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Determining an equilibrium euro/dollar exchange rate: a cointegration approach

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Abstract

We apply cointegration techniques to monthly euro/dollar exchange rate data from 1990–1999. The evidence suggests the existence of a stable relationship between the exchange rates, price levels and interest rates. This relationship between the dollar and the euro is used to forecast developments in 2000, and the forecast is compared with observed data. Results suggest that the euro exchange rate has in recent months been deviating from the cointegration relationship. This suggests that a structural break may have occurred during the current year.

Preliminary and **for internal eurosystem use only**. Note as well that the same applies for the version of the Detken et al paper that is referred to below. Comments welcome.

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an internal Bank of Finland seminar. Remaining errors and omissions are still in the process of being addressed

Contents

1 Introduction

The question of the "right" euro/dollar parity has been hotly debated since the launch in 1999 of the common currency for eleven European countries. On the face of it, it seems odd to debate the appropriateness of the exchange rate. Few markets can claim to operate more efficiently than the currency exchange market for dollars and euros. In terms of depth, liquidity and sophistication of market players, major currency markets are unrivalled. Indeed, trading patterns of euros for dollars have not exhibited the types of swings that commonly characterise many asset markets. On the whole, price movements have been steady and controlled, as might be expected from markets where arbitrage opportunities are discovered and exploited in matters of seconds. All of the above argues against the hypothesis that the "right" euro/dollar exchange rate could be any other than that determined by market players.

Nevertheless, the persistent decline of the euro/dollar exchange rate from 1.17 at the outset to recent levels below 0.85 has surprised and even amazed many observers. Academic economists, politicians and central bankers are now virtually unanimous in proclaiming the euro to be significantly undervalued. As a consequence, a cottage industry has developed in devising explanations why one of the most efficient markets in the world is pricing the euro at a "wrong" level.

Euro dollar exchange rate
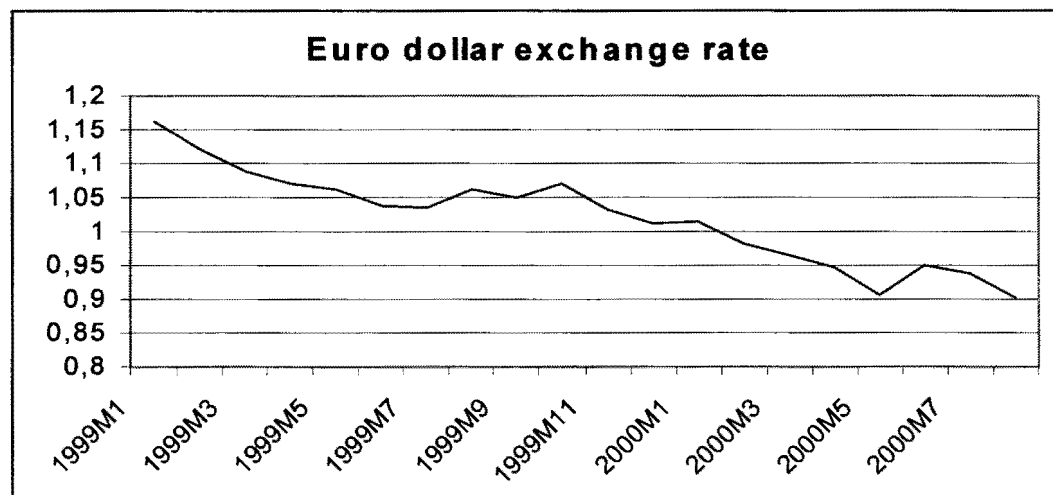
In this paper, we develop a benchmark medium run equilibrium euro/dollar exchange rate using a cointegration and error correction mechanism. In developing this benchmark, we make use of the theories of long run purchasing power parity (PPP) and uncovered interest parity (UIP). A cointegration of exchange rates with developments in relative price levels and interest rates yields what is known in the literature as a capital enhanced measure of the equilibrium exchange rate, or CHEER. After testing for such cointegration, we determine the

existence of a stable relationship between the dollar and the euro, which allows us to create a benchmark equilibrium exchange rate for the present and near future. By mean reversion arguments, the market-determined exchange rate should not deviate too far from our calculated benchmark, and should on average be the same.

