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Can American Dollar Survive the Onslaught of Euro? An Empirical Investigation

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ABSTRACT

The American dollar has been the anchor currency of the international monetary system and no other currencies have so far been able to rival the greenback in its standing. Does the birth of Euro pose a challenge to the hegemony of the dollar as the predominant currency? This paper seeks to answer the question by first reviewing the process of internationalization of the euro and then examining the movements in dollar-euro exchange rates by means of cointegration techniques. By identifying the key determinants of the exchange rate and analysing the recent developments in the euro area and the United States, the paper discusses some important policy implications for ECB and the success of Euro in general.

INTRODUCTION

The American dollar has been the world's predominant currency since the end of World War II. Following the breakdown of the Bretton Woods system in 1970, the US dollar has been the benchmark for other national currencies. No other currencies, the deutsche mark, yen or the pound sterling, have come to being a close contender for the dollar's international role. Primary commodities and financial assets are largely denominated in dollars and the dollar is used extensively as a vehicle currency by private agents in international trade and financial transactions and as a reserve currency by central banks worldwide. This is somewhat surprising because for nearly two decades between the early 1970s and the early 1990s, the economic performance of the United States was lacklustre. Double-digit inflation and slow growth rates had characterized America during this period.

Consequently, the lack of confidence in the dollar was seen as a major impetus behind Europe's efforts at creating a single currency union, beginning with the introduction of the European Monetary System in 1979. Prior to the launch of the virtual euro on January 1 1999, two issues were widely debated regarding the birth of this new currency. The first is whether the euro would be able to challenge the international standing of the dollar, thus creating a bipolar international monetary system and the second pertains to the value of the dollar-euro exchange rates. Whether

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the euro would quickly attain the status of the dollar hinges critically on the preferences and decisions of private investors and central banks alike, and this in turn depends on the value and stability of the euro. Certainly, a strong and stable euro would have greater appeal to private and public agents, and positively impact the international role of the currency. This paper studies the development of the international role of the euro since inception and considers its future role in the international monetary system.

The choice of international currency depends on several factors that include the size and financial infrastructure of the domestic economy, stability of the currency and historical bias. Euroland[3] (accounting for more than 20% of World GDP in 2002) seemingly is providing a domestic market that can rival that of the United States. Size is commonly seen as the main reason behind the dollar's supremacy over other currencies and as such, we expect that the euro has an equal chance of attaining key position in the international monetary system. However, it is germane to mention that having a strong home base is only necessary but not sufficient to establish and sustain a currency's international status (Neumann 2001). Indeed, other more significant criteria seem to favour the predominance of dollar as the global currency.

The depth, breadth and degree of openness of financial markets in Euroland lag that of their American counterparts. Whilst capital markets are widely used to raise funds in US, the same does not apply to Euroland, which still depends largely on bank loans. Moreover, the European Central Bank, tasked to ensure the stability of the euro, is a young institution with no track record. Inertia bias has also tended to lean toward the dollar. These considerations have led some to predict that the dollar will retain its pole position in the international monetary system. Frankel (1995), for instance, believes that the built-in incumbency advantage of the dollar would ensure that it remains the premier reserve currency. Eichengreen (1998) has also commented "one of the few things that can be said with certainty about the European monetary unification is that its economic effects are uncertain". Still, many other observers[4] have predicted that the new currency would quickly rise to equal status with the dollar.

This paper considers the strengths of different arguments and is organized as follows: Section 2 discusses the international role of the dollar and euro; Section 3 reviews the literature and examines trends in the dollar-euro exchange rates. Following that, Section 4 considers how recent developments in the Euro area plausibly impact the euro's international role and Section 5 presents the conclusion.

INTERNATIONAL ROLE OF THE DOLLAR AND EURO

An international currency can be defined as a currency that is used by residents outside the country of issue. It performs the same functions as that of any other national currency- as a medium of exchange, store of value, and unit of account. Hartmann and Issing (2002) cite the following factors as key to determining the choice of international currency: (1) the size and strength of the domestic economy (2) the depth, breadth, liquidity and degree of openness of the domestic financial markets (3) the convertibility of the currency (4) historical bias.

[3] The 12 countries in the Euro area are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain.
[4] See Bergsten (1997), Mundell (1998) and Portes and Rey (1998)

One often cited reason for the predominance of the dollar in the international monetary system is that no other country has even come close – both in physical and economic size- to the United States (Bergsten 2002). Table 1 compares the relative economic size and strength of the US, Euroland, and Japanese economy just before the completion of Stage 3 of EMU.

TABLE 1: THE EURO AREA COMPARED WITH US AND JAPAN

	United States	Euro area[5]	Japan
Population (million)	270	291	126
Employment (million)	131	114	65
GDP ($bn)	8510	6471	3780
Financial assets[a,b]	33828	16648	12414
Degree of openness[c] (% of GDP)	11.9	16.1	10.5
Share of world exports (%)	16.5	19.0	8.5
Current account	-2.6	1.0	3.2
Macroeconomic performance[a]			
CPI Inflation (%)	2.2	1.1	-0.3
GDP growth (%)	4.0	2.0	0.5
Unemployment rate[d] (%)	4.1	10.0	4.6

Source: Neumann 2001
Figures reflect 1998 data
[a] Figures reflect 1999 data
[b] Bank loans, outstanding cosmetic debt securities and stock market capitalization
[c] Averaged GDP ratios of exports and imports of goods and services
[d] Percentage of labour force

It can be clearly seen that the euro area compares favourably to the US in most aspects. Population size, employment levels and the value of GDP are fairly close for the Euro area and US and the euro area outperforms the US in terms of trade openness. One area of concern is that the size of financial assets in the euro area was only about half that of the US in 1999, at $16448bn. This could potentially limit the attractiveness of the euro since deep, broad and liquid financial markets are necessary to service non-resident users of the currency.

