THE VALUE OF THE EURO: UNDERVALUED OR OVERVALUED?

Keun H. Lee, Northern State University, keunlee@northern.edu

Farid Sadrieh, Quinnipiac University, farid.sadrieh@quinnipiac.edu

INTRODUCTION

Since its introduction in January 1999, the value of the Euro has been eroding steadily against the U.S. dollar. Though preceded by the European Currency Unit (ECU), the Euro has replaced most national currencies in the European Union (EU), and as such can be viewed as a new currency. As with any new currency, the uncertainty and the risk surrounding it remain high, and hence the steady decline in the value of the Euro is somewhat expected.

In his discussion of exchange rate regimes, Mundell (1961 and 1997) suggests that several countries could form an "optimal currency area," and derive benefits from using the same currency. Whether the creation of the Euro is rooted in the Mudellian notion of the optimal currency area, or is merely motivated by political aspirations is a moot question. Nonetheless, the Euro is generally believed to be beneficial for the participating nations of the European Monetary Union (EMU). One benefits cited is a greater transparency of prices of goods and services across national borders; prices denominated by a common currency, the Euro, would make price comparisons easier, forcing unjustified price differentials in various nations to be removed, and hence benefiting consumers in all participating nations. The Euro would also eliminate costs and risks associated with exchange rate fluctuations among countries in the Euro-zone, which would help businesses operating in the area be more cost-effective.

These positive assessments of the Euro's impact have accompanied a natural expectation that the value of the Euro would be strengthened, or at least remain steady, once introduced. Its value, however, has been declining steadily against the U.S. dollar. One account for this weakness of the Euro would be the uncertainties and risk associated with a relatively new currency, as noted above; it would be generally expected that the confidence in the new currency would build up only gradually over time, not immediately. The Euro appears to have stabilized somewhat in recent months when the actual currencies and coins began to circulate, and this could be evidence for a growing confidence in the Euro. This stability, however, may turn out to be another temporary blip in its value which the Euro has frequently experienced in the past three years since its introduction.
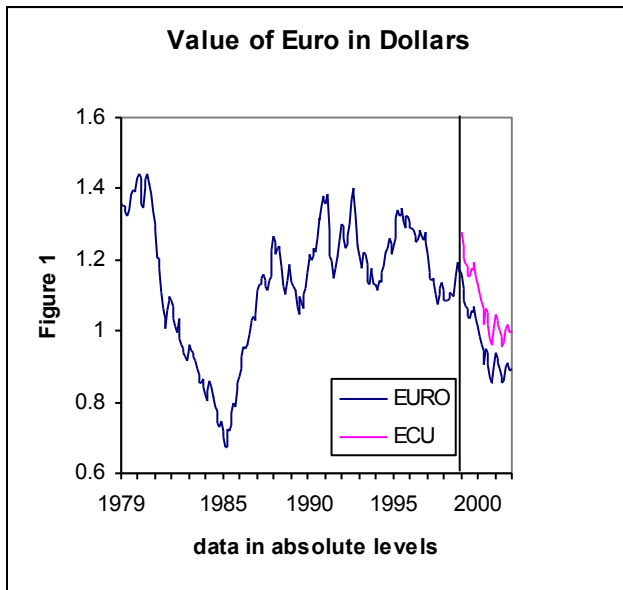
Another account for the Euro's decline could be the absence of the Pound Sterling and the Danish Krone in the composition of the Euro. Because Britain, Sweden, and Denmark chose to remain outside of the EMU, their currencies are not taken into account in the valuation of the Euro. Given that the Pound Sterling and the Krone have been relatively stronger than the Euro in the recent past, if their values had been included in the Euro, its valuation could be higher than it presently is. This paper examines this hypothesis by including the two missing currencies in calculating the value of the Euro.

Notwithstanding the two currencies absent in the Euro, the value of the Euro would be determined ultimately by the fundamentals of the underlying economy or economies. This paper examines the Euro in this perspective as well. Specifically, it examines which economic fundamentals in the Euro-zone and the U.S. is largely responsible for the trend in the relative values of the Euro and the U. S. dollar, and considers the future course of the Euro in light of these fundamentals.

The paper is organized as follows: the next section calculates the value of the Euro by including the two missing currencies in the component of the Euro, and compares it with the value of the Euro for the current EMU members to examine where the value of the Euro presently stands. Section 3 considers economic fundamentals that are believed to be the driving forces behind currency's exchange value. Section 4 uses regression analysis to identify factors which are significant in explaining the value of the Euro. The final section summarizes and considers the future course of the Euro briefly.