The rest of the paper is structured as follows. Section 2 reviews recent literature first on the equilibrium value of the euro, then on testing purchasing power parity using a cointegration and error correction mechanism. Section 3 presents the data we use in our regressions, including the construction of a synthetic euro for the years 1990-1998. In section 4 we present the formal cointegration results, and discuss their robustness. Section 5 concludes.

2 Literature review

The value of the euro

Explanations for the weakness of the euro fall broadly into three groups. First, there is the focus on "fundamentals", such as rates of growth in worker productivity and economic activity -- aside from these two variables, opinions are quite divided regarding which fundamentals are the most relevant. Nevertheless, according to this reasoning, the appreciation of the dollar is explained by the surprisingly strong performance of the US economy relative to the euro area. This is a conventional wisdom explanation, which is often found in the financial press. De Grauwe (2000) systematically studies a variety of underlying economic fundamentals in the US and Europe. He concludes that since the launch of the common currency, economic news from Europe has generally been more favourable than news from the United States, so that a very selective reading of the news is necessary in order for this explanation to be valid.

The second group of explanations focuses on expectations for the future. According to this school of thought, the euro is weak because markets remain sceptical of the capacity of European policymakers to carry out necessary structural and institutional reforms in order to fully realise the potential of the new economic and monetary union (EMU). Related to this scepticism is doubt about the institutional credibility of the European Central Bank (ECB). A summary of these arguments is provided in Favero et al (2000).

The third group attributes the continuing downward trend of the euro to market sentiments and herd behaviour among investors, thus questioning the efficiency of the foreign exchange market in the first place. This line of explanations also includes speculation of an unsustainable "bubble" developing in the US economy. De Grauwe (2000) and Corsetti (2000) partly subscribe to this view, finding that market actors "filter" economic news and assign the greatest weight to facts that fit their prior beliefs, thus generating a process which can lead to market overreactions.

Common to all three explanations is their "soft" nature, meaning that they are virtually impossible to prove or disprove. As De Grauwe (2000) has pointed out, there are so many theories that in the end only confusion is left over.

Leaving aside hypotheses concerning reasons for the weakness of the euro, there have been some efforts into quantifying this weakness. Here, the standard

approach is to develop a benchmark value for exchange rate equilibrium, and to assess deviations of the current value from the calculated benchmark.

Alberola et al (1999) construct a theoretical model explaining real exchange rates, which encompasses both balance of payments and Balassa-Samuelson internal balance considerations. The long-run and short-run equilibrium conditions of the model are mapped into panel data for 20 countries; in essence, a multivariate cointegration matrix is decomposed into a (time-varying) permanent and a transitory component, respectively. Currency misalignments are computed as deviations of market rates from what is predicted by the permanent component of the model. In particular, the equilibrium nominal euro-dollar rate for early 1999 was computed as 1.26 dollars per euro.

Chinn (2000) estimates parameters for a structural monetary model, which examines the long and short run relationship between exchange rates and money supplies, interest and inflation rates, industrial production and a relative price of non-tradables. An artificial euro is created to allow use of data from the pre-EMU period. The evidence provides some support for the monetary model as a long run relationship, but using only pre-1999 constructed exchange rate data and dynamically simulating subsequent developments leads to a substantial overestimation of the euro dollar exchange rate. In other words, the model fails to explain the current weakness of the euro. The interpretation of this is either that the euro is substantially undervalued, for unknown reasons, or that the results reflect shortcomings of the model and/or the constructed pre-1999 data.

Detken et al (2000) apply four methods of analysis to a synthetic euro (constructed for the years 1973-1998) in order to determine the level and dynamics of the equilibrium real effective exchange rate. All four methods -- multivariate cointegration, a structural VAR, a "Natural Real Exchange Rate" (NATREX) framework with three structural equations[1], and a small macroeconometric model -- yielded essentially disappointing results. The clearest results seem to come from the cointegration analysis, however, where the real exchange rate of the synthetic euro was found to correlate with relative prices of non-tradables, real wage differentials and real interest differentials. This general approach will be examined in more detail below, as it underlies our applied work contained in Section 4.

