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# A Paradigm for Economic Growth in The 21 st Century

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## Abstract
This study presents a paradigm for determining economic equilibrium in economic systems. The economic disequilibria curve is introduced and shows the robust correlation between productivity and exchange rates and plots the optimal rate of economic growth and interest rates along the economic disequilibria curve. This study examines the evidence for a productivity based model of the dollar/euro real exchange rate. Cointegrating relationships between the real exchange rate and productivity, real price of oil and government spending are estimated using the Johansen and Stock-Watson procedures. The findings show that for each percentage point in the US-Euro productivity differential there is a three point change in the real dollar/euro valuation. These findings are robust to the estimation methodology, the variables included in the regression, and the sample period.Watson procedures. The findings show that for each percentage point in the US-Euro productivity differential there is a three point change in the real dollar/euro valuation. These findings are robust to the estimation methodology, the variables included in the regression, and the sample period.

***Index terms***— exchange rates, labor productivity and economic growth and equilibrium.

# 1 Introduction

he euro greatly depreciated against the dollar during the period 1995-2001. This decline has often been associated with relative productivity changes in the United States and the euro area over this time period. During this time period in particular, average labor productivity accelerated in the United States, while it decelerated in the euro area. Economic theory suggests that the equilibrium real exchange rate will appreciate after an actual or expected shock in average labor productivity in the traded goods sector. Such an equilibrium appreciation may be influenced in the medium term by demand side effects. Thus, productivity increases raise expected income, which leads to an increased demand for goods. However, the price of goods in the traded sector is determined more by international competition. By contrast, in the nontraded sector, where industries are not subject to the same competition, goods prices tend to vary widely and independently across countries.

The work of Harrod (1933), Balassa (1964), ??amuelson (1964) and Olson (2012) show that productivity growth will lead to a real exchange rate appreciation only if it is concentrated in the traded goods sector of an economy. Productivity growth that has been equally strong in the traded and non-traded sectors will have no effect on the real exchange rate.

This paper analyses the impact of relative euro area on the dollar/euro exchange rate. This paper then provides evidence on the long-run relationship between the real dollar/euro exchange rate and productivity measures with and without the oil prices and government spending variables. Importantly, to the extent that traders in foreign exchange markets respond to the available productivity data stresses the importance of reliable models.

From the first to the second half of the 1990's, average productivity accelerated in the United States, while it decelerated in the euro area. This relationship has stimulated a discussion on the relationship between productivity and appreciation of the dollar during this time period. Also, of equal importance is the depreciation of the dollar during the early part of the 2000's (United States productivity increased slowly while the euro area productivity increased more rapidly). Bailey and Wells (2001), for instance, argue that a structured improvement in US productivity increased the rate of return on capital and triggered substantial capital flows in the United States, which might explain in part the appreciation of the US dollar during the early part of the 2000's.Tille and

Stoffels (2001) confirm empirically that developments in relative labor productivity can account for part of the change in the external value of the US dollar over the last 3 decades. ??lquist and Chinn (2002) argue in favor of a robust correlation between the euro area United States labor productivity differential and the dollar/euro exchange rate. This would explain the largest part of the euro's decline during the latter part of the 1990's.

This paper presents the argument that the euro's persistent weakness in the 1995-2001 period and its strength during the 2001-2007 period can be partly explained by taking into consideration productivity differentials. In particular, the study analyses in detail the impact of relative productivity developments in the United States and the euro area on the dollar/euro exchange rate.

# 2 a) Productivity Developments and the Real Exchange Rate

The theoretical relationships that link fundamentals to the real exchange rate in the long-run center around the Balassa-Samuelson model, portfolio balance considerations as well as the uncovered (real) interest rate parity condition. According to the Balassa-Samuelson framework, the distribution of productivity tradable goods sectors in each country is important for assessing the impact of productivity advances on the real exchange rate. The intuition behind the Balassa-Samuelson effect is rather straight-forward. Assuming, for instance of simplicity, that productivity in the traded goods sector increases only in the home country, marginal costs will fall for domestic firms in the tradedgoods sector. This leads (under the perfect competition condition) to a rise in wages in the traded goods sector at given prices. If labor is mobile between sectors in the economy, workers shift from the non-traded sector to the traded sector in response to the higher wages. This triggers a wage rise in the non-traded goods sector as well, until wages equalize again across sectors. However, since the increase in wages in the non-traded goods sector is not accompanied by productivity gains, firms need to increase their prices, which do not jeopardize the international price competitiveness of firms in the traded goods sector Harrod (1933), Balassa (1964) and ??amuelson (1964).