EURO VALUATION

Figure 1 shows the monthly exchange value of one ECU and Euro in U.S. dollars before and after 1999, respectively, for the past two decades. Although the current value of the Euro is not quite at its historical low, which occurred in 1985, the erosion of the value of
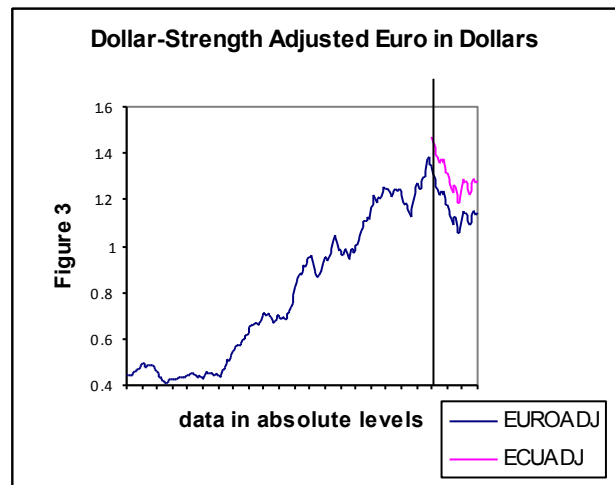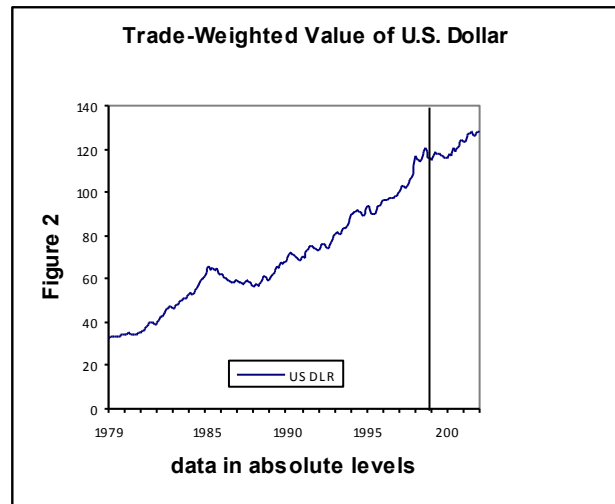
Value of Euro in Dollars

Figure 1
data in absolute levels

Trade-Weighted Value of U.S. Dollar

Figure 2
data in absolute levels

assumption that those three countries also joined the EMU.

Dollar-Strength Adjusted Euro in Dollars

Figure 3
data in absolute levels

the Euro against the U.S. dollar is without a doubt.[1] The reason for this decline could be, in part, because of the recent strength of the U.S. dollar against most major currencies. The strength of the U.S. dollar can be seen in Figure 2, which is based on the trade-weighted index for the value of the U.S. dollar since 1979. Thus, the downturn in the Euro's value could be seen as a result of the dollar's strength, and hence of no significance. Figure 3, in which the nominal values of the Euro in Figure 1 are adjusted for the dollar's strength, however, tells a different story.[2] In this figure, the recent decline in the Euro is much less pronounced and milder, and the current value of the Euro does not seem as low historically as it is in Figure 1. In spite of the adjustment, however, the downward trend in the Euro remains for the Euro values after 1999, suggesting a genuine weakness in the Euro in recent years.

As already noted, this weakness may be due to the absence of three EU member countries (Britain, Sweden, and Denmark) in the EMU, and hence values of their currencies are not reflected in the valuation of the current Euro. To examine this hypothesis, this paper recalculates the value of the Euro under an

The ECU is the currency unit which was created in December 1979 and was replaced with the Euro at the end of 1998. In fact, the Euro series shown in Figure 1 and 3 before 1999 is the ECU. It is a composite currency unit consisting of specified amounts of the currencies of the Member States of the European Communities, which is based on each country's share in intra-EU trade. The weights given to each currency in the ECU before 1999 were as follows (Begg et al., 1997)[3]:

$$1ECU = 0.642DM + 1.332FF + 0.2198HFL$$
$$+ 3.301BFR + 0.13LFR + 151.8LIT$$
$$+ 0.1976DKR + 0.008552IRLP$$

---

[1] For the 20-year period shown in the figure, the mean of the exchange value of the Euro is $1.11 with the standard deviation of $0.18. The range of the value with one standard deviation on both sides of the mean value, therefore, would be between $1.29 and $0.93. In this regard, the current valuation of the Euro, which stands at around $0.90, appears slightly undervalued.

[2] For the adjustment, the nominal values of the Euro are multiplied by the decimalized index (i.e., 1.5 for 150) for the values of the U.S. dollar. This adjustment is to make low values of the Euro higher for the period when the dollar is strong, and vice versa.

[3] The weights are adjusted every five years, and the ones given in the text have been in use since 1995. The next adjustment was scheduled for 1999, the year in which the Euro was introduced.