Purchasing power parity

A cointegration relationship between exchange rates and relative price levels is implied by the purchasing power parity (PPP) hypothesis. The PPP hypothesis, in its simplest form, states that national price levels are equal when prices are expressed in the same currency. Equivalently, changes in the nominal exchange rate should be proportional to the ratio of national price levels, so that the real exchange rate (nominal exchange rates adjusted for differences in national price level movements) remains constant. Among international economists, there is an overwhelming consensus that in the long run, some variant of purchasing power parity must indeed underlie the determination of real exchange rates. This is therefore a natural starting point for construction of a benchmark long-run equilibrium euro/dollar exchange rate.

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[1] This approach is developed and explained in Stein (1999).

For a long time, empirical tests were generally unable to reject the hypothesis that real exchange rates, rather than remaining stable, actually follow a random walk process, at least under floating exchange rate regimes. Since the mid-1980s, however, it has become generally accepted that this was only an artifact of the statistical weakness of available tests. The test weakness problem has been circumvented in subsequent research, which has used more powerful tests, longer data sets and/or panel estimation techniques. The result is a current consensus of theory and empirical evidence that mean reversion exists in real exchange rates, albeit at puzzlingly slow rates (see e.g. Froot and Rogoff, 1995, Rogoff, 1996 or Taylor and Sarno, 1998 for more detailed overviews of what has become a vast literature).

Once a long-run equilibrium purchasing power parity relationship is shown to exist, the next step is to convincingly explain large and persistent deviations from this equilibrium. The speed of mean reversion may be thought of as a function of real factors, transaction bands, pricing to market and hysteretic effects; the magnitude of real exchange rate movements likewise reflects both institutional and business cycle components.

One typical approach is to add more explanatory variables and test for cointegration between the real exchange rate and movements in various "fundamentals", such as real oil prices, relative fiscal positions, changes in relative prices of traded/non-traded goods, etc[2]. On balance, real exchange rate movements have historically reflected a variety of the above factors in various measures, but by and large without prejudice to the underlying PPP-based long run equilibrium real rate[3].

A second approach is to combine PPP with variables related to capital markets, thus obtaining a capital enhanced measure of the equilibrium exchange rate, or CHEER. This approach has been popularised by Juselius (1991, 1995), Johansen and Juselius (1992), MacDonald and Marsh (1997, 1999) and Juselius and MacDonald (2000). This approach is based on long term persistence both in the real exchange rate and the interest differential.

Cointegration analysis is beginning to be conducted also in the context of the euro. The short period of existence of the euro, combined with the medium- and long-term nature of the theoretical relationships, has necessitated the creation of an "artificial euro" consisting of a weighted average of euro area countries' nominal exchange rates. As a bottom line, existing studies suggest an equilibrium value for the euro/dollar exchange rate that is greater than 1, sometimes substantially so. Nevertheless, all studies are also wary of suggesting that the euro is currently undervalued, and cite large confidence intervals surrounding the point estimates derived from the regressions.

Closterman and Schnatz (2000) apply cointegration procedures to an artificial euro and a series of fundamentals, finding broadly that in addition to the real interest rate differential, three variables are statistically significant determinants of the euro/dollar real exchange rate movements. These are: (i) real oil prices; (ii) relative size of public sector spending, and (iii) the relative price relationship between traded and non-traded goods.

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[2] A good overview of this literature is contained in Frankel and Rose (1995).

[3] See e.g. MacDonald, 1999. One factor that did seem to have robust persistent effects was related to Balassa-Samuelson catching-up growth. This effect was not found to be strong in samples containing predominantly industrialised countries, however.

The cointegration results of Detken et al (2000) provided some further evidence that the real exchange rate of the euro correlates with the relative prices of traded and non-traded goods, the real wage differential and the real interest rate differential vis-à-vis the rest of the world[4]. Nonetheless, Detken et al were unable to reject the null of non-stationarity of the real exchange rate, which is a precondition for PPP.

