data: International Monetary Fund (1998a).

In the long run, EMU is likely to have two effects on the demand for international reserves of the European Central Bank compared to the aggregated foreign exchange demand of the individual central banks of member countries before EMU:

- a level effect and
- a structural effect.

The level effect is related to the frequent observation that there is a positive correlation between the value of international trade of an economy and the foreign exchange demand of the central bank. It has often been argued that this reflects the objective of central banks to provide foreign exchange for imports in the event of a negative shock on foreign exchange inflows. Since most international trade of EMU member countries is with other EMU member countries and intra-EMU trade does not represent trade with a different currency area, the overall level of reserves is likely to decline. In other words, only trade with non-EMU countries require reserve holdings of the ECB. Thus, EMU induces savings of international reserves. This will negatively affect the demand of the ECB for dollars and yen compared to the pre-EMU situation.

The second effect is structural. While individual central banks of EMU countries have held some foreign exchange reserves in currencies of other EMU member countries, the number of alternative currencies for the reserve holdings of the ECB will be much more limited. This implies that the share of the dollar and the yen in international reserves of the ECB will rise.

We estimate the described effects for two country groups. One group comprises the eleven countries that became EMU members in 1999. We will refer to this group as EMU-11. The other group includes all current EU countries and is referred to as EMU-15. The latter group is used to describe a medium-term scenario of EMU. Of course, with the expansion of the EU to the east, new EU member could eventually also increase the number of EMU member countries in the long term.

The demand for reserves estimated by various authors is subject to several problems in the context of this paper so that these findings cannot be used here. For example, Heller and Khan (1978) find that the demand for international reserves is positively related to both the level of GDP and the variability of the overall balance of payments, and negatively related to the import-GDP ratio. There are basically three problems in applying these results to the projection of the demand for international reserves under EMU. First, their study focuses mainly on the Bretton Woods period and the coefficients were estimated across too wide a range of countries for the purpose of our study. Second, projections would require an estimate of the future balance of payments variability of Euroland, which cannot be projected at this time. Third, if the balance of payments variability is excluded from their estimates and GDP as well as import ratios are included, the estimation yields implausible results. The more recent study by Lizondo and Mathieson (1987) merely updates the Heller and Khan estimates and is therefore subject to the same problems in the context of our projections.

Given the problems outlined above, we apply a fairly simple approach and estimate reserve demand functions for different country groups and then use these estimates for projections of developments under EMU. We start by estimating simple demand functions for

international reserves for the period 1979 through 1997, i.e., for the period of the EMS. We assume that the level of foreign exchange held by central banks are positively related to imports of goods and services. This is based on the idea that central banks hold international reserves in order to be able to intervene in foreign exchange markets in case of real external shocks. We focus on the long-run relation between imports and reserves and therefore do not examine the dynamics of the reserve adjustment process to imports. Therefore, we estimate the following simple demand function using OLS:

$$(1) \quad \log res_t = \beta_0 + \beta_1 \log imp_t + \varepsilon_t ,$$

where *res*, *imp*, and ε denote imports, reserve levels, and an error term, respectively. Our approach implies that more imports induce central banks to hold more reserves in order to be prepared to intervene in foreign exchange markets. For both EMU-11 and EMU-15, we pool the reserve data of member countries and employ quarterly and annual data, alternatively.

Table 3 reports the regression results. The estimates of the coefficients have the correct sign and the overall statistical properties of the regressions seem to be acceptable, although the Durbin Watson values are relatively low. However, this only indicates that there are some dynamics in the adjustment process of the reserve holdings. While the analysis of the dynamics is important for most issues in which variables do not adjust instantaneously, this does not constitute a problem for the purpose of our study since the focus is on the long run.¹ As the regressions indicate, the elasticity of reserves with respect to imports is around unity and somewhat higher for EMU-15 than for EMU-11.

Table 3: Regression Results for the Demand for International Reserves in Europe

| Independent Variable (logs) | Data Frequency | Constant | Imports _t (logs) | R ² | D.W. |
|------------------------------|----------------|-------------------|-----------------------------|----------------|------|
| Reserves of EMU-11 | Annual | -2.293 (-3.82) | 1.047 (23.89) | 0.97 | 1.18 |
| | Quarterly | -0.691 (-2.00) | 1.035 (36.72) | 0.95 | 1.03 |
| Reserves of EMU-15 countries | Annual | -3.905 (-5.92) | 1.160 (24.54) | 0.97 | 1.13 |
| | Quarterly | -1.988 (-5.31) | 1.136 (38.00) | 0.95 | 0.94 |

Source of data: International Monetary Fund (1998a, b).
Data series are from 1979Q1 to 1997Q4; t-values in parentheses.