International trade linkages are also an important consideration as it further expands the transactions domain and increases the network externalities associated with using the currency. Neumann (2001) observes that the outward-oriented policy adopted by the European economies, as compared to the US and Japan, plays to its advantage. This is especially since trade invoicing is often in the exporter's currency, which would enhance the unit-of-account function of the euro.

[5] Note that due to the wide differences within the Euroland, the figures may not be fully indicative of the true picture. For instance, a number of countries had unemployment rates which were more than 10 percentage points higher then the EU combined rate of 10%.

Historical facts also underline the importance of economic strength in the choice of international currency, with the pound and dollar chosen as the pre-eminent international currencies in the past two centuries at a time when both domestic economies were booming. Similarly, the growth of the Japanese and German economies in the later part of the twentieth century quickly prompted the use of the yen and deutsche mark in international transactions.

The second determinant of an international currency is the maturity and more significantly, the sophistication of the financial markets in the domestic economy. Broad, deep and open financial markets are necessary to satisfy the global needs of both private investors and central banks. It is essentially this criterion that has ensured the continued dominance of the dollar in international transactions and sets the United States apart from Japan and Europe. The Japanese economy remains straddled with bad loans and corporate reform has been slow to come. This greatly discounts the yen as an international currency. Financial liberalisation and integration in Europe, although underway, is also hampered by slow progress in consolidation in the securities settlements industry and absence of fiscal harmonization (Hartmann and Issing 2002). Table 2 below compares the depth, breadth and openness of the financial markets across the United States, Euro area, and Japan after the formation of the European Union.

TABLE 2: COMPARISON OF FINANCIAL MARKETS IN THE UNITED STATES, EURO AREA AND JAPAN IN 1999

	US	Euro area	Japan
Financial Markets	40543.8	24133.4	20888.8
Bank assets	7555.3	12731.3	6662.5
Domestic debt securities outstanding	15426.3	5521.9	6444.9
Stock market capitalization	17562.2	5880.2	7781.4

Source: Pollard (2001)
Note: All figures are in $ billions

The relative stability in the value of a currency is also an important precondition for the development of an international currency. A stable currency, especially in the long term, instils confidence in investors by preserving the value of investments undertaken in the currency, thus fulfilling the store-of-value function. Begg (2002) and Hartman and Issing (2002) acknowledge that whilst short-term exchange rate levels have little impact on the long term choice and development of international currencies, concrete exchange rate expectations would be significant in deciding when a currency develops its international role, as with the experience of Bundesbank.

Other than the economic considerations, historical inertia also plays a part in deciding the predominant international currency. Fratianni, Hauskrecht and Maccario (1998) are of the view that agents are likely to adopt a wait-and-see attitude when faced with a new and untested player. In the same vein, Krugman (1980), Hartmann and

Issing (2002) and Mckinnon (2002) have commented that once an exchange structure is established, it resists change unless it experiences a sufficiently significant shock.

In order to satisfy private demands, the euro must function as an invoice currency in international trade contracts, as a vehicle currency and as a denomination for international financial assets. The dollar continues to play an eminent role as a standard of value and international means of payment. Few studies have been conducted regarding trade invoicing and the most recent one conducted by the ECU Institute (1995) found that the dollar had a market share of 47% in trade invoicing in 1992, which is greater than the US share of world trade. This evidence confirms that the dollar is the most important vehicle currency[6] . In comparison, the euro legacy currencies[7] combined only accounted for 32% of total trade invoicing in the same period. There is no direct measure available on vehicle currencies but this information is often gleaned from the share of currencies in foreign exchange transactions, as shown in Table 3.

TABLE 3:
CURRENCY DISTRIBUTION OF REPORTED FOREIGN EXCHANGE TURNOVER (% OF GLOBAL TURNOVER)

Currency	1995	1998	2001
US Dollar	83.3	87.3	90.4
EMS Currencies and Euro	59.7	52.5	37.6
Yen	24.1	20.2	22.7
Pound	9.4	11.0	13.2
Swiss Franc	7.3	7.1	6.1
Canadian and Australian Dollars	6.1	6.7	8.7
All other currencies	10.1	15.2	21.3
All currencies[a]	200.0	200.0	200.0

Source: Kenen (2002); Bank for International Settlements, *Triennial foreign exchange and derivatives survey 2001.*
[a] Percentage sum up to 200 as each trade involves two currencies and is thus counted twice.

It is evident that the US dollar remains the largest currency traded in foreign exchange markets, appearing on 90.4% of all trades, compared with 37.6% for that of the Euro in 2001.

[6] See SanPaolo (1990), Table 14 which estimated the dollar's vehicle currency role at 79.4% of exports and 77.9% of imports. This is followed by the Deutsche mark and the European Currency Unit, ECU. Notably, the latter has a role predominantly in intra-European trade and no role in raw material pricing.
[7] The currencies include the Deutsche mark, Dutch guilder, French franc, Pound Sterling and Italian Lira

The use of the euro as a vehicle currency depends primarily on how efficient the euro is, as measured by transactions costs. Where transaction costs are lower, and the volumes to which they apply are large, the incentive effects become considerable. Based on Detken and Hartmann (2002), the transaction costs for USD/EUR trading are surprisingly higher compared to those for DEM/USD trading prior to the formation of the EMU. In fact, available data suggests that traded spreads for the USD/EUR pair from 1999 to 2002 were consistently 20% – 50% higher than before 1999. Preliminary data from Table 3 also shows that use of dollar in foreign exchange transactions is well above that of the euro. Indeed the market share of the euro in currency markets appear to have fallen, from 59.7% in 1995 to 37.6% in 2001, confirming the inverse relationship between transaction costs and trading volumes. Another reason as to why the use of the euro as a vehicle currency seems to have fallen relative to the mark may be that a vehicle currency is no longer needed to facilitate exchanges amongst euro currencies.