In this paper, we follow closely the approach of Closterman and Schnatz (2000) and Detken et al (2000) by constructing an artificial euro and re-testing for the existence of a stationary long-run equilibrium euro/dollar real exchange rate. Our analysis differs from the above in four ways.

- First, we use higher frequency exchange rate data (monthly as opposed to quarterly), and look only at the relationship between the euro and the dollar. A higher frequency of data is desirable because exchange rates are generally presumed to adjust speedily.
- Second, we estimate an error correction mechanism (ECM) in order to better understand the dynamic adjustment of the model. An ECM is also useful to confirm the existence of a cointegration relationship.
- Third, we do not attempt to include real economy "fundamentals" in the cointegration. Instead, we focus on the interaction between the real exchange rate and the capital account, by including nominal interest rates.
- Finally, we construct the "artificial euro" data series differently, and do not include observations prior to 1990. To test the robustness of our results, we apply the same tests to an alternative data set on the artificial euro, namely that compiled and used by Closterman and Schnatz (2000).

3   Data

We have computed historical dollar exchange rates for an artificial euro, using a weighted average of monthly dollar exchange rates for each of the eleven national currencies which were merged into the euro. Our weights are the same as those which are used in the calculation of euro area harmonised index of consumer prices (HICP) inflation measure, and are constant throughout the period in question.

A nontrivial choice was made with regard to the time period of the data. We start our analysis in January 1990, instead of going back to the mid 1970s as other authors have done. The reasoning behind this is twofold: currency markets were relatively underdeveloped until the late 1980s, and harmonisation of euro area macroeconomic policies was still far from a reality before about 1990. As a consequence, calculations of an artificial euro are likely to be increasingly noisy and misleading as we add older and older data.

With regard to price data, we use the US consumer price index and the euro area HICP. With regard to interest rate data, we use the rates for three month treasury bills (US) and eurostat-reported 3 month euro interest rates, which is available from January 1990.

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[4] For estimation purposes, the rest of the world was defined as the United Kingdom, the United States, Japan and Switzerland.

4 Testing for cointegration

First, we test a cointegration relationship between the euro exchange rate against US dollars and variables including euro zone prices, US prices, the euro zone interest rate, and the US interest rate from January 1990 to December 1999. Second, we estimate an error correction mechanism in order to understand the dynamic adjustment of the model. Third, on the basis of the cointegration relationship from January 1990 to December 1999, we forecast euro exchange rates from January 2000 to August 2000. The purpose of the forecasting exercise is to understand whether recent movements of the euro exchange rate against the U.S. dollars have been deviating from its long-run equilibrium. Major deviations can be interpreted as evidence of a structural break between these two periods.

We estimate the cointegration relationship as below (all variables are in logs):

$$e_t = \alpha + \beta p_t + \gamma p_t^* + \chi i_t + \delta i_t^* + \varepsilon_t$$

where e_t is the nominal cost in dollars of one euro at time t, p_t is the consumer price index of the euro area, p_t^* is the US consumer price index, i_t is the interest rate of the euro area, and i_t^* is the interest rate of the US. Note that no symmetric restriction is imposed on the price or interest rate coefficients.

The essence of cointegration is that although two or more time series may individually be non-stationary, there exists some combination of them which is stationary. Thus, even if exchange rates, price levels and real interest rates individually follow random walks, the random walks are not random with respect to each other. A necessary condition for this to hold is that the non-stationary time series are integrated of the same order.

As a first step in the analysis, we determine the order of vector autoregression (VAR) on the basis of the Akaike information criterion (AIC) and the Schwarz Bayesian criterion (SBC). The AIC suggests that the correct order is at most three for all variables apart from the U.S. prices, while the SBC implies it is one or two. Thus it appears reasonable to take three lags for our analysis. Given the order of VAR is three, the augmented Dickey-Fuller (ADF) unit root test statistics for models with an intercept without a linear trend suggest that all variables are I(1).