The estimates of reserve demand functions can be used to project the overall level of foreign exchange reserves of the ECB. This is done by replacing aggregated import data of all member countries by imports from outside the currency area. This means that we use import values excluding intra-EMU trade. The projections are based on 1997 trade data and the average of the estimated import coefficients in the reserve demand functions. They do not take into account future growth in trade flows. This facilitates the comparison with the most recent reserve data. Table 4 shows that the level of international reserves of the ECB is projected to be significantly lower than the sum of the reserve holding of individual countries before EMU. This, of course, reflects the reduced openness of Euroland compared to the individual member countries which, in turn, requires lower holdings of international reserves. As a consequence, the implied savings are considerably higher under a wider EMU. This also reflects the slightly higher import elasticity estimate for EMU-15.

These estimates must be interpreted with caution as EMU may well induce a structural change in the reserve demand function. Nevertheless, the projections indicate that the savings are likely to be substantial. They amount to 52 percent under EMU-11 and are projected to increase to 68 percent under EMU-15. This result confirms an early rough estimate of the European Commission (1990) which predicted a decline of foreign exchange holdings under EMU by about one half .

Table 4: EMU Effects on the ECB's Overall Demand for International Reserves*

| Country Group | Pre-EMU | With EMU | Difference (US\$ millions) | Relative Change in Reserves |
|---------------|---------|----------|-------------------------------|-----------------------------------|
| EMU-11 | 300,091 | 144,275 | -155,816 | -52% |
| EMU-15 | 369,225 | 116,918 | -252,307 | -68% |

*Projections refer to reserve and import data of 1997, i.e., the last data point in the estimates of the reserve demand function.

We now turn to the structural effect described above, that is, the EMU effects on the currency composition of the foreign exchange reserves of the ECB. Compared to the pre-EMU choices of EMU central banks for reserve currencies, the ECB now has fewer

alternatives for any given level of foreign exchange reserves. It seems realistic to assume that the ECB will hold most of its foreign reserves in dollars and yen. Thus, for the reserves of the ECB, these two currencies become more important than they were for individual central banks in Euroland before. While we have shown that the overall level of reserves is likely to decline significantly, the expected increase in the share of the dollar and the yen could at least partly offset the first effect.

Quantifying the described structural effect in the foreign exchange reserves of the ECB is restricted by the fact that no complete data set is available for the currency composition of reserves held by individual European central banks. We therefore rely on data published by the IMF (1998) on the currency structure of foreign exchange reserves of industrial countries. We assume that the published shares of currencies which are replaced by the euro will be proportionally distributed over the remaining choices of currencies for the ECB. Applying this assumption we calculate that the dollar share in official international reserves in Euroland will increase from 67 percent to 82 percent under EMU-11 (and to 84 percent under EMU-15) while the yen share will increase from 5.7 percent to 7.0 percent under EMU-11 (and to 7.2 percent under EMU-15).²

Table 5: The Effect of EMU on the Absolute Level of the ECB's Dollar and Yen Reserves*

| Country Group | Currency | Current Holdings | Holdings under EMU | Difference | Relative Change |
|-----------------------|----------|------------------|--------------------|------------|-----------------|
| (in millions of US\$) | | | | | |
| EMU-11 | US\$ | 200,160 | 118,219 | -81,942 | -41% |
| | Yen | 17,105 | 10,099 | -7,006 | -41% |
| EMU-15 | US\$ | 246,273 | 98,223 | -148,050 | -60% |
| | Yen | 21,046 | 8,395 | -12,651 | -60% |

* Projections are based on the following currency composition of international reserves of the ECB: Pre-EMU (estimated) dollar share 66.7 percent, yen share 5.7 percent; EMU-11: dollar \$ share 81.9 percent, yen share 7.0 percent; EMU-15: dollar share 84.0 percent, yen share 7.2 percent.

The combined effects of the reduced level of international reserves in Europe and the change in the currency composition translate into changes in the absolute level of the ECB's demand for dollars and yen as shown in Table 5. The projections indicate that the overall demand for dollars and for yen will decline significantly (by 41 percent for EMU-11 and by

60 percent for EMU-15) reflecting that the level effect clearly dominates the structural effect.