Tille, Stoffels and Gorbachev (2001) revealed that nearly two-thirds of the appreciation of the dollar was attributable to productivity growth differentials (using the traded and non traded differentials). However, it is important to note that Engel (1999) found that the relative price of non-traded goods accounts almost entirely for the volatility of US real exchange rates. . Accordingly, there should be a proportional link between relative prices and relative productivity. Labor productivity, however, is also influenced by demandside factors, though their effect should be of a transitory rather than of a permanent nature. In particular, as the productivity increases raise future income, and if consumers value current consumption more than future consumption, they will try to smooth their consumption pattern as argued by (Bailey and Wells 2001). This leads to an immediate increased demand for both traded and non-traded goods. The increase in demand for traded goods can be satisfied by running a trade deficit. The increased demand for non-traded goods, however, cannot be satisfied and will lead to an increase in prices of non-traded goods instead. Thus, demand effects lead to a relative price shift and thereby to a real appreciation.

According to the Balassa-Samuelson model, the distribution of productivity gains is important for assessing the impact of productivity on the real exchange rate. Increases in productivity can lead to an increase in exchange rates and growth of the economy as shown below (productivity 1 to productivity 2 and price vector 1 to price vector 2).With this change the growth rate of the economy increases from A to B and the interest rate decreases from A to B. The increase in the exchange rate is shown as point A to point B (exchange rate 1 to exchange rate 2).The optimum growth and interest rate is at point B. The growth rate can be increased to point B but any further increase in the growth of the national output beyond B will result in a less than optimum rate of interest and economic growth rate.

These results are shown in the Economic Disequalibria Curve in Fig. ??. The empirical analysis employs cointegration tests as developed by Johansen (1995). In the present setting, some variables would theoretically be expected to be stationary, but appear to be near-integrated processes empirically.

The presence of the cointegration relationships is tested in a multivariate setting. Table 2 and 3 show the results of the cointegration tests. Over all, the results suggest that it is reasonable to assume a single cointegration relationship between the variables and suggest being viewed as an order of I(1).

# 3 b) Data for Variables

For the period prior to 1999, the real dollar/euro exchange rate was computed as a weighted geometric average of the bilateral exchange rates of the euro currencies against the dollar. In addition, the model was estimated controlling for several other variables, which included US productivity, M2, oil prices, government spending and US GDP. As regards the real price of oil, its usefulness for explaining trends in real exchange rates is documented. For example, Amano and Van Norden (1998a and 1998b) found strong evidence of a long-term relationship between the real effective exchange rate of the US dollar and the oil price. As regards government spending, the fiscal balance constitutes one of the key components of national saving. In particular, ??renkel and Mussa (1985) argued that a fiscal tightening causes a permanent increase in the net foreign asset position of a country, and consequently, an appreciation of its equilibrium exchange rate in the long term. This will occur provided that the fiscal consolidation is considered to have a long-run affect.

# 4 Explaining the Euro Volatility by Productivity

Developments during ??995-2001 and 2001-2007. (1998-2001) of the euro, it depreciated by almost 30% against the US dollar. Figure 5 shows the impact of a change in relative productivity developments over these periods on the equilibrium real exchange rate. The contribution of the relative developments in productivity on the explanation of the depreciation of the euro against the US dollar since 1995 is significant. However, these developments are far from explaining the entire euro decline. Figures 3-4 show the impact of a change in relative US GDP and Euro GDP on the equilibrium dollar/euro real exchange rate.

Period 2 (2001-2007) covers the US dollar depreciation against the euro. Figure 5 also shows the impact of a change in relative productivity developments over these periods on the equilibrium real exchange rate. The impact of productivity on the real exchange rate is significant. The contributions of the oil prices, US GDP, M2 and US government spending on the explanation of the volatility of the euro against the US dollar since 1995 are also shown in chart 1. This study shows how much of the decline of the euro against the US dollar during the 1995-2001 period can be attributed to relative changes in productivity in the United States and the Euro area. While the estimation covers the period 1985-2007, the following analysis concentrates on two distinct periods.