Besides serving as an international unit of account and medium of exchange, a global currency must also fulfil the store-of-value function. Trends in the international debt and money markets reflect how attractive the euro is as a denomination for financial assets. One area in which the euro has exhibited strong growth is the use of the currency in debt markets. We observe a steady increase in the net issuance of euro-denominated debt securities, indicating the growing importance of the euro as an international financing currency.

TABLE 4: NET ISSUANCE IN INTERNATIONAL DEBT MARKETS (% OF TOTAL)

Region/Currency	1998	1999	2000	2001	2002	2003[a]
By currency of issue						
Dollar	60.3	44.0	49.4	48.4	41.5	24.6
Euro	32.9	48.4	37.9	44.3	51.7	65.2
Yen	-3.9	-0.9	3.0	1.2	-4.3	-1.3
All other currencies	10.8	8.5	9.7	6.1	11.1	11.4
By Country of issue						
United States	41.1	38.9	37.4	44.2	32.6	11.9
Euro area	31.1	41.6	44.9	40.6	47.6	59.9
Japan	-2.6	0.2	-2.2	-0.9	-0.5	-0.7
Developing countries and offshore centres	7.6	4.2	4.9	5.3	1.3	2.3
International institutions	8.2	2.0	1.8	1.2	2.1	0.2
Net issues in US$bn	681.1	1241.2	1246.0	1346.6	1009.6	702.7

Source: BIS Quarterly Review, various issues

[a] First half of the calendar year

Table 4 shows that in 1998, the euro legacy currencies, taken as a group, accounted for a mere 32.9% of new issues in debt securities. This pales in comparison to dollar-denominated debt securities, which made up 60.3% of net issues. The situation has however changed considerably, with net issuance of euro-denominated bonds standing at 65.2% of the total in 2003, eroding the dollar's dominance in this area.

There has also been an increase in the share of euro-denominated bonds issued by non-residents[8]. Where the corresponding share for legacy currencies was below 20% prior to the launch of the euro, this had risen to more than 30% by mid-2003. In the international banking arena, we observe a movement towards currency diversification. The Bank of International Settlements (2003) estimates that 35.7% of the total cross-border claims of banks were in euros as compared to over 20% in 2001. Over the same period, the share of the dollar for cross-border claims remained nearly constant. Evidently, the birth of the euro has led to some serious competition for the dollar as the predominant financing currency. This can be attributed to the adoption of a common monetary policy and the creation of the trans-European automated real-time gross settlement express transfer payments (TARGET) system, which has undoubtedly increased the attractiveness of the euro as capital markets become more integrated.

Foreign exchange reserves remain largely denominated in the US dollar. Table 5 below shows the currency composition of international reserves and it is fairly obvious that the US dollar continues to capture a huge market share, accounting for 70.1% and 61.3% of total reserves in developed and developing countries respectively in 2002.

An interesting point to note is that although the dollar persists as the principal reserve currency, this does not necessarily imply that central banks prefer the greenback to the euro. In fact, one can plausibly attribute the accumulation of dollar reserves to a need and not necessarily a want. The external value of the dollar has been steadily declining in the past two years. This has impelled central banks worldwide, especially in Asia[9], to increase their dollar reserves in order to prevent their currency from appreciating against the dollar, since America is the export country of choice for many of these Asian countries. From this perspective, we expect that when these countries begin to recognise and tap on the export opportunities present in the Euro area, central bankers will become less fixated with the dollar and there will be a gradual shift in reserves out of the greenback and into euros.

[8] See Review of the International Role of Euro, ECB, December 2003
[9] See IMF World Economic Outlook September 2003, Figure 1.14

TABLE 5:
CURRENCY COMPOSITION OF INTERNATIONAL RESERVES
(PERCENT)

Country group/currency			
Industrial countries	1998	2000	2002
US dollar	66.7	72.7	70.1
Euro[a]	16.8	10.4[b]	11.3[b]
Japanese yen	6.6	6.3	4.8
Pound sterling	2.2	2	2.2
Others and unspecified	7.7	8.6	11.6
Developing countries			
US dollar	64.9	63.8	61.3
Euro	13.6	14.9	16.8
Japanese yen	4.5	4.4	4.3
Pound sterling	5.1	5.2	5.8
Others and unspecified	11.9	11.7	11.8

Source: IMF Annual Report 2003

[a] Consists of the deutsche mark, French franc, Dutch guilder and ECUs in 1998

[b] Not directly comparable with combined share of euro area currencies in 1998 as it excludes the euros received by euro area members when their holdings of other member countries' currencies were converted on 1 January 1999

In fact, it is noteworthy that overall, central bankers in developing countries are already gradually diversifying out of the greenback into the euro which now makes up 16.8% of total reserves in these countries, as compared to the combined 13.6% of euro legacy currencies in 1998. This is significant in absolute terms as developing countries account for the major proportion of total reserves. In the case of the developed countries, we note a fall in the proportion of total reserves kept in euros. This can possibly be explained by the fact that prior to the formation of the single currency union, Euro area countries kept each other's currencies as reserve currencies. However, there no longer exists the need after the creation of the euro.

A direct consequence of the dollar's role as the main reserve currency is that it is and perhaps will persist in being the principal intervention currency in foreign exchange markets. Although data on interventions are limited, it is believed that nearly all interventions, with the exception of those undertaken by the United States, are carried out in US dollars[10]. In order for the euro to rival the dollar as main intervention currency, it must be liquid and acceptable[11]. This is because countries would generally prefer to hold their reserves in short-term interest-bearing assets and this underscores the importance of a liquid bond market in the euro area. Where the private medium of exchange function of the euro is enhanced, the exchange market for the euro will also become larger. This then allows monetary authorities to carry out interventions using euros with ease.

With the demise of the Bretton Woods system, many exchange arrangements ensued. A broad classification separates these countries according to the regimes

[10] See Giavazzi (1989) for details.

