

## **The Effects of European Monetary Union on the Dollar and the Yen as International Reserve and Investment Currencies**

Michael Frenkel and Jens Søndergaard

This paper estimates demand functions for international reserves and projects the effects of EMU on the level and the composition of international reserves both of the European Central Bank and of non-EMU central banks. Furthermore, this paper investigates possible shifts in the currency composition of international bonds and bank deposits in private portfolios. Using different scenarios for the ultimate country composition of EMU, the analysis points to a sizable reduction in the level of international reserves in EMU and to a reduction in the demand for dollar assets both within and outside EMU. However, these changes require a high degree of price stability within the EMU and are expected to take place only gradually so that no immediate drastic effect on international financial markets may result from these shifts.

### **I. Introduction**

European Monetary Union (EMU) will constitute the most important change to the international monetary system since the breakdown of the Bretton Woods System. With the introduction of the euro as the currency of EMU, central banks and international investors will have, 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 a wide EMU, say with eventually all 15 current member countries of the European Union, will represent a currency area with a higher GDP and a higher share in world trade than the USA. As the size of the underlying economy and the volume of global trade flows are important factors that determine whether a currency develops into an international currency, EMU could lead to a role of the euro exceeding by far the combined role of the currencies the euro replaces. In addition, the strong external economic position of the EU could also indicate the euro's potential as a major international currency, according to Bergsten [3].

Bergsten's argument is that one should doubt the future stability and value of the dollar as the USA has run current account deficits for many years and its foreign debt has surged. The EU has a balanced international creditor position. This raises the question to what extent could the euro indeed challenge this role of the US dollar? An interesting further question concerns the effect of the introduction of the euro on the Japanese yen, which, after the dollar and the deutschmark, is now the third most important international currency.

Historically, the question of what determines the use of a currency as an international reserve currency has been a frequently studied topic. For example, Heller and Knight [7] examine the factors influencing the currency preferences of central banks. Similarly, Dooley, Lizondo, and Mathieson [4] study the currency composition of international reserves.

---

**Michael Frenkel**, Professor of Economics at WHU Koblenz Otto Beisheim Graduate School of Management, Burgplatz 2, D-56179 Vallendar, Germany. **Jens Søndergaard**, a graduate student with University of Copenhagen.

---

Lizondo and Mathieson [13] analyze the stability of demand functions for reserves by estimating these functions for different periods. The effects of the EMU on financial markets have recently received increased attention. Gros and Thygesen [6] were among the first to explore possible effects of EMU on the international monetary system. Johnson [12] discusses various arguments that may play a role in the future role of the dollar under the EMU and derives the conclusion that EMU will not pose serious negative consequences for the international role of the dollar if the FED continues its prudent monetary policy. Prati and Schinasi [16] study the implications of EMU on the European securities market. Alogoskoufis and Portes [1] investigate different features of an international currency and apply it to the question of whether the euro may be an international currency. Masson and Turtelboom [15] examine the question of whether the euro will facilitate macroeconomic stability and what this implies for the reserve currency use under EMU. Leahy [14] gives some estimates of reserve demand under EMU.

This paper estimates the quantitative effect of EMU on the demand for both the dollar and the yen as international reserve and investment currencies. While the examination of the role of the euro as an international reserve currency focuses on the foreign exchange demand of the European Central Bank (ECB) and other central banks, the investigation of the euro as an international investment currency looks at the future currency shares of international bonds issues and international bank deposits. In order to quantify the effects, demand functions for international currencies are estimated and subsequently applied to a new structure of international currency areas. The quantification given in this paper rests on two decisive assumptions. The first assumption recognizes that, in addition to size, the stability of a currency is important for its international role. It is assumed that the euro will be as stable as the deutschmark and, thus, may succeed the deutschmark. This is what policymakers in Europe have often declared as the objective, that governed the work on the regulatory framework of EMU (e.g., the Maastricht Treaty and the Stability Pact). The second assumption is that, despite the change in the international monetary system resulting from the EMU, the induced changes of the demand functions for international currencies will not be too extensive. This means that the Lucas critique can be ignored for the estimates of the asset demand changes. In addition, since the quantitative effects investigated in this paper depend on the country group forming EMU, alternative groups are examined.