+ 0.08784GBP + 1.44DR+ 6.885PTA
+ 1.393ESC.

The currency symbols are: DM for the German Mark, FF for the French Franc, HFL for the Dutch Guilder, BFR for the Belgian Franc, LFR for the Luxembourg Franc, DKR for the Danish Krone, LIT for the Italian Lira, IRLP for the Irish Punt, GBP for the Pound Sterling, DR for the Greek Drachma, PTA for the Spanish Peseta, and ESC for the Portuguese Escudo.

The dollar value of 1 ECU would be the sum of the dollar values of all currencies included in the formula by the same weight. Since the Pound Sterling and the Danish Krone are no longer components of the Euro, their strengths would not be present in the current dollar value of the Euro. Using the same weights in the formula, and including those two currencies as well, the value of the ECU has been calculated again, and is shown with the dotted lines in Figures 1 and 3. In both charts, it is clear that the drop in this hypothetical Euro, shown as ECU, is much less salient than for the current value of the Euro. The implication is that the value of the Euro would have been considerably higher if the Pound Sterling and Danish Krone joined the EMU. The current weakness of the Euro, therefore, could be viewed as "Pound-Krone" discounts and, with the discount taken into account, the Euro valuation appears to be well within its historical norm.

Although the recent decline in the Euro appears less alarming and mild in this perspective, the downward trend in the Euro after 1999 still remains and begs the question as to whether the economic fundamentals in the Euro-zone have shifted recently, prompting a downward slide in the value of the Euro. The next section identifies and selects those fundamentals to examine the Euro in this light.

FACTORS BEHIND EXCHANGE RATES

The economic theories identify two broad classes of factors that are believed to be the major forces driving the value of a currency. The first class includes items which normally affect the flow of traded goods and services while the second class includes items which affect foreign investments. As both types affect the need for foreign exchanges, they also determine the strength or the weakness of the exchange values of a currency.

The items in the first class include such items as the relative strength of the underlying economy and the relative rates of price inflation among trading partners. For the relative strength of the economy, a faster growing economy would, by definition, generate a faster

growth of income which might be translated into larger imports from other regions, giving rise to a greater need for foreign exchanges. In the relatively stronger economy, the need for capital goods would also grow faster and the imports for those goods from abroad would increase as well. Thus, a faster growth in the economy is expected to have a negative impact on the value of the local currency. In the analysis below, the differences in the GDP growth rates in the Euro-zone and the U.S. are used to capture the impact of the growth differentials on the exchange value of currency.

Price inflation and its influence over trade have its roots in the Purchasing Power Parity (PPP) doctrine; regions with lower price inflation will have a competitive edge in the world market, and hence would be able to increase the volume of their exports. Thus, lower inflation is believed to be favorable to the currency value while higher inflation is believed to be unfavorable (Balassa, 1964 and Samuelson, 1964). This analysis takes the change in the consumer price index (CPI) as the rate of price inflation. Like GDP growth, it takes the differences between the changes in the CPI in the Euro-area and the U.S. to study the movements in the value of the Euro.

A third item added to the current analysis is the price of crude oil in the world market. It should be noted that none of the current members of the EMU is an oil-producing country while the U.S. partly meets its oil needs with domestically produced oil. This difference between the two regions has varying implications on the need for foreign exchanges; as the crude oil price rises, for example, the burden of obtaining crude oil and related energy products for the Euro-zone countries would be relatively higher than for the U.S., giving rise to a relatively larger need for foreign exchanges, and hence in a weaker currency for the Euro-zone countries. The analysis below is based on the "spot price" of the North Sea Brent blend as a proxy for the world crude oil price. Crude oil prices are often quoted in dollars in the world market, and may be subject to the fluctuations as the value of the dollar itself change in the currency market. To remove the bias arising from such fluctuations, the dollar denominated spot price for the crude oil has been converted into an index in the following analysis.

The other class of factors underlying currency values includes items that affect the flow of foreign investments (Mundell, 1960 and Calvo et al., 1993). Foreign investments are often divided into two groups for convenience; foreign direct investment (FDI) and foreign portfolio investment (FPI). FDI is usually long-term in nature and, as such, its movements are sensitive to the prospects for future economic growth in a region.

The region whose economy is expected to grow quickly would be perceived to yield a higher return than others, and hence will experience an inflow of FDI, and vice versa. In this regard, the differences in the GDP growth rates mentioned above would partly account for the flow of FDI as well. For FDI, however, the "prospects or expectations" for future growth would be more relevant than contemporaneous growth. Putting aside the controversial issue of expectation formation, because long-term interest rates are often viewed as reflecting the future growth of the economy, this analysis takes them as the proxy variable for future growth prospects.