[11] See Pollard (2001) for a detailed explanation.

adhered to: fixed pegs, managed floating and free float. Fixed pegs are usually adopted by countries for two main reasons. Firstly, pegging enhances the credibility of countries that perennially experience high rates of inflation since these countries are in effect importing the monetary policy of the country whose currency they are pegging the national currency to. Countries also consider a fixed peg when they want to minimize exchange rate fluctuations with the anchor country with which they have extensive trade and financial links with. These two reasons explain why Latin American and Caribbean countries peg their currencies to the dollar while European and the geographically nearby African countries peg theirs to the euro. In recent years, the euro has displaced the dollar as the most popular international currency anchor and we expect this trend to continue as more countries plan to enter the European Union.

At present, the above figures paint a somewhat mixed picture of the progress of the euro in the international monetary system. Whilst the euro has yet to be able to mount a sustained and comprehensive challenge to the international role of the dollar, it has certainly made meaningful progress since its launch. The euro is now widely used as an international financing currency, as can be seen from recent trends in the global bond and money markets. Central banks are also gradually increasing the share of euros in their portfolio of reserve currencies. Indeed, early signs are encouraging for those who believe that the euro will eventually rise to equal status with the dollar.

THE DOLLAR-EURO EXCHANGE RATES

The euro was launched at 1.176 dollars at inception. Prior to the launch of the euro, many observers had predicted an appreciation of the euro vis-à-vis the dollar[12]. There was widespread anticipation that financial markets in the Euro area would quickly consolidate and unify with the completion of Stage 3 of the EMU, which would tend to prompt a shift in the portfolios of public and private agents in favour of the euro. However, the euro began to depreciate after its launch and fell below parity with the dollar at the beginning of 2000. It continued its downward trend and reached an all time low of 0.852 dollar per euro in October 2000. The decline of the euro caught many by surprise.

Optimists like Mussa (2001) argued that the weakness of the euro in foreign exchange markets was not an intrinsic feature of the euro and does not reflect shaky fundamentals in the Euro area. He observes that the movement of the euro against other hard currencies like the yen and the dollar since inception was acceptable by most standards, and estimates that the volatility of the euro was lower than that of its predecessor currencies. He predicts a stronger euro in the medium to long term, with the currency benefiting from expanding productive employment and higher growth from capital accumulation. Still, the weakening of the euro was disturbing to many especially since the US was faced with a burgeoning current account deficit.

The falling euro sparked the interests of many economists and there is extensive literature containing attempts to explain the downward trend. They all point to the many factors that come into play in the determination of exchange rates. Stylized economic theory suggests that the actual and expected monetary policy can significantly impact exchange rates in the short run. For instance, Cohen and Loisel

[12] See Bergsten (1997), Mundell (1998) and Portes and Rey (1998)

(2001) identify the double whammy of tight fiscal policy, imposed by the Maastricht fiscal criteria, coupled with relatively loose monetary policy as an explanation for the weak euro. Such a policy mix was argued to have resulted in interest rates converging to the lower end of the spectrum, leading to a shortage in local demand. This prompted European producers to cut the prices of their products in order to stimulate external demand, resulting in a nominal and real depreciation of the euro. Similarly, Neumann (2001) opines that a turnaround in the exchange rate could only be achieved with a turnaround in the policy stance.

Another view attributes the decline in the euro to differentials in predicted growth estimates in the US and Euroland. Corsetti and Pesenti (2000) present empirical evidence that the dollar-euro exchange rate during 1999-2000 could be amply explained by revisions in the forecasts of output growth rates in the US and Euroland. Where projected growth rates were higher for the US, the value of the dollar also increased relative to the euro. A noteworthy point is that the correlation between growth forecasts and exchange rates did not hold for other currencies, e.g. the yen-dollar exchange rate in the same period. De Grauwe (2000) attributes this phenomenon to a tendency for market participants to focus exclusively on one variable that provides evidence of their beliefs, and to ignore other fundamental variables that also determine the exchange rate in the process.

In considering the effects of macroeconomic fundamentals on the dollar-euro exchange rate, Neaime and Paschakis (2002) study the effects of differences between the US and Euro area in cyclical behaviour, inflation rates, trade and capital flows and risk-return opportunities on the dollar-euro exchange rate and conclude that there was substantial positive shock to aggregate demand in the US, which can explain the appreciation of the dollar in the 1999 -2000 period. Arestis et al (2002) also explain the decline in the value of the euro as a result of weak fundamentals in the Euro area. They contend that there exist inherent weaknesses in the single currency area, which adversely affected the value of the euro, due to the divergent state of economic conditions in member countries.

Economists have established several models with the objective of explaining exchange rate movements, the earliest being the 'Flexible Price Monetary Model'. Building on the premises of the flexible price model, the 'Sticky Price' and 'Tradeables-Nontradeables' monetary models were later developed on the basis of more realistic assumptions and to encompass more explanatory variables.

The Flexible Price Monetary Model defines the exchange rate as the relative prices of two monies and is determined by the interaction of demand for, and supply of, the two monies. It is built on the basis of two main assumptions- flexible prices and the existence of law of purchasing power parity. A generalised form of the model is as follows:

$$s_t = \beta_1 (m_t - m^*_t) + \beta_2 (y_t - y^*_t) + \beta_3 (i_t - i^*_t) + u_t \qquad (1)$$

where st is the exchange rate at period t, m_t and m^*_t denote the domestic and foreign money stocks, y_t and y^*_t are the domestic and foreign output levels i_t and i^*_t are the domestic and foreign interest rates. All the variables, with the exception of interest rates, are in logarithmic form.