The rest of the paper is structured as follows. Section II estimates the effect of EMU on the level and currency structure of international reserves of the European Central Bank as compared to the central banks of the individual countries before EMU. Section III projects EMU effects on the currency composition of international reserves of non-EMU central banks. Section IV begins the analysis of the impact of EMU on the use of international currencies in the private sector by examining possible effects on the share of the dollar, the yen, and the euro in international bonds issues. Section V estimates demand functions for international currency deposits and applies the results to projections on the currency structure under EMU. Section VI contains the summary and some conclusions.

## **II. International Reserve Demand of the European Central Bank**

In 1997, foreign exchange reserves of all member countries of the IMF amounted to \$1.5 trillion (Table 1). There are considerable differences among the reserve levels of individual industrial countries. While Germany and Japan hold relative high levels of international reserves, traditionally both the USA and the U.K. have shown fairly small levels. Taken together, EU countries account for roughly 25% of all official foreign exchange holdings.

**Table 1**  
Distribution of Foreign Exchange Reserves, 1997 Q2 (in millions of US\$)

All Countries	1,540,676	
USA	32,934	
Japan	212,560	
EU-15	369,544	
Germany		73,957
Spain		61,500
Italy		40,487
United Kingdom		32,650
France		25,547
Netherlands		24,633
Other		110,772
Asia	444,300	
China P.R. Mainland		120,937
China P.R. Hong Kong		67,598
Indonesia		19,935
Singapore		80,322
Thailand		30,855
Korea		33,316
India		25,404
Other		65,935

Source: IMF [9].

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 international trade of an economy and the foreign exchange demand of a 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 requires reserve holdings of the ECB. Thus, the 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 a structural effect. While individual central banks of EMU countries have partly held foreign exchange reserves in currencies of other EMU member countries, the alternatives of 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 these two effects for three different country groups, which are called EMU-8, EMU-11, and EMU-15 (see Box 1). The first group is the group of countries for which financial markets have associated a high probability that they may be founding members of the EMU. The second group, i.e., EMU-11, is the group of countries that has often been referred to as the possible outcome of the political interpretation of the Maastricht convergence criteria. In addition to the EMU-8 countries, EMU-11 includes Italy, Portugal, and Spain. The third country group, EMU-15, comprises all EU countries and can be regarded as a medium-term objective within the EU. The difference to EMU-11 is that it also includes Denmark, the U.K., and Sweden as the countries that have expressed their preference not to belong to the founding members of EMU (the so-called “voluntary outs”) and Greece as a country that is unlikely to qualify as founding member (the so-called “involuntary out”).

### Box 1

Alternative country groups for European Monetary Union used in the analysis

<b>I. EMU-8</b>	<b>II. EMU-11</b>	<b>III. EMU-15</b>
Austria	Austria	Austria
Belgium	Belgium	Belgium
Finland	Finland	Finland
France	France	France
Germany	Germany	Germany
Ireland	Ireland	Ireland
Luxembourg	Luxembourg	Luxembourg
The Netherlands	The Netherlands	The Netherlands
	Italy	Italy
	Portugal	Portugal
	Spain	Spain
		Sweden
		Denmark
		Greece
		United Kingdom

A frequently quoted study on the demand for international reserves is the one by Heller and Khan [8], who estimate reserve demand for various country groups using quarterly data from 1964 to 1979. According to their results, 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 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 on 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 EMU, which cannot be projected at this time. Third, if balance of payments variability is excluded from their estimates and GDP as well as import ratios are applied to their estimates, the results yield implausible results. They would imply that the level of international reserves under EMU increases. The more recent study by Lizondo and Mathieson [13] merely updates the Heller and Khan estimates and, therefore, implies basically the same problems for the purpose of our projections.

In order to project EMU effects on the level of international reserves, we apply a fairly simple approach and start by estimating demand functions for international reserves for the EMS period 1979 through 1996. We assume that the level of foreign exchange held by central banks is positively related to imports of goods and services. This is based on the idea that an important reason of central banks to hold international reserves is to be able to intervene in foreign exchange markets in case of real external shocks. Of course, for EU countries, borrowing in international capital markets is always a feasible option to generate foreign exchange inflows. However, this option may be expensive and may be regarded only as a complement to reserves. Our approach implies that more imports induce central banks to hold more reserves in order to be prepared to intervene in foreign exchange markets. We use OLS estimates and regress the demand for international reserves on the level of imports and on the lagged reserve level, reflecting adjustment lags. For each country group, we pool the reserve data of member countries and employ alternatively quarterly and annual data. Table 2 reports the regression results as well as the implied long-run values for the import elasticity of reserve demand. The overall statistical properties of the regressions shown in Table 2 seem to be acceptable although the Durbin Watson values are low for some of the estimates. Interestingly, in most cases, the estimates without a constant have better statistical qualities.