III. How Will the Euro Affect the Reserve Holding of Non-EMU Central Banks?

During the five decades following World War II, international reserves have largely consisted of US dollars, a fact often ascribed to the role of the dollar as the most important intervention and invoicing currency. We now examine whether this may change with EMU.

In order to examine how EMU may affect the reserve holdings of non-EMU central banks, we first assume that the share of a reserve currency in international reserves is determined by the economic size of the country which issues the currency and by its inflation record. Greater economic size indicates that a currency is used more widely in goods and financial markets. Greater width (size) and depth (sophistication) of the market for a currency increases its use as an international currency. The inflation record of a country can also be expected to influence the use of a currency as a reserve currency. Price stability in the reserve currency center encourages the use of the reserve currency as a unit of account and as store of value. On the basis of these assumptions, both higher economic activity (as measured by GDP) and higher price stability contribute to an increase in the role of a reserve currency. Thus, we estimate the following equation:

$$(4) \quad Sh_{i,t} = \beta_0 GDP_{i,t} + \beta_1 Movinf_{i,t} + \varepsilon_t ,$$

where Sh_i is the share of currency i , GDP is the share of the corresponding country's GDP in the total GDP of US, Japan and Germany, and $Movinf$ represents the five-year moving averages of inflation relative to the other two currencies. Since no quarterly data are available on the currency composition of the reserves of non-EMU central banks, we use annual data covering the period 1978-1997. We also test for a constant and a lagged dependent variable but find no significant coefficients. Instead, a discontinuity seems to apply in the case of the deutschmark after 1989, which we take into account by a dummy variable. This effect may well be related to German unification. In the case of the yen, a

significant autoregressive process can be found but inflation does not seem to have had a significant influence on the currency share. The results are reported in Table 6.

Table 6: Regression Results for Currency Shares in International Reserves*

| Dependent Variable | Relative GDP Share | Relative Inflation (lagged) | Dummy | AR(1) | R2 | D.W |
|--------------------|--------------------|-----------------------------|-------------------|-----------------|------|------|
| Deutschmark share | 0.998 (32.46) | -0.010 (-5.18) | -0.035 (-4.64) | - | 0.20 | 1.54 |
| Dollar share | 1.258 (37.73) | -0.025 (-3.47) | - | - | 0.31 | 1.05 |
| Yen share | 0.223 (11.77) | - | - | 0.711 (4.80) | 0.80 | 1.08 |

*Data series are from 1978 through 1997; t-values in parentheses; trend for the period after German reunification. Source of data: International Monetary Fund (1998a, b)

The regression results can be used to project the currency shares under EMU. For the projections, we need to make an assumption about the inflation differential between the three major currencies. We assume that inflation rates for the dollar, the yen and the euro will be the same. In addition, to eliminate cyclical factors on GDP shares, we apply average GDP shares during the period 1995-1997. Table 7 shows the projected shares of the dollar, the euro, and the yen in reserves of non-EMU central banks for both EMU-11 and EMU-15. Under EMU-11, the dollar share drops from 62 percent to about 51 percent, while the euro share increases from 13 percent (the deutschmark share) to about 34 percent. Thus, although the dollar is likely to remain the most important currency for non-EMU central banks, the euro is projected to substantially gain in importance.

Table 7: Projected EMU-Effects on the Currency Composition of International Reserves of Non-EMU Central Banks*

| Country Group | Dollar-share | Euro-share (pre EMU: deutschmark) | Yen-share |
|---------------|--------------|-----------------------------------|-----------|
| Pre-EMU | 62.1% | 12.8% | 4.9% |
| EMU-11 | 50.9% | 35.0% | 5.4% |
| EMU-15 | 46.7% | 40.4% | 5.0% |

* Based on the following GDP shares (in percent): pre-EMU: Germany 15.67, United States 52.56, Japan 31.77; EMU-11: Euro 35.04, United States 40.49, Japan 24.47; EMU-15: Euro 40.44, United States 37.12, Japan 22.43. GDP shares are calculated as a three-year average of GDP shares of EMU, United States and Japan in 1995, 1996 and 1997.

The projected absolute changes in dollar and yen holdings of non-EMU central banks are shown in Table 8. They indicate that, for EMU-11 (EMU-15), a significant reduction in dollar holdings can be expected to amount to nearly US\$152 billion (US\$199 billion) or nearly 18 percent (25 percent) of current dollar holdings. In absolute terms, this represents a significantly stronger decline than the projected decline in dollar holdings of the ECB.