Invoking the Fisher relationship, the following is derived:

$$s_t = \beta_1 (m_t - m^*_t) + \beta_2 (y_t - y^*_t) + \beta_3 (r_t - r^*_t) + \beta_3 (\pi_t - \pi^*_t) + u_t \quad (2)$$

where r_t and r^*_t denotes the real interest rates in the domestic and foreign economy and π_t and π^*_t refer to domestic and foreign expected inflation rates respectively. Equation (2) suggests that fundamentals such as the relative stocks of money, relative output levels, real interest rates and expected inflation differentials have an impact on the spot exchange rates. As it is, although the model does not specify how expectations are formed, the general academic consensus is that the model holds in the context of rational expectations (De Grauwe 2000).

The Sticky Price Monetary Model, originally mooted by Dornbusch (1976), presupposes the same underlying fundamentals as the flexible price monetary model, with the exception that it assumes neither flexible prices nor continuous purchasing power parity. Nonetheless, the conclusions derived from this model are comparable to those derived from the flexible monetary price model. A key difference resulting from the assumption of price stickiness is that past price changes, as with expectations of future inflation rates, have an impact on the exchange rate. (De Grauwe 2000).

The Tradables-Nontradables model, proposed by Dornbusch, is an extension of his earlier sticky price monetary model. This model is motivated by the failure of purchasing power parity to hold for broad price indices such as consumer price indices and GDP deflators. As such, the approach is to explicitly recognise the role of nontraded goods and postulate that PPP only holds for traded goods. We obtain this model if the price level index can be represented by a Cobb-Douglas function of the individual non-traded and traded price indices.

Much empirical work has been carried out to assess the usefulness of the abovementioned exchange rate models in explaining and predicting the nominal exchange rate movements of major currency pairs. A number of studies done after the late 1970s have shown that monetary models fail to adequately explain movements in exchange rates, much less outperform the benchmark set by a simple random walk[13]. This apparent lack of connection between macroeconomic fundamentals and cross rates of major currencies have been largely attributed to excessive exchange rate volatility which is found to far exceed standard measures of economic fundamentals.

In a landmark paper, Meese and Rogoff (1983a) demonstrate that a whole range of state-of-the art fundamentals-based models were unable to explain, much less predict, short-term systematic movements in major nominal exchange rates in an out-of-sample forecasting exercise and that a naïve random walk model beats these monetary models. Following their findings, others have come to somewhat similar results. More recently, Rogoff (1999) has revisited this issue and reiterated the low predictive content of these structural models.

However, there are also others who have argued to the contrary. Empirical studies by Woo (1985) and Wolff (1987) reveal that the forecasting ability of monetary models can be improved by including lagged values of the exchange rate as explanatory

[13] See Meese and Rogoff (1983a) and Frankel and Rose(1995)

variables and postulating the unconstrained VAR systems for the regressor of the exchange rate equation. More recently, Macdonald (1999) has also dismissed the pessimism surrounding the capabilities of standard exchange rate models and demonstrated in his paper that these structural models have forecasting powers at horizons as short as two months ahead. Bearing in mind that structural models, albeit imperfect, are still appropriate and significant in explaining exchange rate tendencies, we plan to use the monetary model to estimate the effects of fundamentals on the long run equilibrium exchange rate of the euro. This aids us in our study of the impact of ECB's monetary policies on the euro exchange rate, and as a result, the internationalization of the euro.

DATA AND METHOD IN OUR STUDY

Following the Tradables- Nontradables model, the data used in our study include the dollar-euro exchange rate, nominal stock of money supply, interest rates, inflation rates, real GDP and relative prices[14]. Monthly data[15] is used and the period under study stretches from January 1994 to December 2003, covering 120 observations. Following the approach undertaken by Chinn and Alquist (2000), we have decided to estimate the monetary model with data from the pre- Stage 3 period as the euro has only existed for five years and there may be too few observations for us to arrive at meaningful conclusions. Bilateral exchange rates, quoted in US$/euro, is obtained from the Pacific Exchange Rate services, and with monthly averages being used. The EU interest rates are proxied by offshore 3-month deposit rates while the US interest rates are given by Federal Reserves Funds rates. The nominal stock of money supply is measured by M1. Both interest rates and narrow money data are taken from 'IMF International Financial Statistics' and data on the remaining variables are obtained from 'OECD Economic Outlook'.

We explain and analyse movements in the dollar-euro exchange rate in the context of cointegration. In order to examine co-movements between the dollar-euro exchange rate and its macroeconomic fundamentals, we study the following relationship:

$$Y_t = a + b_1X_{1t} + b_2X_{2t} + b_3X_{3t} + b_4X_{4t} + b_5X_{5t} + e_t \qquad (3)$$

where Y_t denotes the value of euro in US dollars, X_{1t}: $m_t^{us} - m_t^{euro}$; X_{2t}: $y_t^{us} - y_t^{euro}$; X_{3t}: $i_t^{us} - i_t^{euro}$ and X_{4t}: $\pi_t^{us} - \pi_t^{euro}$ and X_{5t}: $\log(CPI^{US}/PPI^{US}) - \log(CPI^{EURO}/PPI^{EURO})$[16]. Based on the interpretations and findings of Chinn and Alquist (2000), we expect the following conditions to be realised. Where prices are assumed to be flexible, then the interest and inflation differential will be the same and the conditions that $b_3 > 0$ and $b_4 = 0$ will hold. If on the other hand, prices are sticky and there is secular inflation, then $b_3 < 0$ and the magnitude of the parameter is positively related to the level of price stickiness. With sticky prices, we also expect that $b_4 > 0$, increasing with the interest semi-elasticity of money demand and decreasing with the level of price stickiness. In this case where we assume that there are nontraded goods, we expect $b_5 > 0$.