Since the estimates based on quarterly data and the specification without a constant yield the best results, we use these coefficients to project the level of reserve demand of the ECB. For the different country groups, we use the estimated coefficients to calculate the new reserve levels by replacing actual available imports of each country group by the level of imports excluding intra-EMU trade. The calculations show that the level of international reserves under EMU is projected to be lower than the sum of reserves held by the countries included in the different EMU country groups. The implied savings increase as more countries are included. This reflects the fact that a wider monetary union implies a higher value of intra-EMU trade which, according to the argument outlined above, does not require the holding of international reserves. Although the estimates have to be interpreted with caution, because EMU may well induce a structural change in the reserve demand function, the projections indicate that the savings are likely to be substantial already under EMU-8.

The savings, which amount to 36 percent under EMU-8, increase to 58 percent under EMU-15. This result confirms an early rough estimate of the European Commission [5] based on a fairly simple accounting approach applying the average reserve-import of industrial countries to EMU. It predicts a decline of foreign exchange holdings under EMU by about 50 percent of the current holdings.

**Table 2**  
Regression results for the demand for international reserves in Europe

Independent Variable	Data Frequency	Constant	Imports <sub>t</sub>	Reserves <sub>t-1</sub>	R <sup>2</sup>	D.W	Implied long-run import elasticity
Reserves of EMU 8 countries	Quarterly	-	0.250 (3.46)	0.742 (9.90)	0.96	1.78	0.971
		0.51 (1.78)	0.258 (3.61)	0.691 (8.71)	0.96	1.77	0.832
	Annual	-	0.54 (3.73)	0.38 (2.30)	0.94	1.62	0.871
		-0.41 (-0.50)	0.56 (3.61)	0.39 (2.28)	0.94	1.67	0.921
Reserves of EMU 11 countries	Quarterly	-	0.173 (2.46)	0.824 (11.43)	0.98	1.59	0.997
		-0.012 (-0.05)	0.176 (2.10)	0.823 (10.74)	0.98	1.59	0.992
	Annual	-	0.422 (2.62)	0.524 (2.85)	0.94	1.28	0.886
		-2.51 (-2.63)	0.830 (4.02)	0.267 (1.45)	0.96	1.97	1.133
Reserves of EMU 15 countries	Quarterly	-	0.10 (1.74)	0.90 (15.63)	0.98	1.51	0.990
		-0.22 (-0.76)	0.15 (1.70)	0.87 (11.81)	0.98	1.51	1.120
	Annual	-	0.30 (2.06)	0.67 (4.01)	0.94	1.06	0.890
		-4.04 (-3.61)	0.94 (4.52)	0.27 (1.63)	0.97	1.90	1.279

Source of data: *IMF* [11]. t-values in parentheses.

We now turn to the EMU effects on the currency composition of the ECB's international reserves. Estimates of this effect are constrained by the fact that no complete data set is available for the currency composition of reserves held by individual European

central banks. We first estimate the pre-EMU currency shares in international reserves. Published data indicate that the dollar share in international reserves of the Bundesbank is 99.95 percent. For the rest of the EMU we have to rely on the aggregate figures for the currency composition of reserves as reported by the IMF for the group of industrialized countries as a whole. On this basis, we assume that the dollar's and the yen's share in international reserves of all EMU countries other than Germany is 43.2 and 6 percent, respectively. Assuming that yen share for the Bundesbank is 0.05 percent, we can calculate the currency composition as a weighted average of German and non-German international reserves for the different country groups with the weights being the ratio of German and non-German international reserves in total reserves of the country groups' reserves. These shares are shown in the first row of Table 4.

**Table 3**  
Projections of the ECB's demand for international reserves

Country Group	Pre-EMU	With EMU	Difference (US\$ millions)	Relative Change in Reserves
EMU-8	177,690	114,468	-63,222	-35.58%
EMU-11	290,403	147,844	-142,559	-49.09%
EMU-15	375,786	157,342	-218,444	-58.13%

**Table 4**  
Projected currency composition of international reserves of the European central bank

	EMU-8	EMU-11	EMU-15
Estimated pre-EMU shares:			
Dollar	67.97%	58.36%	54.91%
Yen	3.40%	4.41%	4.77%
Basis for estimates under EMU:			
- Share of US trade in EU trade	9.40%	11.23%	15.61%
- Share of Japanese trade in EU trade	5.40%	6.29%	8.15%
- Share of U.K. trade in EU trade	13.27%	16.41%	-
Projected shares under EMU (using DLM results):			
Dollar	75.18%	71.49%	82.46%
Yen	8.58%	9.22%	9.84%