While FDI is normally long-term in kind, FPI can either be long-term or short-term in nature. Long-term FPI refers to investing in foreign equities for a considerable amount of time similar to FDI, and thus would be sensitive to the same factors, such as the future GDP growth prospects or the long-term interest rates. In fact, the difference between the FDI and the long-term FPI is only in the management power exercised by the investor but this is merely a matter of degree, not of substance; an equity investor could also be heard through the boardroom meeting. In addition, whether the FPI is short-term or long-term in kind, because both are made through the equity market, the relative performance of the equity markets could also affect the rate of return, and hence is a significant factor. It is believed, however, that, while the relative performance of the market could be an important factor for short-term FPI, it might not be a critical determinant of the long-term FPI.

The objective of short-term FPI is primarily short-term profit taking in foreign equity or debt markets and, as such, the forces driving this type of investment are different from others. Specifically, they would be short-term interest rates or equity market returns, depending on the type of investment vehicle chosen; in the case of debt-market investing, it would be short-term interest rates which reflect short-term credit availability and, in the case of equity market investing, it would be equity market performance which reflects current economic cycles. Unlike the long-term FPI, it would be largely independent of the prospects of future output growth in the economy.

Among the variety of factors behind foreign investments as noted above, this analysis focuses on two of them; the 10-year government bond yield (the long-term interest rate) for long-run FDI and FPI, and the equity market index for short-term FPI. The equity markets are known to be highly sensitive to the movements of short-term interest rates, and hence short-term interest rates are omitted in the analysis. Similar to output growth and price inflation earlier, the

analysis takes the differences in the 10-year government bond yields between the two regions for the interest rate differentials. For the equity market, it takes the differences in the stock market returns between the Dow Jones Euro STOXX Broad and the Standard and Poor's 500.

QUANTITATIVE ANALYSIS

The analysis below is based on a regression equation as follows:

$$(2) \quad EURO = a + b\ DUMMY + c\ GDPDIF \\ + d\ CPIDIF + e\ BRENTINDX \\ + f\ GB10DIF + g\ STOCKDIF,$$

where a = constant, EURO = the exchange value of euro in dollars, DUMMY = 0 for the period before 1999, 1 for the period after 1999, GDPDIF = Euro-zone GDP growth rate - U.S. GDP growth rate (annual), CPIDIF = Euro-zone CPI changes - U.S. CPI changes (annual), BRENTINDX =the spot price of a barrel of Brent crude oil converted to an index, GB10DIF = Euro-zone 10-year government bond yield - U.S. 10-year government bond yield (annual), STOCKDIF = Changes in STOXX Broad Index - S&P 500 index (monthly).

The regression is based on monthly data from January 1995 to September 2001. The data for the Euro prior to 1999 is the dollar value of the ECU. The sample period in the analysis encompasses two time horizons with distinct characteristics; it contains four years prior to (pre-Euro period) and three years after (post-Euro period) the introduction of the Euro. This choice of a long sample period was a deliberate one as the main interest of this paper is to study the value of the Euro in the long-term, not in the period after its introduction. The variables examined in the earlier section and used in the analysis are also believed to influence the value of the Euro gradually overtime, and hence focusing on three post-Euro years appears less meaningful. The analysis begins with the data starting from 1995 because the 10-year government bond yield figures for the Euro-zone countries are not available prior to that year. Most data in the analysis come from the European Central Bank (ECB) data bank. Detailed sources of each data set are listed in Appendix.

Except for the Euro and Brentindx, all variables in the regression are the differentials in the rates of change between the Euro-zone and the U.S. The two exceptions above are either in "absolute" terms or in "log" terms. Based on the variables defined as such, two estimates are made; in the first, the absolute-levels of the

Euro and Brentindx are used, and in the second, their log-levels. The difference between the two is in the interpretation of the coefficients estimated. In the absolute-level estimation, a unit change in Brent oil price implies a change of "e dollars" in the value of the Euro. For other explanatory variables in this estimation, interpretations are similar; a one-percent increase in the difference in the GDP growth rates between the two regions, for example, implies a change of "c dollars" in the value of the Euro. In the log-level estimation, however, a unit change in the index of Brent oil price means a change of "e percent" change in the value of the Euro. For other variables in this estimation, the coefficients are their elasticities. For example, the elasticity of the Euro with respect to the GDP growth rate differential would be "c."

Table 1 presents two sets of coefficient estimates together with the t-values and the associated probabilities.