[14] The relative price variable is defined as $X_{5t} \equiv \log(CPI^{US}/PPI^{US}) - \log(CPI^{EURO}/PPI^{EURO})$

[15] Monthly real GDP is interpolated from quarterly data

[16] m_t is the (log) nominal money stock, y_t is (log) income, i_t and π_t are the interest and expected inflation differentials respectively and is the X_{5t} relative price of traded to nontraded goods

As exchange rates are likely to be non-stationary, the statistical concept of cointegration plays a major role in determining the validity and reliability of the relationship. Cointegration thus enables us to reach the conclusion of a stable equilibrium relationship between the dollar-euro exchange rate and its macroeconomic fundamentals. Cointegration tests, which are the key to determining the presence and nature of an equilibrium economic relation, was first introduced by Granger (1981) and later developed by Granger (1987). A detailed description of cointegration techniques can be found in Hamilton (1994), Wong et al. (2003) and Penm et al. (2003). Before testing for cointegration, a unit root test has to be performed to test for non-stationarity for both endogenous variable and exogenous variables.

Cointegration tests in this paper take the form of a two-step procedure. The first step is to examine the stationary properties of the various stock indices in our study. If a series, say y_t , has a stationary, invertible and stochastic ARMA representation after differencing *d* times, it is said to be integrated of order *d*, and denoted as $y_t = I(d)$. Most non-stationary series are integrated of order one. We refer to a stationary series as one that is integrated of order zero. To test the null hypothesis H_0: $y_t = I(1)$ versus the alternative hypothesis $H_1 : y_t = I(0)$, we apply the Dickey-Fuller (1979,1981) unit root test procedure based on the OLS regression

$$\nabla y_t = b_0 + a_0 t + a_1 y_{t-1} + \varepsilon_t \qquad (4)$$

or apply the augmented Dickey-Fuller (ADF) test based on the OLS regression

$$\nabla y_t = b_0 + a_0 t + a_1 y_{t-1} + \sum_{i=1}^{p} b_i \nabla y_{t-i} + \varepsilon_t \qquad (5)$$

where $\nabla y_t = y_t - y_{t-1}$ and y_t can be Y_t or $X_{1t,}\ldots, X_{5t}$ as defined in (1). The regressions in (4) and (5) allow for a drift term (b_0) and a deterministic trend (a_0). The regression in (5) further allows a stochastic structure in the error term, ε_t, while *p* is chosen in equation (5) to achieve white noise residuals. Testing the null hypothesis of the presence of a unit root in y_t is equivalent to testing the hypothesis that $a_1 = 0$ in equations (4) and (5). If a_1 is significantly less than zero, the null hypothesis of a unit root is rejected. The test statistic used is the usual t-ratio, but the distribution is not the t-distribution under the null hypothesis. When p=0, the test is known as the Dickey-Fuller (DF) test. This test assumes that the residuals ε_t are independently and identically distributed. If serial correlation exists in the residuals, then p>0 and the augmented Dickey-Fuller (ADF) test must be applied.

In addition, we test the hypothesis that y_t is a random walk with drift, i.e. $(b_0, a_0, a_1) = (b_0, 0, 0)$ and y_t is random walk without drift, $(b_0, a_0, a_1) = (0,0,0)$ using the regression (4). The test statistics are the likelihood ratios Φ_3 or Φ_2 found in Dickey and Fuller (1981). The decision rule is to reject the null hypothesis if Φ_3 and Φ_2 are larger than the critical value. If the hypotheses that $a_1 = 0$, $(b_0, a_0, a_1) = (b_0, 0, 0)$ or $(b_0, a_0, a_1) = (0,0,0)$ are accepted, we can conclude that y_t is $I(1)$. If we cannot reject the hypotheses that y_t is $I(1)$, we need to further test the null hypothesis $H_0 : y_t = I(2)$

versus the alternative hypothesis H_1 **:** y_t = *I(1).* If both Y_t and X_t are of the same order, say *I(d)* , with $d > 0$, we then estimate the cointegrating parameter of (3) by OLS regression. If the residuals of equation (3) are stationary, the two series, Y_t and $X_{1t},\ldots,$ X_{5t} are then said to be cointegrated. Otherwise, Y_t and X_t are not cointegrated.

The three most common tests for stationarity of estimated residuals are Cointegrating Regression Durbin-Watson (CRDW), Dickey-Fuller (CRDF), and Augmented Dickey-Fuller (CRADF) tests. Engle and Granger (1987) suggest that the CRDW test might be used to obtain a quick approximate result. Although the power of the CRDW test is greater than the DF type tests for the case where the alternative hypothesis is a simple stationary first-order autoregressive process, it is sensitive to the dynamic structure of the error term. Thus, the CRDF and CRADF tests that are based on the OLS regression:

$$\nabla \hat{e}_t = \gamma \hat{e}_{t-1} + \sum_{i=1}^{p} \gamma_i \nabla \hat{e}_{t-1} + \xi_t \qquad (6)$$

should be employed, where $\hat{e}_t$ are residuals from the cointegrating regression (3) and p is chosen to achieve empirical white noise residuals. The null hypothesis of non-cointegration is rejected if the t-ratio is less than the relevant critical value.

Engle and Granger (1987) point out that when a set of variables is cointergrated, a vector autoregression in first differences will be mis-specified. The first differencing of all the nonstationary variables puts too many unit roots and any potentially important long-term relationship between the variables will be unclear. Thus, inferences based on vector autoregression in first differences may lead to incorrect conclusions (Granger, 1981, 1988 and Sims, et al., 1990). However, there exists an alternative representation, an error correction representation of such variables, which takes account a short- and long-run equilibrium relationship shared by those variables.

RESULTS AND POLICY IMPLICATIONS

Table 6 shows the results of testing the order of integration of the dollar-euro exchange rate and its fundamentals. We do not reject that all the test variables are *I(1)* in our sample at the 5% significance level for the entire period of study. Cross-correlation is then employed to account for any lead-lag effects between the dollar-euro exchange rate and its fundamentals. Our findings show that there are no strong lead-lag effects and thus the results originally obtained are a good measure for testing co-movement between exchange rate and its determinants. The cointegration results are presented in Table 7.