Source of data: *IMF*[10]

In view of the lack of available data on currency composition of individual central banks, we derive a projection for the currency composition of the ECB, using previous work on this issue by Dooley, Lizondo and Mathieson [4] (in the following called DLM) from the

IMF, which uses data only available to the IMF. The authors conclude that countries' trade flows to the different reserve currency centers play an important role in determining the currency composition of reserves. DLM present the following two estimates for the share of dollar and the yen in a central bank's foreign exchange holdings:

$$\text{dollar-share} = 0.9317* + 0.16 \text{ us} - 0.81 \text{ uk} + 0.41 \text{ fr} - 0.64 \text{ ge} - 1.62 \text{ ja} \quad (1)$$

$$\text{yen-share} = 0.0485* - 0.03 \text{ us} + 0.03 \text{ uk} - 0.33 \text{ fr} + 0.06 \text{ ge} + 0.67 \text{ ja} \quad (2)$$

where us, uk, fr, ge, and ja denote the proportion of trade with the USA, the UK, France, Germany, and Japan, respectively. We apply a fairly simple methodology to project the order of magnitude of the EMU effect on the share of dollar and yen reserves of the ECB. We use DLM coefficients, assuming that the ECB will follow more or less the same considerations regarding the currency composition of international reserves as the average central bank of the DLM study. We also eliminate from these equations all variables referring to trade with future EMU countries. This implies that only the US dollar and the Japanese yen remain as the main choices for international reserves of the ECB.<sup>1</sup>

The projected currency composition of the ECB's international reserves in Table 4 implies that both the dollar share and the yen share will increase. This structural effect is the result of the fewer choices of currencies for the ECB under the EMU. In particular, under EMU-15, with no more British pounds, more than 91 percent of the ECB's international reserves are projected to be in either the dollar or the yen.

Table 5 shows how the combined effects of the reduction in the 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 yens. The projections show that the overall demand for dollars will decline significantly, reflecting that the level effect dominates the structural effect. Regarding the yen demand, the expected absolute changes are fairly small. However, due to the small base, they appear relatively high in relative terms.

**Table 5**  
The effect of EMU on the absolute level of the ECB's dollar  
and yen reserves (in millions of US dollars)\*

	Pre-EMU	With EMU	Difference	Relative Change
EMU-8:				
Dollar	120,776	86,051	-34,725	-28.75%
Yen	6,041	9,823	+3,782	+62.60%
EMU-11				
Dollar	169,479	105,698	-63,781	-37.63%
Yen	12,807	13,629	+822	+6.42%
EMU-15				
Dollar	206,344	129,743	-76,601	-37.12%
Yen	17,925	15,489	-2,436	-13.59%

### III. EMU Effects on the Currency Composition of International Reserves of Non-EMU Central Banks

In this section, we investigate the effects of EMU on the composition of international reserves of non-EMU central banks and focus on induced changes in the demand for the dollar and the yen. Historically, international reserves have largely consisted of the US dollar. The preference for the dollar is often ascribed to the dollar's status as an intervention and invoicing currency.

We start by assuming that the share of a reserve currency in international reserves of a country is determined by the extent of economic activity in the country it represents and by the inflation record. Higher economic activity 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 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.

We, therefore, regress the shares of the dollar, the yen, and the deutschmark in international reserves of non-EMU central banks on GDP and lagged inflation. As the variable for economic activity, we use the share of the US, Japan and Germany in total GDP of these three countries. As the price stability variable, we use 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 1978-1996. We also test for the significance of a constant and a lagged dependent variable but find that the best statistical results are derived from using GDP, inflation, and a trend variable. Table 6 reports the results. A trend seems to apply only to the deutschmark until the end of the 1980s. 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.

**Table 6**  
Regression results for currency shares in international reserves of non-EMU central banks

Dependent Variable	Relative GDP Share	Relative Inflation (lagged)	Trend	AR(1)	R <sup>2</sup>	D.W
Deutschmark share	1.010 (28.27)	-0.011 (-4.54)	-0.007 (-3.14)	-	0.24	1.56
Dollar share	1.268 (30.88)	-0.025 (-3.55)	-	-	0.56	1.25

Yen share	0.246 (14.44)	-	-	0.678 (5.13)	0.86	1.15
-----------	------------------	---	---	-----------------	------	------

t-values in parentheses; trend for the period prior to German reunification.