In both estimations, the values of R^2 and F-statistics are encouraging, and appear to support strongly the model used. Furthermore, most variables are shown to be statistically significant in accounting for the Euro value against the U.S. dollar. The only exception is the variable for inflation differentials measured by the relative changes in CPI in the two regions. Given that the price inflations in both the Euro-zone and the U.S. have been mild and have not differed greatly with each other in recent years, the lack of explanatory power for the inflation rate is not surprising. The dummy variable is also shown to be significant in both estimates, suggesting that there has been a significant change between the two periods before and after 1999. More will be discussed on this change later.

The sizes of the estimated coefficients together with their signs shed additional insight into the forces behind the value of the Euro. The log-level estimation shown in the lower panel indicates that the elasticity of the Euro with respect to the GDP growth differential is -0.06. To begin with, the negative sign suggests that a relatively faster GDP growth in the Euro-zone would put downward pressure on the Euro against the dollar. The size of the elasticity, however, shows that its impact would be little, if any; for a one-percent difference in the GDP growth rate, its effect on the value of the Euro is six hundredths of a percent.

Figure 4 below shows the data for the GDP growth differential between the Euro-zone and the U.S. in 3-month averages. For most of the 7 years included in the sample period, the GDP growth rate for the Euro-zone trails that of the U.S., and hence should have had some positive effect on the value of the Euro. Due to the slow-down in the U.S. economy during 2001, however, the GDP growth differential between the two regions disappears in 2001 and the Euro-zone growth rate began to exceed that of the U.S. in that year. Though the impact may not a significant one, this narrowing gap in the output growth in the regions does bode well for the Euro in the near future according to the results above.

A similar observation can be made in regard to 10-year government bond yields in the two regions. The elasticity for this variable is 0.08, meaning that a relatively higher bond yield in the Euro-zone would put upward pressure on the value of the Euro. But the size of the elasticity is small, and hence the impact of the bond yield would be insignificant; for a one-percent difference in the bond yield, its effect on the value of the Euro is eight hundredths of a percent.

The data for the bond yield differential in 3-month averages reported in Figure 4 show that their historical pattern is also similar to that of GDP growth rate. Until recently, the Euro-zone bond yields trails that of the U.S., and thus should have had a negative effect on the value of the Euro. In the past few months, however, it began to exceed that of the U.S. and, if its trend continues, could undermine the value of the Euro in the near future.

It is interesting to note that the combined effect of the two variables above could be a wash; the elasticity for the GDP growth is negative and that for the bond yield is positive, and the size of the elasticities are about the same. As the Euro-zone economies improve, the value of the Euro could be adversely affected on the one hand. But an improving economy generally accompanies better prospects for the future performance of it as well, which would result in a higher long-term interest rate. The rising long-term rate or the 10-year bond yield would in turn deliver a positive influence over the Euro. The net result would be that the output growth presently and the accompanying rosier prospective will have little impact on the value of the Euro

It is often suggested that, as the growth rate of the economy picks up in the Euro zone, the Euro will also strengthen subsequently. This belief is grounded in the notion that when the Euro-zone economies improve and the future prospects for them as well, they will give rise to a surge in long-term FDI and FPI, strengthening the value of the Euro. This view, however, overlooks the fact that an improving Euro-zone economy will bring about a larger trade deficit as well, undermining the Euro.

In contrast to the two GDP-related variables discussed above, the impact of the world crude oil price

on the value of the Euro is shown to be substantial. The coefficient is -0.14, indicating that a one-unit increase in the index of crude oil price in the world market will bring about a 14 percent decline in the value of the Euro. Although this magnitude appears somewhat excessive, it nonetheless provides insight into the fall of the Euro to a new low in the second half of 2000 when the world crude oil price had peaked at a new high.

Given that the crude oil price remains at about the current level, it might be expected that the Euro will maintain stability at its current level against the U. S. dollar according to the result. It is, however, difficult to determine the direction of the world crude oil price for the future. Even for the near future, there appears to be many unpredictable variables which would affect the price such as terrorism and an unforeseen political conflict in the oil producing regions. In Figure 5, which shows the 3-month average figures for Brent, there appears to be a recent downward trend. If this trend continues, it is likely that the Euro may recover some of the value it lost since 1999, but this would be contingent upon a hypothesis whose nature is speculative at best.

In the results above, the relative stock market performances in the two regions are also shown to be significant for the exchange value of the Euro. The elasticity for this variable is 0.41 and it is, in fact, the largest among all the variables included in the analysis. With its positive sign, the elasticity of this magnitude means that the FPI, short-term portfolio investment, plays a favorable and prominent role in determining the value of the Euro. This result is not surprising in light of the unprecedented speed with which the integration of the world capital markets has been moving forward in recent years.

The relative performance of the equity markets in the two regions, the Euro-zone and the U. S., is reported in Figure 5 as well. It can be seen easily that the equity market performance in the Euro-zone in 2001 was much worse than in the U.S. Although it is difficult to predict what the relative returns would be in 2002 and beyond, if it is assumed that the equity return in the Euro-zone would eventually catch up with that in the U. S. in the near future, it may be expected that the value of the Euro would improve significantly.