TABLE 6: UNIT ROOT TEST RESULTS

Variable	DF[17]	ADF	Φ_2	Φ_3[18]		ADF lag	ADF on lag1
Y_t	-0.03	-0.70	0.53	0.53	I(1)	1	
X_{1t}	-1.65	-2.47	3.44	1.62	I(1)	4	
X_{2t}	-2.02	-1.39	2.75	2.05	I(1)	5	
X_{3t}	-2.31	-2.71	2.65	6.16	I(1)	2	
X_{4t}	-2.65	-2.65	2.39	4.08	I(1)	0	-2.45
X_{5t}	-1.30	-1.30	1.37	1.41	I(1)	0	-1.44

TABLE 7:
COINTEGRATION RESULTS FOR DOLLAR-EURO EXCHANGE RATE

	Model	R^2	CRDF[19]	CRADF	ADF lag
$Y_t = a + b_1X_{1t} + b_2X_{2t} + b_3X_{3t} + b_4X_{4t} + b_5X_{5t}$	$Y_t = -0.12241 - 1.06866 X_{1t} + 5.22727 X_{2t} - 0.01778 X_{3t} + 0.17840 X_{4t} - 1.95858 X_{5t}$	0.8305	-4.40**	-4.18**	3

The estimate for R^2 is 0.830, which means that the chosen model is able to explain 83% of the variation in the dollar-euro exchange rates. This result highlights the significance of macroeconomic fundamentals in explaining the exchange rate of the euro. Furthermore, results of the CRDF and CRADF tests show that the estimated residuals are *I(0)* at the 1% significant level, confirming the appropriateness of employing cointegration tests. The signs of the coefficients are consistent with our earlier assumptions, with the exception of real income differentials. This may be attributed to the fact that monthly data used in this study was interpolated from quarterly data, thus rendering it less accurate. Notably also, all the coefficients are

[17] The DF & ADF for n=100 critical values at 1% and 5% are -4.04 and at -3.45 respectively. Values are obtained from Table D.7, Gujarati (2003), Basic Econometrics, 4th edition

[18] As mentioned earlier, Φ_2 and Φ_3 are the Dickey-Fuller likelihood ratios. The critical values for them at 5% are 4.88 and 6.49 and at 1% are 6.50 and 8.73 respectively, for n=100.

[19] CRDF & CRADF critical values at 5% = -1.95* and at 1% = -2.58** from Table D.7, Gujarati (2003), Basic Econometrics, 4th edition

significant at the 5% critical level with the exception of inflation differentials and the constant term.

We then proceed to repeat the same tests, with the exception that the time period is now subdivided into pre and post-Stage 3 of EMU, that is, from 1994 – 1998, and 1999 – 2003. The purpose of this test is to check for the consistency of our results. Tables 8 and 9 below illustrate our findings.

TABLE 8:
COINTEGRATION RESULTS FOR THE DOLLAR-EURO EXCHANGE RATE FOR THE SUBPERIOD 1994 – 1998

	Model	**R^2**	**CRDF[20]**	**CRADF**	**ADF lag**
$Y_t = a + b_1X_{1t} + b_2X_{2t} + b_3X_{3t} + b_4X_{4t} + b_5X_{5t}$	$Y_t = 1.50373 + 0.71937X_{1t} - 0.50618X_{2t} + 0.02818X_{3t} + 7.87863X_{4t} + 0.85332X_{5t}$	0.6406	-2.85**	-2.85**	3

TABLE 9:
COINTEGRATION RESULTS FOR THE DOLLAR-EURO EXCHANGE RATE FOR THE SUBPERIOD 1999 – 2003

	Model	**R^2**	**CRDF[21]**	**CRADF**	**ADF lag**
$Y_t = a + b_1X_{1t} + b_2X_{2t} + b_3X_{3t} + b_4X_{4t} + b_5X_{5t}$	$Y_t = 0.11430 + 1.55511X_{1t} + 5.45490X_{2t} - 0.05227X_{3t} + 1.87910X_{4t} - 2.81674X_{5t}$	0.875	-4.59**	-4.59**	3

The results show that cointegration tests are still suitable even after the tests are conducted on data from two separate time frames. R^2 is found to be significantly higher for the period 1999 – 2003, at 0.875 compared to 0.6406 for the first period. Notably, many of the signs of coefficients in the former period are not what would have been predicted by conventional wisdom. This can probably be explained by the fact that prior to the completion of the stage-3 EMU, the data obtained was the aggregate for the EU legacy countries, which may have led to some distortions. In all, our findings

[20] CRDF & CRADF critical values at 5% = -1.95* and at 1% = -2.58** from Table D.7, Gujarati (2003), Basic Econometrics, 4th edition
[21] CRDF & CRADF critical values at 5% = -1.95* and at 1% = -2.58** from Table D.7, Gujarati (2003), Basic Econometrics, 4th edition

suggest that three variables, namely differences in the nominal stock of money supply, interest rate spreads and the relative prices of traded to nontraded goods, are particularly significant in explaining the movements of the dollar-euro exchange rates. Interestingly, the former two are policy tools under the purview of the ECB. This underscores the importance of the policy stance of the central bank on the external value of the euro.

Monetary policy in the Euro area is conducted centrally by the ECB and its primary task is to ensure price stability, defined as keeping euro area-wide inflation rates, measured by the Harmonised Index of Consumer Prices (HICP), at below 2% per annum. A two-pillar strategy[22] was formulated to achieve this goal. The first pillar is signalled by the announcement of a quantitative reference value- of 4.5% - for the growth of the broad monetary aggregate M3 and the second pillar refers to a broad assessment of other variables deemed to be significant by the ECB[23]. In addition, it is understood from the Maastricht Treaty that the ECB is also responsible for sustaining the overall economic activity in the Euro area, subject to the condition that the pursuit of other macroeconomic objectives is not incompatible with price stability.