Table 8: EMU Effects on Absolute Levels of Dollar and Yen Holdings of Non-EMU Central Banks*

| Country Group | Currency | Current Holdings | Holdings under EMU | Difference | Relative Change |
|-----------------------|----------|------------------|--------------------|------------|-----------------|
| (in millions of US\$) | | | | | |
| EMU-11 | US\$ | 843,678 | 692,017 | -151,661 | -17,98% |
| | Yen | 66,570 | 74,134 | 7,563 | 11,36% |
| EMU-15 | US\$ | 800,745 | 602,168 | -198,576 | -24,80% |
| | Yen | 63,183 | 64,509 | 1,326 | 2,10% |

*Changes refer to end-1997 reserve data.

IV. The Euro and International Bond Holdings

We now turn to international asset holdings of the private sector. As pointed out earlier, we confine the analysis in this paper to international bond holdings and international bank deposits. There are three reasons for this. First, these international assets account for a high share in international private portfolios. Second, relatively complete and consistent data are available for these assets. Finally, unlike in the case of equities, virtually the same type of asset can be held in alternative currencies so that the currency of denomination and the expected return on it is the most important factor in the demand for these assets in a specific currency.

International bond holdings are very important in quantitative terms. Towards the end of 1997, they amounted to about \$3.3 trillion according to the Bank of International Settlement (1998) and, thus, exceeded the total amount of foreign exchange reserves of central banks by far.

To derive the order of magnitude of EMU effects on the currency composition of

international bond holdings, we first estimate demand functions for international bonds. We assume that the width of a market represents an important factor for the currency structure of private bonds portfolios. Higher width of a market, with everything else remaining unchanged, increases the liquidity of assets and therefore the demand for assets denominated in the currency of this market. As before, we restrict the analysis to the dollar, the yen, and the euro. As a proxy for the market width we use the GDP share of the United States, Japan, and Euroland in the total GDP of these three countries. Another important factor determining the currency structure of international bonds portfolios is the stability of the currency in which the bonds are denominated. Portfolios are likely to include more bonds denominated in low inflation currencies than in currencies with higher inflation. We assume that expectations of central banks are more backward-looking than those of managers when deciding about the currency structure of their assets. Therefore, we assume that portfolio managers take into account expected inflation differentials of a currency vis-à-vis other currencies.

Based on these considerations, we estimate the following equation for the share of bonds denominated in currency i , which we denote by Sh_i ($i = \text{dollar, yen or deutschmark}$):

$$(5) \quad Sh_{i,t} = \beta_0 GDP_{i,t} + \beta_1 Inf_{i,t}^e + \varepsilon_t .$$

The notation is as follows: GDP_i represents again the GDP share, Inf_i^e is the expected inflation differential, and ε is the error term. As a proxy for the expected inflation differential, we use the actual inflation differential of the dollar, the yen, and the deutschmark during the two subsequent years vis-à-vis the countries whose currencies are considered as alternative bond denominations.

We perform OLS estimates and use quarterly data as published by the Bank for International Settlement for the period 1990 through 1997. Table 9 reports the results. We were not able to find a significant inflation coefficient in the demand function for yen bonds, but we find significant inflation coefficients for the demand for dollar bonds and deutschmark bonds.

Table 9: Regression Results for the Currency Shares of International Bonds*

| Dependent Variable | Relative GDP Share | Inflation Differential ¹⁾ | AR(1) | R ² | D.W. |
|--------------------|--------------------|--------------------------------------|------------------|----------------|------|
| Deutschmark share | 0.716 (22.55) | -0.008 (-2.25) | 0.664 (3.58) | 0.77 | 2.35 |
| Dollar share | 0.766 (56.16) | -0.018 (-3.05) | 0.503 (3.10) | 0.89 | 1.92 |
| Yen share | 0.469 (9.68) | - | 0.910 (13.13) | 0.90 | 2.07 |

*Data series are from 1990Q1 to 1997Q4; t values in parentheses.

1) Inflation differential during the subsequent two years.

Source of data: Bank for International Settlement (1998).