It is also clear in the figure that the movements in the relative equity market performance over the years have been random, especially in the pre-Euro era. In more recent years, they seem to have somewhat greater serial correlation, though not a significant one. The implication of the random movements of the stock market performance is disturbing. Given that the equity market performance in the two regions have a sizable impact on the value of the Euro, random movements of

the stock returns make the task of predicting the future course of the Euro highly unreliable. In other words, the value of the Euro is largely in the hands of short-term portfolio mangers, whether their actions are justified or not in light of economic fundamentals.

Earlier, it was noted that one part of the sample period is without the Euro, and the other with the Euro, and hence a change or a shift in the forces driving the exchange value of the Euro between the two periods could be suspected. The model has been put to a Chow test for this reason. The test was based on F-statistics with restrictions on slope dummies, while the dummy for intercept was not restricted in order to capture a shift in the intercept between the two periods. The restrictions imposed, however, were rejected; the test yielded a F-value of 4.32 with the p-value of 0.00 for the absolute-level estimation, and 2.99 with a 2% p-value for the log-level estimation. In other words, the slopes of all variables in the model, or possibly the structure of the model itself, have changed since the introduction of the Euro.

To investigate the changes further, additional estimates were made for each sub-period separately, and the coefficient estimates together with the t-values and the associated probabilities are reported in Table 2 for each period.

While the value of R^2 and F-statistics are encouraging, the results shown in the table are somewhat striking; for the post-Euro period only one variable, Brent crude oil price, proves to be of any significance. All other variables are rejected. For the pre-Euro period the results improve but only marginally; in the absolute-level estimation, for example, the output growth rate and 10-year government bond yield show some significance but the rest are rejected.

Contrary to these results, however, it may be recalled that all but one variable were statistically significant in the estimation based on the entire sample period. The implication appears to be that the model is more appropriate for the entire sample period than for any one of the two sub-periods, before and after 1999. This is also consistent with the belief that the fundamentals represented by the variables in the model influence the exchange value of the Euro only gradually over a period of time, spanning several years. It is for this reason that this analysis chooses and examines the estimates for the entire sample period rather than those for the sub-periods.

CONCLUSION

The eroding value of the Euro since its introduction in

1999 has caused considerable debate among economists and politicians. This paper argues that the decline shown in the market data is somewhat exaggerated in that the strengths of two opt-out currencies, the Pound Sterling and Danish Krone, are not reflected in the market data. The paper shows that when these two currencies are included in the calculation, the value of the Euro is considerably higher than it presently is, and hence the Euro with its current composition is not as undervalued as it is often claimed to be. Thus, the current weakness of the Euro could possibly be viewed as the result of the discount for the two currencies not included in the Euro. Yet, the downward trend for the Euro still remains even in the hypothetical Euro series as in the present Euro series.

To study the causes for this declining trend further, the paper considers five economic fundamentals which are believed to be essential for the currency value, and includes them in a regression analysis to identify the scope of their impact. Among the five, the regression rejects price inflation as having any statistically significant impact on the Euro. Of the remaining four, the effects of the GDP growth rate and the long-term interest rate are shown to be small, while those of the world crude oil price and the equity market performance are strong. The course of the Euro, therefore, appears to depend mainly on the two latter variables. Provided that the crude oil price remains at the current level and that the return in the equity market in the Euro-zone is expected to improve in the near future, the value of the Euro may witness some improvement accordingly. The crude oil market as well as the equity market are, however, highly unpredictable or even random in nature, and hence preclude any meaningful prediction for the future course of the Euro beyond the immediate future. As with most currencies, the Euro's future seems to hang on a fine balance that is highly unpredictable at best.

Being largely a political brainchild, an erosion of the value of Euro, if continued, will have considerable political repercussions in the Euro-zone, and it is likely that a call will be made to strengthen the Euro through market intervention. History shows, however, that such an intervention rarely succeeds and, even when it does, success is only temporary. Random events lurking around in the crude oil or in the equity markets could easily deliver a powerful shock to derail such an attempt. Thus, a more constructive course of action at present would be to take the opposite course, that is, to strengthen the economies by taking advantage of the current weakness of the Euro and of the accompanying competitiveness for Euro-zone exports. This will enable the Euro-zone economies to better withstand unforeseen shocks arising from a variety of sources, including the crude oil market and the equity market.