# 5 Volume XVII Issue III Version I

Period 1 (1995-2001) covers the US dollar appreciation against the euro.

Moreover, it encompasses the period during which the productivity revival in the United States has taken place. Over this period, the dollar appreciated by almost 41%.against the euro area currency. During the first three years Lutkepohl (2004) suggests the VAR model is general enough to accommodate variables with stochastic trends, but not the most suitable type of model if interest centers on the cointegration relations because they do not appear explicitly. He recommends the following VECM form as it is a more convenient model setup for cointegration analysis: Lutkepohl (2004) recommendations several extensions of the basic model to represent the main characteristics of a data set. It is clear that including deterministic terms, such as an intercept, a linear trend term, or seasonal dummy variables, may be required for a proper representation of the data gathering process. One way to include deterministic terms is simple to add them to the stochastic part,y t = A I Y t-1 + . . . + A p Y t-p + ? ty t = ? y t-1 + I I Î?” t-1 + . . . I p-1 Î?” t-p+1 + ? t e) Deterministic Termsy t = ? t + x t

A VECM (p-1) representation has the formy t = ? 0 + ? 1 t + ? y t-1 Ð?” I Î?” y t-1 + . . . Ð?” p-1 Î?” t-p+1 + ? t f) Exogenous Variables Lutkepohl (**2004**

) recommends further generalizations to include further stochastic variables in addition to the deterministic part. A rather general VECM form that includes all these terms is y t = ? y t-1 + Ð?” I Î?” y t-1 + . . . Ð?” p-1 Î?” t-p+1 + CD t ? zt + ? t where the zt are unmodeled stochastic variables, D t contains all regressors associated with deterministic terms, and C and ? are parameter matrices. The z 's are considered unmodeled because there are no explanatory equations for them in the system.

# 6 Estimation of VECM's

Under Gaussian assumptions estimators are ML estimators conditioned on the presample values **??**Johansen 1988). They are consistent and jointly asymptotically normal under general assumptions,V -T VEC( [Ð?” t . . . Ð?” p-1 ] -[ Ð?” t. . . Ð?” p-1 ]) ? d N(0, ? t )

Reinsel (1993) gives the following:VEC (? k?-r ) ? N (VEC (? k-r ), {y 2 -1 MY 2 -1 } -1 ? {? ' ? ? -1 ?} -1 )

Adding a simple two-step (S2S) estimator for the cointegration matrix.y t -? y t-1 -Ð?” x t-1 = ? 2 y t-1 2 + ? t

The restricted estimator? k-r R obtained from VEC (? k-r R ) = ? ? + h, a restricted estimator of the cointegration matrix is ? R = [I r : ? K-r ] -

# 7 g) Impulse Responses

Figures 6 and 7 display the impulse responses of the dollar/euro exchange rate to a one standard deviation change in the US productivity, M2, oil prices, and government spending.

The responses are significant at the 95% level. Table 8 (in the appendix) displays the point estimates of the impulse responses of the real exchange rate to the one-standard deviation US productivity shocks. Also note that the results are relatively robust with the individual impulse responses falling within the 5% significant tests. Figure 13 shows that for the exchange rate these shocks have a highly Here ? t is the deterministic part and x t is a stochastic process that may have a VAR or VECM representation. A VAR representation for y t is as follows:

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A Paradigm for Economic Growth in The 21 st Century significant impact over the 10-year time period and the correlation between these impulse responses is high. They show that productivity shocks have a very significant long-run impact on the dollar/euro exchange rate. The results follow those of Clarida and Galf (1992). The point estimates in table 8 show that for each percentage point in the US-Euro area productivity differential there is a three percentage point real change in the dollar/euro valuation. This suggests that fundamental real factors are significant in the long-run fluctuations in real exchange rates. Refer to figures 10-17 for the US and