The estimates are used to project the currency composition of international bonds under EMU. For the projections, we again assume that the euro will basically replace the deutschmark with the difference that it will represent a greater economic area. Replacing the relative GDP levels by the GDP shares of the United States, Japan, and Euroland in their combined GDP, we derive the projected currency composition of international bonds as reported in Table 10. In addition, the projections take into account that EMU also leads to the replacement of non-German European currencies. For simplicity, we assume that their share will be proportionally distributed over the remaining international currencies so that their elimination does not affect the relative magnitudes of the other currency shares. Thus, there are two medium-term effects on the share of dollar-denominated bonds. First, as the relative GDP share of the United States in the sum of the GDPs of the United States, Japan, and Euroland decreases, the dollar share declines. Second, the replacement of bonds denominated in European currencies other than the deutschmark by bonds denominated in dollar, yen, euro and other remaining currencies will increase the share of dollar-denominated bonds. However, our findings suggest that this effect will not completely offset the first one so that a decline in the demand for dollar-denominated bonds will result.

Table 10: Projected EMU Effects on the Currency Shares of International Bonds.

| Country Group | Dollar-share | Euro-share | Yen-share |
|---------------|--------------|------------|-----------|
| Pre-EMU | 42.0% | 10.1%* | 14.4% |
| EMU-11 | 36.6% | 29.6% | 13.6% |
| EMU-15 | 37.4% | 38.1% | 13.9% |

* Euro share for pre-EMU situation represents share of deutschmark.
The projected DM and USD share were calculated on the basis of GDP-weights. Shares take into account the shares of non-German EU-currencies.

The projections in Table 10 show a projected decline of the share of dollar-denominated bonds from 42 percent to 36.6 percent under EMU-11 and to 37.4 percent under EMU-15. The share of yen-denominated bonds is projected to decline by only half a percentage point to close to 14 percent under both scenarios. Euro bonds are expected to constitute nearly 30 percent of total international bond holdings under EMU-11 and over 38 percent under EMU-15 compared to a deutschmark share of around 10 percent before EMU.

From the changes in the currency shares of international bonds, we can derive absolute changes in the demand for the different bonds. Table 11 shows the implied absolute change in the demand for international bonds denominated in dollar and in yen. Under EMU-11, the holdings of dollar-denominated bonds are projected to decline by US\$178 billion equivalent to nearly 13 percent of the 1997 level, while the demand for yen-denominated bonds can be expected to decline by US\$27 billion or 5.6 percent. With fewer currencies as options for international bonds under EMU-15, the shares of the dollar and the yen are projected to be slightly higher.

Table 11: Effects of EMU on Absolute Dollar and Yen Holdings in International Bond Portfolio*

| Country Group | Currency | Pre-EMU Holdings | Holdings under EMU | Difference | Relative Change |
|---------------|----------|------------------|-----------------------|------------|-----------------|
| | | | (in millions of US\$) | | |
| EMU-11 | US\$ | 1,405,400 | 1,226,561 | -178,839 | -12.73% |
| | Yen | 480,600 | 453,935 | -26,665 | -5.55% |
| EMU-15 | US\$ | 1,405,400 | 1,252,672 | -152,728 | -10.87% |
| | Yen | 480,600 | 463,643 | -16,957 | -3.53% |

*Pre-EMU holdings are from 1997Q4.

V. The Effects of the Euro on International Bank Deposits

International bank deposits constitute another important form of international asset holdings. Their volume is close to the volume of international bonds and amounted to US\$1.9 trillion at the end of 1997. We therefore also examine possible effects of EMU on the currency composition of international bank deposits. Based on data from the Bank of International Settlement we define as international bank deposits the sum of bank deposits in foreign currency with domestic banks and bank deposits abroad.

We assume that the market size of a currency – again reflected in GDP data – is one factor determining the currency composition of international bank deposits. Another factor is the relative return on deposits, which is given by the interest rate differential including exchange rate changes. Since bank deposits can be considered shorter term assets than bonds, we focus on short-term returns of these deposits.³ On the basis of these considerations we estimate the following demand function for the share of dollar-denominated bank deposits:

$$(6) \quad \text{Shd}_{\$,t} = \beta_0 \text{GDP}_{i,t} + \beta_1 \text{Yield}_{i,t} + \beta_2 \text{Shd}_{i,t-1} + \varepsilon_t .$$

Shd_i denotes bank deposits denominated in currency i ($i = \text{dollar, yen or deutschmark}$); GDP_i is again the relative GDP share of the country with currency i in the combined GDP of the United States, Japan, and Germany; the variable “*Yield*” is defined as the domestic short-term interest rate minus the sum of the foreign interest rate (proxied by the average interest rate on the other two currencies in our sample) and the rate of nominal depreciation of the domestic currency.⁴ Thus, if the yield variable for a currency is positive, this currency yields on average a higher return on a short-term asset than the other currencies. We apply again a rational expectations approach and use the change in the exchange rate during the subsequent quarter as the rate of depreciation. We also take into account a lagged dependent variable in order to capture some of the adjustment dynamics which can be expected for a short-term asset like international bank deposits.