Source of data: *IMF* [11]

To project the currency shares under EMU, we assume that the euro will be as stable as the deutschmark. Using the same country groups as in the previous section, we apply the relative GDP variable using purchasing power parity conversion rates. The data indicate that the euro currency area will represent about the same GDP share as the USA, while Japan's GDP will be somewhat more than one half of this share.

Table 7 shows the projected shares of the dollar, the euro, and the yen in reserves of non-EMU central banks. Under EMU-15 the dollar share drops to about 45 percent, while the euro share increases to about 39 percent. Thus, although the dollar is likely to remain the most important currency for non-EMU central banks, the euro is projected to become nearly as important as the dollar. The share of the yen is likely to remain nearly unaffected by the introduction of the euro.

**Table 7**

Projected currency composition of international reserves of non-EMU central banks\*

Country Group	Dollar-share	Euro-share	Yen-share
Pre-EMU	63.70%	14.00%*	6.20%
EMU-8	57.12%	25.10%	6.68%
EMU-11	51.46%	32.40%	6.03%
EMU-15	50.61%	32.40%	5.92%

\* Based on the following GDP shares (in percent): pre-EMU: Germany 15.97, USA 51.70, Japan 31.33; EMU-8: Euro 28.61, USA 44.77, Japan 26.62; EMU-11: Euro 35.69, USA 40.33, Japan 23.98; EMU-15: euro 38.85, USA 38.35, Japan 22.80.

The projected absolute changes in dollar and yen holdings of non-EMU central banks are shown in Table 8. They indicate that, using EMU-11 or EMU-15, a significant reduction in dollar holdings can be expected amounting to over \$150 billion or about 20 percent of current dollar holdings. In absolute terms, this represents about twice the projected decline in dollar holdings of the ECB.

**Table 8**

EMU Effects on 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-8	US\$	869,276	779,482	-89,793	-10.33%
	Yen	84,608	91,158	6,550	7.74%
EMU-11	US\$	795,072	642,299	-152,774	-19.22%
	Yen	77,385	75,264	-2,122	-2.74%
EMU-15	US\$	746,011	592,710	-153,301	-20.55%
	Yen	72,610	69,331	-3,279	-4.52%

#### IV. EMU Effects on the Currency Effects on the Currency Composition of International Bonds

While the previous two sections concentrated on official holdings of foreign exchange, we now turn to private assets in foreign exchange. We begin the analysis in this section by examining EMU effects on the currency composition of international bond issues and examine the currency composition of bank deposits in the following section. At the end of 1996, international bonds holdings amounted to about \$2.3 billion according to the Bank of International Settlement [2] and, thus, exceeded by far the total amount of foreign exchange reserves of central banks.

To estimate EMU effects on the currency composition of international bonds demand, we first estimate demand functions for international bonds. We assume that the demand for a specific currency denomination of bonds depends on the economic size of the currency area and the stability of the currency in which the bonds are denominated. We, therefore, regress the total volume of bonds issued in an international currency on the relative GDP share of the country the currency represents and on the relative inflation rate of this country.

We perform OLS estimates for the U.S. dollar, the yen, and the deutschmark and use quarterly data from the Bank for International Settlement for the period 1990 (first quarter) through 1996 (third quarter). Table 9 reports the results. As we did in the previous section, we use the relative GDP share of the three countries relative to the sum of the three GDP values. Likewise, the inflation difference is a ten-year moving average relative to the other two countries. The inflation differential was not found to be a significant factor determining the yen nomination of bonds. For the deutschmark and the yen, a trend was again found to be significant. Indications of serial correlation were found in the demand for US dollars; for all three estimated demand functions, there were significant lags in the adjustment of actual to desired levels of bond holdings.

**Table 9**  
Regression results for currency shares of international bonds

Dependent Variable	Relative GDP Share	Inflation Differential	Lagged Dependent Variable	Trend	R <sup>2</sup>	D.W.
Deutschmark share	0.149 (3.02)	-0.024 (-1.80)	0.435 (2.91)	0.002 (2.39)	0.94	1.76
Dollar share	0.780 (9.24)	-0.033 (-3.69)	0.229 (2.77)	-0.003 (-6.47)	0.97	1.16
Yen share	0.086 (3.37)	-	0.805 (13.02)	-	0.93	1.62

t values in parentheses.

Source of data: *Bank for International Settlement* [2].