Euro productivity differentials. Figure **??** shows the long-run impact of productivity shocks on the dollar/euro real exchange rate. Figure 13 Forecast error variance decomposition is a special way of summarizing impulse responses. Following Lutkepohl (2004) the forecast error variance decomposition is based on the orthogonalized impulse responses for which the order of the variables matters. Although the instantaneous residual correlation is small in our subset VECM, it will have some impact on the outcome of a fore cast error variance decomposition. The forecast error variance is? 2 k (h) = ?(? 2 kl,n + ?+ ? 2 k,n ) = ? 2 kjo + ?? 2 kh-1 )

The term ( 2 kl,n + ?+ ? 2 k,n) is interpreted as the contribution of variable j to the h-step forecast error variance of variables k. This interpretation makes sense if the ? ? s can be viewed as shocks in variable i. Dividing the preceding by ? 2 k (h) gives the percentage contribution of variable j to the h-step forecast error of variable h.(t) (h) = ? 2 kjo + ?? 2 kh-1/ ? 2 k (h)

Chart 1 shows the proportion of forecast error in the dollar/euro accounted for by US productivity, government spending, M2, oil prices and US GDP. The US productivity accounts for 28% over the 20 year time interval with a sharp rise of 21% during the first 5 years. This shows that productivity shocks have a very significant short-run impact on the 1dollar/euro exchange rate while the long-run impact is more transitory in nature. Figures 9 and 13 show the time series forecasts of the system for the years 2007-2011 with 95% forecast intervals indicated by dashed lines. That all observed variables are within the approximately 95% forecast intervals is viewed as an indication of model adequacy for forecasting purposes.

# 8 III.

# 9 Appendix

Table 7

# 10 Results

This paper provides evidence on the long-run relationship between the real dollar/euro exchange rate and productivity measures, controlling for the real price of oil, relative government spending and M2. The results of this study show evidence of high correlation between productivity shocks and the real us/euro exchange rate and the rate of growth of the US economy. Intuitively, it makes sense that an increase in the US productivity will be followed by an increase in the real euro/dollar exchange rate and the expansion of the US economy. [1]

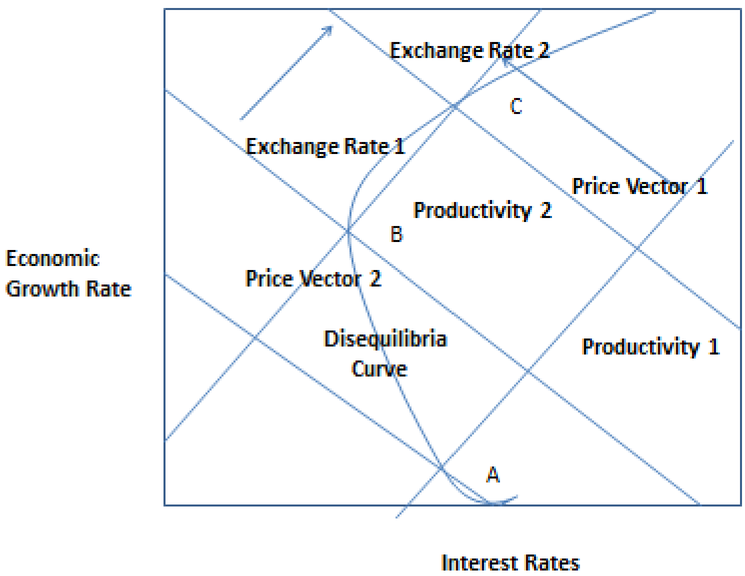


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Figure 1: Figure 1 : 2017 A

2 3

[1]© 2017 Global Journals Inc. (US)

[2]y t = ? 0 + ? 1 t +A y-1 + . . .A p y t-p + ? t © 2017 Global Journals Inc. (US)

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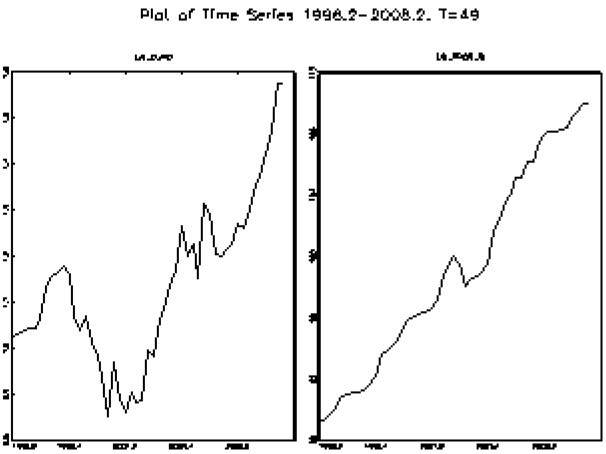