TABLE 1

Coefficients	a	DUMMY	GDPDIF	CPIDIF	BRENT	GB10DIF	TOCKDIF
(Euro in Absolute-Levels)							
Coefficient	1.22	-0.04	-0.06	-0.00	-0.00	0.10	0.42
t-value	45.39	-2.22	-7.78	-0.09	-6.45	11.99	2.23
p-value	0.00	0.03	0.00	0.93	0.00	0.00	0.03

$R^2 = 0.998$ $F(6,73) = 99.52$ (0.00% significance)

Coefficients	a	DUMMY	GDPDIF	CPIDIF	BRENT	GB10DIF	TOCKDIF
(Euro in Log-Levels)							
Coefficient	0.69	-0.05	-0.06	-0.00	-0.14	0.08	0.41
t-value	6.52	-2.76	-7.40	-0.05	-5.91	10.33	2.14
p-value	0.00	0.01	0.00	0.96	0.00	0.00	0.04

$R^2 = 0.873$ $F(6,73) = 83.39$ (0.00% significance)

TABLE 2

Coefficients	a	GDPDIF	CPIDIF	BRENT	GB10DIF	STOCKDIF

For 1995:1 - 1998:12
(Euro in Absolute-Levels)

	a	GDPDIF	CPIDIF	BRENT	GB10DIF	STOCKDIF
Coefficient	-0.04	-0.02	-0.01	0.37	0.06	-0.19
t-value	-0.37	-3.04	-2.06	1.56	12.42	-1.34
p-value	0.72	0.00	0.05	0.13	0.00	0.19

R^2 = 0.983   F(5,41) = 56.44 (0.00% significance)

(Euro in Log-Levels)

	a	GDPDIF	CPIDIF	BRENT	GB10DIF	STOCKDIF
Coefficient	1.08	-0.02	-0.01	0.00	0.08	-0.24
t-value	42.80	-2.53	-2.20	2.21	12.95	-1.44
p-value	0.00	0.02	0.03	0.03	0.00	0.16

R^2 = 0.999   F(5,41) = 63.30 (0.00% significance)

For 1999:1 - 2001:9
(Euro in Absolute-Levels)

	a	GDPDIF	CPIDIF	BRENT	GB10DIF	STOCKDIF
Coefficient	0.74	-0.01	0.00	-0.17	-0.06	0.30
t-value	4.69	-0.55	0.68	-5.45	-1.59	1.19
p-value	0.00	0.59	0.50	0.00	0.12	0.25

R^2 = 0.853   F(5,27) = 25.99 (0.00% significance)

(Euro in Log-Levels)

	a	GDPDIF	CPIDIF	BRENT	GB10DIF	STOCKDIF
Coefficient	1.16	-0.02	0.00	-0.00	-0.03	0.40
t-value	27.99	-1.25	0.85	-6.74	-0.99	1.75
p-value	0.00	0.22	0.40	0.00	0.33	0.09

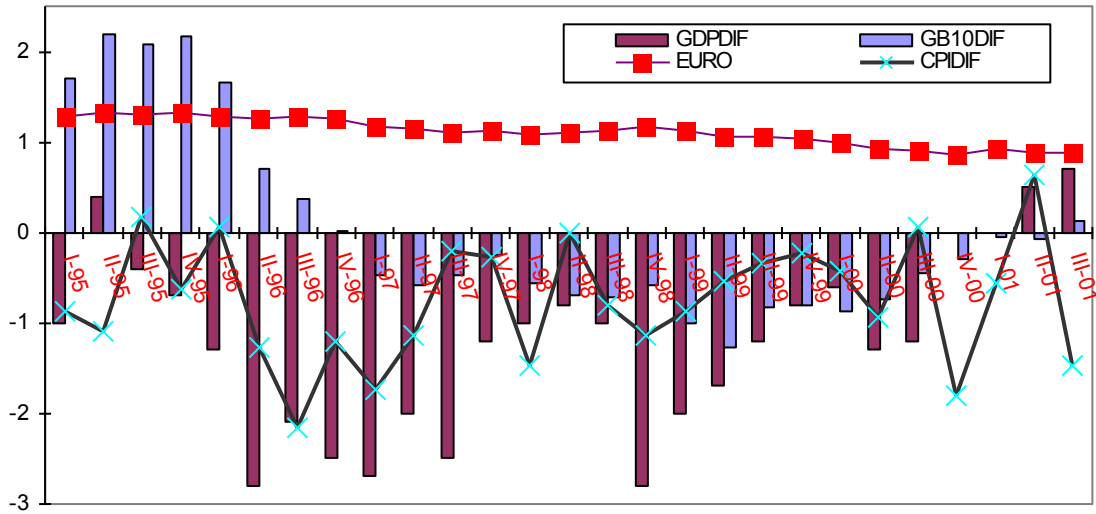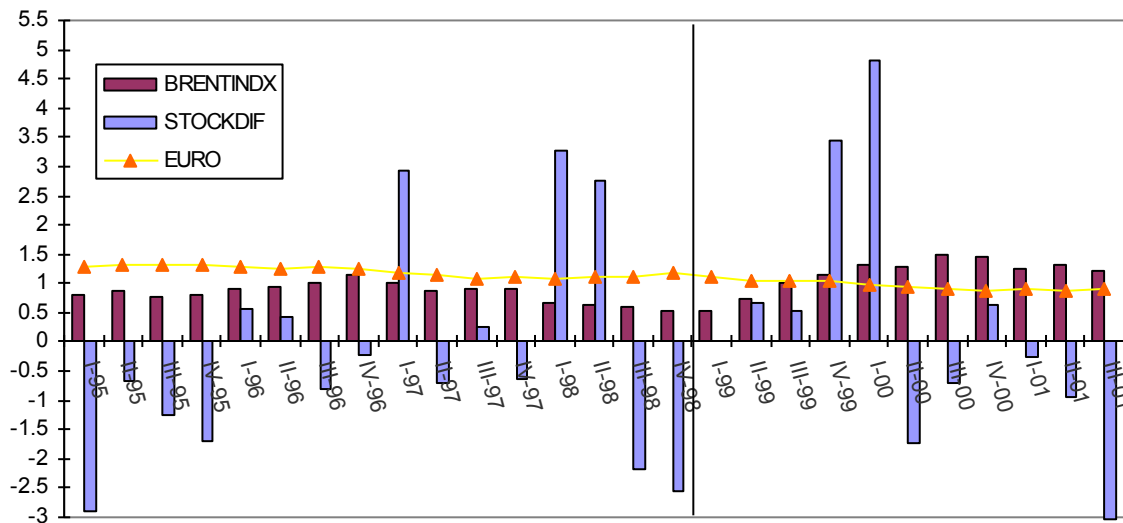R^2 = 0.999   F(5,27) = 34.12 (0.00% significance)