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 only difference that it will represent a greater economic area. Replacing the relative GDP level by the projected share under EMU, 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, which played only a small role in international bonds markets. For simplicity, we assume that their share will be distributed proportionally over the remaining international currencies. Therefore, while the dollar share declines with a decrease in the relative GDP share of the USA in the sum of the GDPs of the USA, Japan, and the euro currency area, it increases somewhat through the medium-term effect of a distribution of non-German European currencies to the dollar, the yen, and the euro.

**Table 10**  
Projected Currency Shares of International Bonds.

	Dollar-share	Euro-share	Yen-share
Pre-EMU	36.80%	12.11%*	14.71%
EMU-8	34.96%	18.48%	14.71%
EMU-11	31.18%	23.46%	14.08%
EMU-15	31.97%	27.55%	15.01%

\*Euro share for pre-EMU situation represents share of deutschmark.

The projected DM and USD share were calculated on the basis of GDP-weights, Trend-value and inflation differential. The Yen share was calculated using GDP-weight. The "corrected shares" were calculated by adding the Non-German EU-currencies after the relative weight of the estimated shares (the sum of the relative weights adds up to 100).

The projections in Table 10 show a projected decline of the dollar share from about 37 percent to close to 32 percent under EMU-15. While the yen share is not expected to change very much, the euro is projected to reach a share of 27.5 percent compared to 12 percent of the deutschmark in 1997.

Table 11 shows the implied change in the demand for international bonds denominated in the dollar and in the yen. While little change is expected for the yen, the demand for international dollar bonds is expected to decline by 5 percent under EMU-8, by 15 percent under EMU-11, and by 13 percent under EMU-15. Although this shift may not seem relatively big, the high volume of international bonds denominated in dollars implies that the decline in the demand for international dollar bonds amounts to more than \$110 billion (EMU-15).

**Table 11**  
Effects of EMU on dollar and yen holdings in international bonds portfolio.

Country Group	Currency	Pre-EMU	Holdings under EMU	Difference	Relative Change
		Holdings			
(in millions of US\$)					
EMU-8	US\$	849,197	806,843	-42,354	-4.99%
	Yen	339,448	339,347	-101	-0.03%
EMU-11	US\$	849,197	719,511	-129,685	-15.27%
	Yen	339,448	324,872	-14,576	-4.29%
EMU-15	US\$	849,197	737,774	-111,423	-13.12%
	Yen	339,448	346,338	+6,890	+2.03%

#### V. EMU Effects on the Currency Composition of International Bank Deposits

Another important form of asset holdings in foreign exchange is bank deposits. Their volume even exceeds the volume of international bonds. While, at the end of 1996, international bond holdings amounted to about \$2.3 billion, bank deposits reached \$3.2 billion. In this section, we, therefore, focus on the possible effects of the 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 start by estimating some simple demand functions for bank deposits in different currencies, using quarterly data from the Bank for International Settlement for the period 1990-1996. We assume that bank deposits are relatively short term and are determined by two factors.<sup>2</sup> First, relative GDP of the major investment currencies can be expected to play an important role since, as postulated before, GDP reflects the width and the depth of

financial markets. Second, the return differential of deposits in foreign exchange is likely to affect the currency denomination of international bank deposits. In concentrating on the dollar, the yen, and the deutschmark, the return is defined here as the sum of the short-term interest differential of a currency and the change in the nominal effective exchange rate. Table 12 presents the results of OLS regressions, using two alternative ways to include nominal exchange rate changes in the return differential on foreign exchange deposits. One possibility is to add to the interest differential the nominal exchange rate change during the previous period. This approach assumes that investors base their expectation on exchange rate changes on recent developments. We refer to this approach as “backward looking.” The other possibility to define the differential rate of return on a foreign currency deposit is to add to the interest differential the expected exchange rate change. For simplicity, we capture expected exchange rate changes by using the actual exchange rate change during the next period. This implicitly assumes rational expectations.

**Table 12**  
Regression results for currency shares of private bank deposits

Dependent Variable	Relative GDP	Backward Looking Relative Return*	Forward Looking Relative Return**	Lagged Dependent Variable	R <sup>2</sup>	D.W.
Deutschmark share	0.088 (1.93)	-0.041 (-2.48)		0.926 (23.69)	0.96	2.46
	0.090 (1.84)		-0.026 (-1.49)	0.93 (22.17)	0.95	2.57
Dollar share	0.171 (2.29)	-0.015 (-0.72)		0.81 (10.29)	0.92	2.15
	0.121 (1.69)		-0.054 (-3.00)	0.864 (11.56)	0.94	2.43
Yen share	0.024 (1.53)	-0.0005 (-0.16)		0.808 (6.03)	0.71	2.11
	0.032 (1.95)		-0.002 (-1.49)	0.73 (5.02)	0.70	1.97

\* Defined as the foreign interest rate (average of the interest rates of the other two currencies included in this study) minus the domestic short term interest rate plus the rate of nominal depreciation of the domestic currency during the previous period.