The regression results are shown in Table 12. While the statistical properties for the demand functions for international bank deposits in dollars and in yen are relatively good, the

yield variable in the regression for the yen is not significant. The long-run GDP elasticity of the demand for international bank deposits in deutschmarks seems to be very high, but alternative specifications resulted in very similar magnitudes for the elasticity.

Table 12: Regression Results for Currency Shares of Private Bank Deposits*

| Dependent Variable | Relative GDP | Relative Yield ¹⁾ | Lagged Dependent Variable | R ² | D.W. |
|-------------------------|-----------------|------------------------------|---------------------------|----------------|------|
| Deutschmark share | 0.097 (1.95) | 0.063 (3.72) | 0.925 (24.93) | 0.96 | 2.00 |
| Dollar share | 0.192 (2.21) | 0.052 (3.90) | 0.754 (6.94) | 0.87 | 2.40 |
| Yen share ²⁾ | 0.013 (1.26) | 0.003 (0.97) | 0.883 (9.82) | 0.80 | 1.14 |

Data series are from 1990Q1 to 1997Q4; t-values in parentheses;

1) Defined as the domestic three-month LIBOR minus the sum of the foreign LIBOR (average of LIBOR of the other two currencies included in this study) and the rate of nominal depreciation of the domestic currency during the subsequent period.

2) Data series for Japan are from 1991Q1 through 1996Q4.

Source of data: International Monetary Fund (1998a) and Bank for International Settlement (1998).

For the projections of the effects of EMU we assume again that the euro will basically replace the deutschmark in international financial markets. Moreover, to avoid arbitrary assumptions on interest rate and exchange rate developments, we assume that all three currencies yield the same return. We calculate the shares of the different currencies by applying the GDP ratios for EMU-11 and EMU-15. The projections again hinge on the assumption that the introduction of the euro will not fundamentally change the estimated demand functions in the medium term. Table 13 shows that, on this basis, the dollar share is projected to decline from close to 43 percent to about 37 percent under the current EMU definition, and to about 35 percent under EMU-15. The share of the yen is projected to decline only slightly under both scenarios, while the euro share can be expected to increase substantially, reaching nearly 47 percent for EMU-11 and 56 percent under EMU-15.⁵ The shares in Table 13 indicate a fairly high value for the euro, although most of the increase does not result from a substitution for the other two main currencies but mainly reflect a

replacement of other European currencies.

Table 13: Projected Currency Shares of International Bank Deposits

| Country Group | Dollar-share | Euro-share | Yen-share |
|-----------------------|--------------|------------|-----------|
| Pre-EMU ¹⁾ | 42.9% | 17.9% | 5.6% |
| EMU-11 ²⁾ | 36.5% | 46.7% | 5.2% |
| EMU-15 ²⁾ | 34.8% | 56.2% | 5.1% |

1) Data refer to 1997Q4.

2) The projected currency shares include the proportional distribution of half of the international bank deposits denominated in non-German EMU currencies. The projections reflect changes induced by the estimated effects of EMU.

Table 14 shows the implied absolute changes in the demand for bank deposits in dollars and in yen. Under EMU-11, the dollar demand is projected to decline by about US\$123 billion under EMU-11 and even by US\$156 billion under EMU-15. The decline in yen deposits is fairly small, but this is partly due to the less significant role of the yen for bank deposits. However, given the relatively weak regression results for the yen share in bank deposits, this particular finding should be interpreted with great caution.

Table 14: Effects of EMU on Absolute Levels of Dollar and Yen Holdings in International Bank Deposits*

| Scenario | Currency | Current holdings | Holdings under EMU (adjusted currency shares) (in millions of US\$) | Difference | Relative Change |
|----------|----------|------------------|---|------------|-----------------|
| EMU-11 | US\$ | 818,399 | 695,254 | -123,145 | -15.05% |
| | Yen | 106,399 | 98,991 | -7,408 | -6.96% |
| EMU-15 | US\$ | 818,399 | 662,550 | -155,849 | -19.04% |
| | Yen | 106,399 | 97,514 | -8,885 | -8.35% |

*Projections are based on estimates presented in Table 12 and bank deposits at end-1997.