The next step is to test for a cointegration relationship between the bilateral exchange rate and other variables. Using the cointegration test by Johansen (1988) and Johansen and Juselius (1990), we check whether there is a cointegration relationship between the variables. Note that the price index and interest rate of the U.S. are assumed exogenous to the other variables. Table 1 presents the results of the cointegration tests, with p denoting cointegration rank.

Table 1. **Cointegration tests (with unrestricted intercepts without trend)**

Null (rank = p)	Alternat.	Adjust. Tr[a]	95% CV	90% CV	Eigen values
$p = 0$	$p = 1$	46.21*	46.44	42.67	0.16877
$p = 1$	$p = 2$	24.58	28.42	25.63	0.15663
$p = 2$	$p = 3$	4.65	14.35	12.27	0.03899

[a] Eigenvalue trace statistics, adjusted for degrees of freedom

For $p=0$, that is, the null hypothesis of no integration, the statistics of the test for cointegration is above the 90% critical value and it is marginally accepted at the 95% critical value. Given the eigen value when there is only one cointegration vector is quite close to that of no cointegration vector, we reject $p=0$ against $p=1$. However, the hypothesis that $p\leq1$ cannot be rejected against $p=2$. This outcome determines p as 1, which implies that there is only one cointegration vector. The cointegration relationship between the variables suggests a stationary real exchange rate.

The resulting combination matrix gives the cointegration vector as

$$e_t = -4.54p_t + 2.76p_t^* - 0.14i_t - 0.30i_t^*$$

The coefficients on the U.S. price and the price of the euro area are far from 1 or - 1, respectively, suggesting that the homogeneity between the three variables, namely the euro exchange rate, U.S. price and the price of the euro area does not hold. In addition, the euro interest rate has the wrong sign; all else equal, an increase in the interest rate in the euro area should lead to an appreciation of the euro exchange rate. Thus we impose a zero restriction on the coefficient on the euro interest rate. The restriction test $\chi^2(1)=0.479$ is not significant and thus the zero restriction is accepted. As a result, the cointegration vector changes to:

$$e_t = -6.54p_t + 4.65p_t^* - 0.33i_t^*$$

The asymmetric effect of the US interest rate and the euro area interest rate suggests that asset markets interpret differently interest rate increases in the US and in the euro zone. Specifically, an increase in the US interest rate may be interpreted as a good tool for stabilising the economy without unnecessarily damaging economic growth prospects. By contrast, capital markets may consider an interest rate increase in the EU as a double edged sword: it can attract a foreign capital for capital gains but at the same time it might dampen economic growth in the euro area. It appears that the latter effect cancels out the former effect, leaving the interest rate policy as an ineffective tool to boost the euro exchange rate.

Furthermore, one cointegration vector for the exchange rate is evidence in favour of standard sticky-price exchange rate models. Changes in the equilibrium real exchange rate do not require price level adjustment but are immediately established via adjustments of the nominal exchange rate. In other words, asset markets, not goods markets, effect the necessary adjustment to shocks.[5]

The existence of a unique cointegration vector leads us to estimate the dynamic short-run equation based on the ECM. Following the Granger Theorem (1987), we reduce the model to an orthogonal form by imposing an ECM and differencing scale variables. According to Kremers et al. (1992), the confirmation of stationarity of the residuals of the ECM together with a significant and negative coefficient on the ECM term is a stronger test for a cointegration relationship.

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[5] Fisher and Park(1991) also found a similar result using data on G-10 countries. According to them, the error-correction for the system takes place largely in the equation having to do with the exchange rate, suggesting that, in the long-run, the price ratio affects the exchange rate rather than vice versa.