\*\* Defined as the foreign interest rate (average of the interest rates of the other two currencies included in this study) minus the domestic short term interest rate plus the rate of nominal depreciation of the domestic currency during the next period.

t-values in parentheses. Source of data: *IMF [11] Bank for International Settlement [2]*.

The results show that the backward-looking return and the forward-looking return are of about the same statistical quality. Most coefficients are significant and the estimates for the lagged dependent variable indicate that there is a fairly high persistence in the currency structure of international bank deposits.

To project EMU effects on the currency composition of international bank deposits, we apply again the approach of the previous sections; that is, we assume that the euro will basically replace the deutschmark in international financial markets. Of the alternative estimates included in Table 12, we use the forward-looking approach as it seems to be more appealing from a theoretical point of view. We, thus, calculate the shares of the different currencies by applying the GDP ratios for the different EMU country groups. 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. On this basis, the dollar share is projected to decline from 44 percent to about 40 percent under the widest EMU definition, while the euro may reach 54 percent compared to 20 percent of the deutschmark in early 1997 (Table 13). The projections also include the assumption that with EMU the share of non-German European currencies will be distributed over the remaining international currencies. The shares in Table 13 indicate a high share of the euro but no strong substitution effect between the three main currencies. The rise of the euro is merely an effect of the fact that the European currencies will be replaced by one currency. In that sense, the comparison with the deutschmark can easily be misleading.

**Table 13**  
Projected currency shares of international deposits\*

	Dollar-share	Euro-share	Yen-share
Pre-EMU	43.72%	19.69%	4.76%
EMU-8	43.26%	36.94%	3.43%
EMU-11	40.23%	47.58%	3.19%
EMU-15	39.90%	54.02%	3.16%

\* The projected currency shares were calculated using model 2, the GDP-weights and the yield-figure. The corrected shares are calculated by adding a share of the non-German currencies to the estimated shares (ex.  $(8.60\% \times 39.83\%) + 39.83\% = 43.26\%$ ).

Table 14 shows the implications of the projections for the absolute levels of international bank deposits. They indicate that the dollar demand will decline by more than \$120 billion once the adjustment is completed. This adjustment may well take some time so that the projections only show the medium-term effects. The decline in the yen is also significant but not as big as for the dollar.

**Table 14**  
Effects of EMU on dollar and yen holdings in international bank deposit

Scenario	Currency	Current	Holdings under EMU	Difference	Relative Change
		holdings	(adjusted currency shares)		
(in millions of US\$)					
EMU-8	US\$	1,385,050	1,370,392	-14,657	-1.06%
	Yen	150,797	108,544	-42,253	-28.02%
EMU-11	US\$	1,385,050	1,274,492	-110,558	-7.98%
	Yen	150,797	100,948	-49,849	-33.06%
EMU-15	US\$	1,385,050	1,264,161	-120,888	-8.73%
	Yen	150,797	100,118	-50,679	-33.61%

## VI. Summary and Conclusions

This paper attempts to quantify the effects of EMU on the use of the U.S. dollar, the Japanese yen, and the euro as international reserve and investment currencies. Using a simple approach to estimate the demand for international currencies for these purposes and assuming that the euro will basically replace the role of the deutschmark in international financial markets, the future demand for the main international currencies is projected. The analysis shows that EMU is likely to lead to a system in which the dollar and the euro play the most important roles with the yen not being substantially affected and, thus, playing only a much smaller role.

More specifically, the projections of the EMU effects suggest that the demand for dollars as reserve currency and as the currency of denomination of international bonds and international bank deposits will decline under a wide EMU (that is, with the current 15 EU member countries) by about \$460 billion. The overall decline in the demand for yen for these purposes is projected to amount to about \$50 billion. Given the level of these assets in early 1997, this represents a decline in the demand for dollars for these assets by close to 16 percent and for the yen by about 8 percent.