Figure 4

Figure 5

Appendix: Data Source

EURO: Table 12.1, Euro Area Statistics from December 2001 issue of the Monthly Bulletin, European Central Bank.

USDLR: Trade-Weighted Exchange Value of U.S. Dollar vs. currencies of a broad group of major U.S. trading partners, Federal Reserve Board of Governors.

EUEXCH: Foreign Exchange Rate, Average daily figures, Federal Reserve Board of Governors.

UGDPCHG: Table 12.1, Euro Area Statistics from December 2001 issue of the Monthly Bulletin, European Central Bank.

EGDPCHG: Euro Area Overview Table, Euro Area Statistics from December 2001 issue of the Monthly Bulletin, European Central Bank (1995 Price).

E10GB: Table 3.2, Euro Area Statistics from December 2001 issue of the Monthly Bulletin, European Central Bank.

U10GB: Table 3.2, Euro Area Statistics from December 2001 issue of the Monthly Bulletin, European Central Bank.

ECPICHG: Table 4.1, Euro Area Statistics from December 2001 issue of the Monthly Bulletin, European Central Bank (1996=100).

UCPICHG: Table 12.1, Euro Area Statistics from December 2001 issue of the Monthly Bulletin, European Central Bank.

BRENT: Brent Blend, Daily Average, Energy Information Administration, U.S. Department of Energy.

ESTOXX: Dow Jones EURO STOXX index, Broad Benchmark, Table 3.3, Euro Area Statistics from December 2001 issue of the Monthly Bulletin, European Central Bank.

USP500: Table 3.3, Euro Area Statistics from December 2001 issue of the Monthly Bulletin, European Central Bank.

REFERENCES

Balasa, B. (1964). "The Purchasing Power Parity Doctrine: A Reappraisal." Journal of Political Economy Volume 72.

Begg D., Giavazzi F., Hagen J., and Wyplosz C. (February 1997). EMU Getting the End-game Right; Monitoring European Integration 7, Center for Economic Policy Research, Eastwest Institute,.

Calvo, G., Leiderman, L., and Reinhard, C. (March 1993) "Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors." IMF Staff Papers (40).

Mundell, Robert A. (Sept. 1961) "A Theory of Optimum Currency Areas." The American Economic Review. Volume 51, 657-665.

Mundell, Robert A., "Optimum Currency Areas," Extended version of a luncheon speech presented at the A Conference on Optimum Currency Areas, Tel Aviv University, Dec. 5, 1997, Photo Copy.

Mundell, Robert A. (May 1960). "The Monetary Dynamics of International Adjustment under Fixed and Flexible Exchange Rates." Quarterly Journal of Economics. Volume 74, 227-57.

Samuelson, P.S. (1964). "Theoretical Notes on Trade Problems," Review of Economics and Statistics, Volume 46.