Table 2 shows the estimation results of the ECM. The negative and significant coefficient on the error-correction term suggests that there is movement towards the long-run equilibrium. The size of the coefficient is in line with other estimation results using monthly data (Fisher and Park, 1991). The significant coefficient on the second lag of the euro price index, combined with the non-significance of the first lag of the variable, suggests that it takes over one month for adjustment in the exchange rate to begin. The negative and positive coefficients on the second lags of the price index of the euro area and the US, respectively, are consistent with theory: higher inflation in Euro zone area than in the US reduces the value of the Euro against U.S. dollars. All short-run coefficients of interest rates do not appear to be significant, suggesting interest rate policy in the euro area does not affect the euro/dollar exchange rate. Diagnostic tests, which are shown in Table 3, show that the model specification is in general well fitted. Apart from the functional form test, all test statistics are below the 5% significance level. In particular, the absence of serial correlation is further evidence that residuals of the short-run model are indeed stationary.

Table 2.   **Short-run Dynamics: Estimates of the Error Correction Mechanism**

Explanatory Variables	Coefficients	T-ratio
Δe_{-1}	0.391	4.450
Δp_{-1}	0.024	0.031
Δp^{*}_{-1}	1.761	1.409
Δi_{-1}	-0.012	-0.217
Δi^{*}_{-1}	-0.041	-0.786
Δe_{-2}	-0.117	-1.332
Δp_{-2}	-3.532	-4.459
Δp^{*}_{-2}	2.737	2.157
Δi_{-2}	-0.031	-0.575
Δi^{*}_{-2}	0.024	0.446
ecm_{-1}	-0.117	-4.356
constant	-1.072	-4.383

$R^2 = 0.392$ DW statistic = 1.877

**Table 3 .**   **Diagnostic Tests on the Residuals**

Alternative	Test	Value
Serial correlation	$F_{(12, 93)}$	0.937
Functional form	$F_{(1, 104)}$	4.931
Normality	$\chi^2(2)$	0.232
Heteroscedasticity	$F_{(1, 151)}$	0.835

We found a long-run stable cointegration relationship between the nominal euro exchange rate, the price indices of the euro area and the U.S., the interest rate of the euro zone and the U.S. interest rate. On the basis of these findings, we

forecast the euro in 2000 to test whether the recent movement of the euro exchange rate from January 2000 through August 2000 has deviated in a statistically significant way from the long-run equilibrium against the US dollar. If we find a persistent deviation outside of a 95 per cent confidence interval, this would suggest the possibility of a structural break in the behaviour of euro exchange rates between the two periods.

Figure 1 shows the results of the forecasting test. The euro rate began to deviate from the long-run cointegration relationship beginning in March 2000, when the forecasting prediction error was outside the 95 per cent confidence interval bounds. Although it slightly reduced in June and July 2000, the euro further deviated from the confidence interval in August 2000.

Figure 1.   **Forecasting test of the euro rate from Jan. 2000 to August 2000**
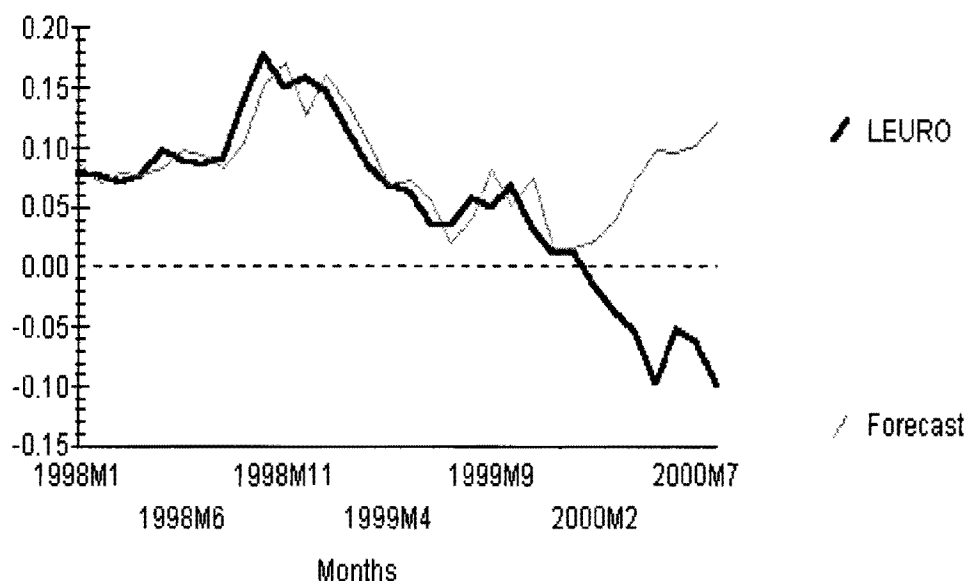
It can be debated whether these deviations should be treated as temporary outliers, or as a bona fide structural break. On the basis of the consistent location of the euro below the bottom levels of the confidence interval since March 2000, and its further deviation from the long-run relationship over time, the possibility of a structural break cannot readily be dismissed.