However, many critics have remarked that the ECB, in so closely following its mandate of price stability, has tended to neglect more pressing issues and concerns. De Grauwe (2002) and Fritz (2002), for instance, argue that the ECB has managed its monetary policy in a less-than-optimal manner.

The prominence attached to money in guiding monetary policies is one aspect in which the ECB has drawn much attention and criticisms. Considering that the ECB aims to keep inflation below 2% every year, De Grauwe (2002) argues that money growth numbers are inconsequential as they contain high noise-to-signal ratios. In fact, it appears to be rather puzzling why the ECB sets a specific money growth target (4.5%) when it systematically ignores the money supply numbers most of the time anyway. The more serious problem is one of credibility when it gives signals about intentions it doesn't act upon.

On several occasions, we also observe that the ECB displayed rigidity and reluctance in adjusting interest rates due to its apparent fixation with keeping inflation below 2%. In the past two years, the dollar plummeted about 30% against the euro and the general consensus amongst economists[24] is that the euro will continue appreciating in the next 12 months to reach 1.40 dollar. Whilst observers generally agree that the ECB should treat exchange rates with benign neglect[25], the fact remains that too strong or weak a euro over a prolonged period is unhealthy for the Euro area.

Faced with a massive current account deficit of nearly half a trillion dollars, the US probably welcomes the dollar's slide against major currencies since a weak dollar helps to reverse the trade deficit. However, given that the European economies are currently performing sluggishly, a natural policy response would be for the ECB to

[22] See Hartmann and Issing (2002) for a more detailed discussion and analysis of the two-pillar strategy

[23] Hartmann and Issing (2002) listed these variables as including the exchange rate, wages, the yield curve, measures of real activity, business and consumer surveys etc. Also included are the ECB's staff macroeconomic projections and other organisation's forecasts

[24] Fortune (Europe), Volume 149, Issue 3, p13

[25] See for instance Alesina et al (2001) and Fritz (2002)

adjust interest rates downward to levels comparable to those of the US so as to ease the appreciating trend of the euro which counters recessionary pressures and stimulates growth. Instead, the ECB has so far doggedly held base lending rates at 2%, above that of 1% in America. Such a move illustrates the preoccupation of the ECB with keeping inflation at less than 2% per annum. Indeed, as De Grauwe (2002) correctly points out, the ECB seem to have concluded, mistakenly, that achieving price stability is not just its primary responsibility, but their sole objective. This leads to a blatant disregard of market demands and changes, which is ultimately damaging to the Euro area, and the internationalisation of the euro.

We observe that hitherto, the ECB has tended to treat the exchange rate of euro with benign neglect. It took considerably long for the ECB to decide to shore up the value of the euro following its enduring decline after its launch in 1999 and again, it has chosen to overlook the sharp appreciation of the euro in the past two years. Admittedly, ensuring internal price stability should continue to take priority and be the way forward, and as such, actively managing the exchange rate of the euro is not feasible. However, we note that if the exchange rate of the euro is allowed to persistently deviate from its long run equilibrium value, this would negatively impact the economic performance of the Euro area and credibility of the ECB, both of which would be damaging to the future development of the euro in the international monetary system.

CONCLUSION

The euro has made significant advancements as an international financing currency. Recent years have seen an increase in the net issuance of euro-denominated bonds over that of the dollar and the same can also be said of the total cross-border claims of banks in euros. Whereas the dollar was previously the most popular denomination for financial assets, it has now been displaced by the euro. This is probably the result of the creation of a more integrated financial market in the Euro area following the use of a single currency, and as such, we expect the euro to sustain its position in this area. In the government sector, we observe that developing countries are gradually diversifying their portfolio by including a larger share of euros in their currency reserves. This is encouraging because the reserves of developing countries account for a large proportion of total world reserves. This implies that even though the increase is only a few percentage points, it is actually very significant in absolute terms. It is noteworthy, however, that the euro has yet to be able to rival the dollar in other functions. We find this neither particularly surprising nor disturbing as it is almost a stylized fact that the structure of international currencies tends to resist changes. Even with such changes, adjustment will only take place gradually over time.

In order to predict the long term prospect of the euro, we examine movements in the dollar-euro exchange rate using cointegration techniques and found that interest rates and money supply growth were important determinants of the external value of the euro. Our findings have important implications for analysing the effects of ECB policy on the exchange rate of the euro, and consequently its international role. We are of the view that the ECB, in its preoccupation with keeping inflation below 2% per annum, tends to be inflexible in responding to other needs in the Euro area. This is exemplified by the refusal of the ECB to adjust interest rates downward despite a sharp appreciation of the euro in recent months for fear of jeopardising price stability.

Nevertheless, we recognise that economic issues only shape in part the future development of the international role of the euro. Political developments in the Euro area and the state of the US economy will have important repercussions on this relatively new currency. As the European Union expands and more countries start using euro, the shocks faced are likely to be asymmetric as the new entrants will be at different stages of growth and business cycles. Given that the ECB has problems prescribing a one-size-fits-all monetary policy for its present members with their divergent state of economies, this problem would be compounded if more countries choose to give up their sovereign currency in favour of the euro. At the same time, If the budget deficit in US continues to be substantial and persists over a prolonged period, the dollar is likely to lose its attractiveness and we anticipate that the euro will take on a more vital role in the near future.

In sum, we are of the view that the euro, though lagging the dollar in some aspects, has managed to set itself up as an important international currency in the global monetary system. Indeed, five years is perhaps too short a period to expect drastic changes to the demand for the dollar relative to the demand for the euro. We believe that given a longer period of time, with the Euro area being fundamentally sound and the ECB establishing some form of track record, the euro will become more predictable and hence, more popular internationally.

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