**Table 15**  
Summary of the effects of EMU on the demand for dollar and yen as reserve and investment currencies

Country Groups	Currency	Change in Inter-national Reserves		Change in Private Holdings		Total Change
		ECB	Non-ECB	Bonds	Deposits	
EMU-8	US\$	-34.73	-89.80	-42.35	-14.66	-181.53

	Yen	+3.78	+6.55	-0.10	-42.25	-32.20
EMU-11	US\$	-63.78	-152.77	-129.69	-110.56	-456.80
	Yen	+0.82	-2.12	-14.58	-49.85	-65.73
EMU-15	US\$	-76.60	-153.30	-111.42	-120.89	-462.21
	Yen	-2.44	-3.28	6.89	-50.68	-49.50
Memorandum		Level of International		Level of	Level of	Total Level:
item: Pre-	US\$	Reserves:		Bonds:	deposits:	3,193.06
EMU level	Yen	981.41		849.34	1,386.95	638.67
(early 1997)		95.52		399.51	146.04	

It should be noted that this paper uses a fairly simple approach to project future demand for international reserves, international bonds, and international bank deposits. However, they seem to be reasonable considering that little can be anticipated about the respect to international reserve holdings and about the response of other central banks to EMU. In this sense, the Lucas critique applies to our work, too, but the results should be regarded as projections justifiable on the basis of current information.

However, all projections are based on the assumption that the European Central Bank will pursue price stability as its main goal. Only then can the euro be expected to take over the role of current European reserve currencies, notably the deutschmark. If this can be accomplished, the shift in demand from dollar to euro can be explained by the fact that the euro would reflect a region with high GDP and sizable and well developed financial markets.

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 adjust to changes in demand.

#### NOTES

1. EMU trade with Japan and the US is calculated as shares in trade excluding intra-EMU trade.
2. Note that, while international bonds serve a store-of-value function, international bank deposits may well show a mix between store-of-value function and means-of-payment function.

#### REFERENCES

- [1] Alogoskoufis, George and Richard Portes. (1997). "The Euro, the Dollar, and the International Monetary System" paper presented for the IMF conference on EMU and the International Monetary System, Washington D.C., (March 17-18, 1997).
- [2] Bank for International Settlement. *International Banking and Financial Market Developments* Basle, various issues.

- [3] Bergsten, C. Fred.(1997). "The Impact of the Euro on Exchange Rates and International Policy Cooperation," paper presented for the IMF conference on EMU and the International Monetary System, Washington D.C., (March), 17-18.
- [4] Dooley, Michael J. Saul Lizondo, and Donald Mathieson. (1989). "The Currency Composition of Foreign Exchange Reserves," *IMF Staff Paper*, 36, 385-434.
- [5] European Commission. (1990). "One Market, One Money", *European Economy*, 44, (October).
- [6] Gros, D. and N. Thygesen. (1992). *European Monetary Integration: From the European Monetary System towards Monetary Union*, London: Longman.
- [7] Heller, H. Robert and Malcolm Knight. (1978). "Reserve-Currency Preferences of Central Banks," *Essays in International Finance*, no. 131 Princeton: Princeton University, (December).
- [8] Heller, H. Robert and Mohsin S. Khan. (1978). "The Demand for International Reserves under Fixed and Floating Exchange Rates," *IMF Staff Papers*, 25, 623-649.
- [9] International Monetary Fund. (1996), *Annual Report*, Washington.
- [10] International Monetary Fund. (1997), *Directions of Trade Statistics*, Washington.
- [11] International Monetary Fund. (1997), *International Financial Statistics*, Washington.
- [12] Johnson, Karen H. (1994). "International Dimension of European Monetary Union: Implications for the Dollar," Board of Governors of the Federal Reserve System, *International Finance Discussion Papers*, 469, (May).
- [13] Lizondo, Jose Saul and Donald J. Mathieson. (1987). "The Stability of the Demand for International Reserves," *Journal of Money and Finance*, 6, 251-282.
- [14] Leahy, Michael P. (1994). "The Dollar as an Official Reserve Currency under EMU, Board of Governors of the Federal Reserve System," *International Finance Discussion Papers*, no. 474, (June).
- [15] Masson, Paul R., and Bart G. Turtelboom. (1997). "Characteristics of the Euro, the Demand for Reserves, and Policy Coordination Under EMU," paper presented for the IMF conference on EMU and the International Monetary System, Washington D.C., (March 17-18, 1997).
- [16] Prati, Alessandro, and Garry J. Schinasi, (1997). "European Monetary Union and International Capital Markets: Structural Implications and Risks," International Monetary Fund, *Working Paper* No. 97/62.