Robustness check

We check the robustness of our results using an alternative artificial euro data set, which was constructed by Closterman and Schnatz (2000). While this alternative artificial euro exchange rate is also a weighted average of the bilateral dollar exchange rates of euro area member countries, the weighting scheme differs[6] and the data is of a lower frequency, being quarterly instead of monthly.

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[6] The weights used correspond to non-euro-area trade exposure, as calculated by the BIS. Given that the theory of PPP attributes adjustment to goods market arbitrage, the choice is justifiable. Nevertheless, some inconsistency is introduced, since HICP inflation figures utilise a different

As in the analysis on monthly data, we ask the following questions: whether there is a cointegration relationship between the nominal exchange rate and the other variables; whether euro movements in the second quarter of 2000 display significant divergences from a calculated benchmark long-term equilibrium. If the answers to the two questions are consistent with the previous estimation results, this suggests a measure of robustness.

We first aim to detect evidence of cointegration between the variables analysed above. As we have used three lags for monthly data, we choose the order of VAE as one. The ADF statistics suggests that both series are I(1).

Table 4.   **Cointegration Tests (with unrestricted intercepts without trend)**

Null (rank = p)	Alternat.	Adjust. Tr[a]	95% CV	90% CV	Eigen values
$p = 0$	$p = 1$	44.12*	46.44	42.67	0.44649
$p = 1$	$p = 2$	21.05	28.42	25.63	0.36129
$p = 2$	$p = 3$	3.56	14.35	12.27	0.08745

[a] Eigenvalue trace statistics, adjusted for degrees of freedom

As in Table 1, the cointegration tests suggest that there is only one cointegration vector. From Table 4, and similarly to the analysis using monthly data, the null hypothesis of no integration is rejected at the 90% critical value and is marginally accepted at the 95% critical value. Given that the eigen value when there is only one cointegration vector is high and close to that of no cointegration vector, we reject $p=0$ against $p=1$. However, the hypothesis that $p\leq1$ cannot be rejected against $p=2$. Thus we conclude that there is one cointegration vector, and it is given as follows:

$$e_t = -2.77p_t + 1.55p_t^* + 0.22i_t + 0.15i_t^*$$

The coefficients on the U.S. price and the price of the euro area are not close to 1 or -1, respectively, suggesting again the invalidity of strong PPP. In this case, the U.S. interest rate has a wrong sign and thus we impose a zero restriction on the coefficient on the U.S. interest rate. The restriction test $\chi^2(1)=0.575$ is not significant and thus the zero restriction is accepted. The resulting combination matrix gives the cointegration vector as:

$$e_t = -7.52p_t + 4.30p_t^* + 0.27i_t$$

The sizes of the coefficients on prices are close to those obtained using monthly data. The only meaningful difference is that with our quarterly data series, the interest rate of the euro zone became significant while the US interest rate proved to be insignificant. However, the effect of interest rate on the euro exchange rate against the US dollar is pretty small: 100 per cent change in the interest rate

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weighting scheme. Since our analysis is more concerned with establishing a long-run PPP relationship than with looking at speed of adjustment to shocks, our baseline estimates used a consistent weighting scheme. As we will see, however, the weighting scheme makes little difference.

increases the value of the euro by only 27 per cent. Given the fact that the current interest rate is 4.75 per cent, a quarter percentage point increase in the interest rate in the euro zone induces a 1.4 per cent increase in the euro exchange rate. Overall, this suggests a very marginal effect of interest rate policy on the dollar/euro exchange rate.