VI. Summary and Conclusions

The objective of this paper is to quantify the effects of EMU on the use of the dollar, the yen, and the euro as international reserve and investment currencies. Assuming that the euro will basically assume the reputation of the deutschmark in international financial markets and, in addition, assuming that EMU does not create extreme structural changes in the behavior of central banks and the private sector, the paper first estimates demand functions

for reserves, international bonds and international bank deposits. It then uses the results to project the demand for dollars, yen, and euros under EMU. The analysis shows that EMU is likely to lead to a system in which the dollar and the euro are the most important reserve and investment currencies and in which the yen will only play a much smaller role.

Table 15 summarizes the effects of EMU on official international reserves and private bond holdings as well as private international bank deposits. Our results suggest that the demand for dollars as reserve currency and as a currency of denomination of international bonds and international bank deposits will decline under EMU-11 by about US\$536 billion and under EMU-15 by about US\$655 billion. The overall decline in the demand for yen is projected to amount to US\$34 billion under EMU-11 and to US\$37 billion under EMU-15. Given the level of these assets around end-1997, this represents a decline in the demand for dollars for these assets of 17 percent under EMU-11 (21percent under EMU-15) and for the yen of about 5 percent (6 percent under EMU-15).

Table 15: Summary of the Effects of EMU on the Demand for Dollar and Yen as Reserve and Investment Currencies (in billions of US\$)

| Country Group | Currency | Change in International Reserves | | Change in Private Holdings | | Total Change |
|--------------------------|----------|----------------------------------|---------|----------------------------|--------------------|--------------|
| | | ECB | Non-ECB | Bonds | Deposits | |
| EMU-11 | US\$ | -81.94 | -151.66 | -178.84 | -123.15 | -535.60 |
| | Yen | -7.00 | +7.56 | -26.67 | -7.41 | -33.52 |
| EMU-15 | US\$ | -148.05 | -198.58 | -152.73 | -155.85 | -655.21 |
| | Yen | -12.65 | +1.33 | -16.96 | -8.89 | -37.17 |
| Memorandum item: | | Level of International Reserves: | | Level of Bonds: | Level of deposits: | Total Level: |
| Pre-EMU level (end-1997) | US\$ | 1,016.47 | | 1,405.4 | 818.40 | 3,240.27 |
| | Yen | 80.20 | | 480.6 | 106.40 | 667.20 |

Since the paper uses a fairly simple approach to project future demand for international reserves, international bonds and international bank deposits, and given the arguments of the Lucas critique, the results should be interpreted with caution and should be regarded as

orders of magnitude for the long-run changes. However, they seem to be reasonable considering that little can be anticipated about the behavior of the ECB with respect to international reserve holdings and about the response of other central banks to EMU.

The changes in the level as well as in the composition of international reserves may not lead to drastic exchange rate effects. Inasmuch as these changes are anticipated and occur only gradually, it can be expected that supply will adjust to changes in demand. In this case, portfolio changes are not accompanied by significant exchange rate changes. However, this does not mean that the described changes may be without any economic effects. For example, a rise in the share of the euro is likely to increase the financial sector of the EMU area. In addition, this could shift seigniorage revenue from the dollar to the euro area. These effects are likely to open up a number of new research topics in the future.

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Endnotes

¹ Here we do not report the results of regression analyses we performed to investigate the dynamics. They did not imply significant differences with respect to the long-run relationship between imports and reserves.

² As an alternative estimate, we use a study of Dooley, Lizondo and Mathieson (1989) from the IMF, who use data available only to the IMF. They show that the trade flows of individual countries to different reserve currency centers play an important role in determining the currency composition of reserves. Using their estimated functions and the most recent trade structure between EMU countries and the rest of the world yields similar results as shown in Table 4.

³ The short-term aspect can also be justified by the fact that, while international bonds serve a store-of-value function, international bank deposits are likely to reflect a mix between store-of-value function and means-of-payment function.

⁴ The rate of depreciation is based on the effective exchange rate.

⁵ The projections also include the assumption that, under EMU, the share of non-German EMU currencies will partly be distributed over the remaining international currencies.

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