We conduct a forecasting test for the period from the first quarter 2000 to the second one 2000. Figure 2 tells a similar story as the previous forecast does: by the second quarter of 2000, the euro appears to be deviating in a statistically significant way from its long-run equilibrium relationship with the U.S. dollar.

Figure 2.   **Forecasting test of the euro rate from the first quarter 2000 to the second quarter 2000**
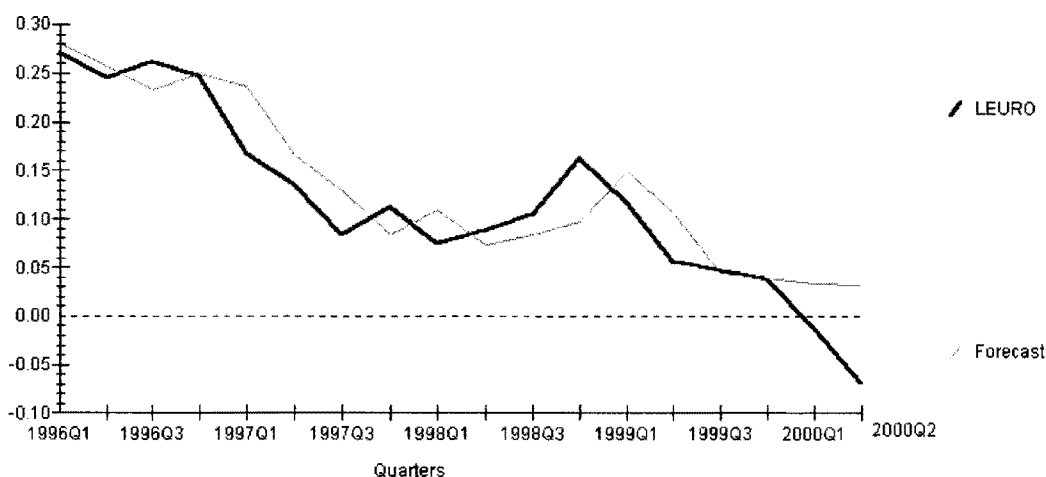
5   Summary and conclusions

The exchange rate is one of several factors which influence inflation in the euro area. As such, the ESCB duly studies and takes into account its evolution. From a monetary policy point of view, the recent weakness of the euro adds to upward pressure on consumer prices, which gives obvious cause for concern. Particular attention is warranted now, when the developments are the opposite of what one might normally expect when looking at fundamentals.

The starting point for analysis is the development of a convincing benchmark. As has been noted by Stanley Black, "In a world where exchange rates can fluctuate by 2 per cent per day and 20 per cent per year, economists are asked to evaluate the causes and consequences of such fluctuations. If we are to go beyond the Panglossian response that 'the market knows best', we need some concept of an equilibrium exchange rate as a standard against which to measure actual exchange rate changes" (see Stein, 1999 p.67).

This paper applies to new euro area data a very standard analytical approach. The outcome is yet more evidence that the recent evolution of the euro is (i) a highly significant but (ii) very recent aberration from a stable long-term economic relationship. In particular, the dollar price of the euro in behaved consistently with a long-term equilibrium cointegration relationship through 1999, but substantially differently in 2000 from what would have be forecast in advance

based on that very same relationship. It is too early to convincingly argue that the recent euro movement signifies a structural break in the cointegration relationship between the euro and the dollar. Nevertheless, the further weakening of the Euro in the third quarter of 2000 suggests that this may well be the case. Statistical tests do not reject the hypothesis of a structural break in 2000.

A plethora of theories have been proposed to explain the observed aberration. The analysis of this paper nevertheless cannot extend further than to use the timing and peculiarities of this aberration to rule out some of the more exotic theories as not being supported by the data.

If a structural break has indeed occurred, the purchasing power parity cointegration relationship should nevertheless hold. There may however have been a change in the intercept. In this case, a new equilibrium level may be significantly below euro-dollar parity, a point worth considering when contemplating currency market intervention.

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