Figure 2: A-

2

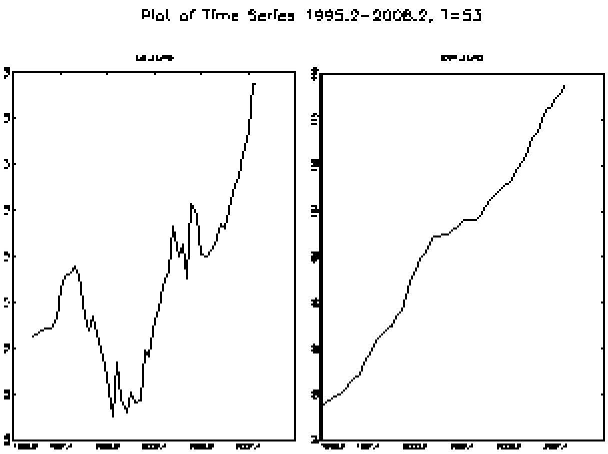


Figure 3: Figure 2 :

3

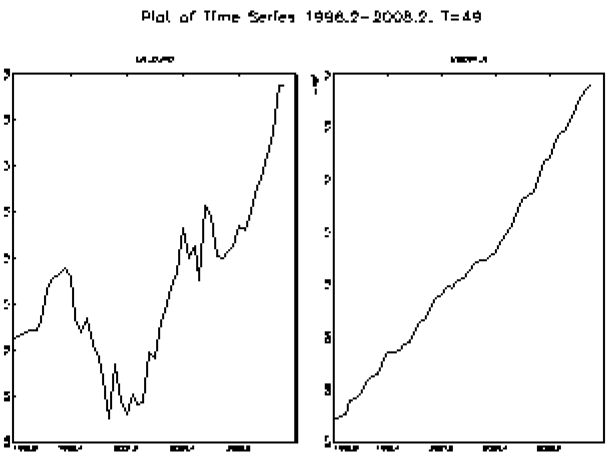


Figure 4: Figure 3 :

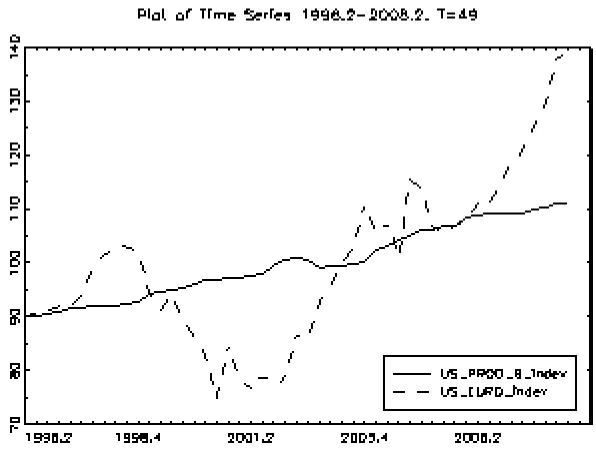


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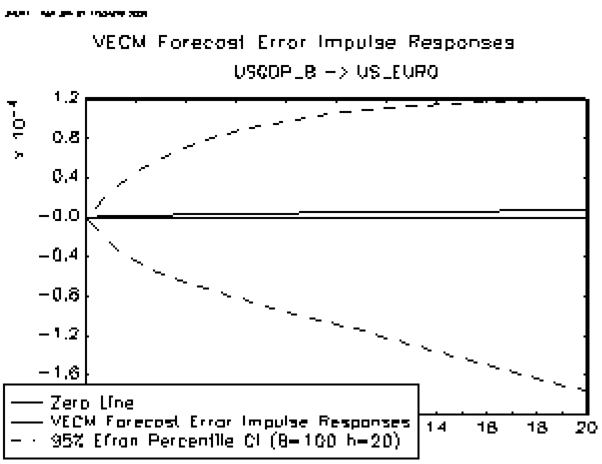
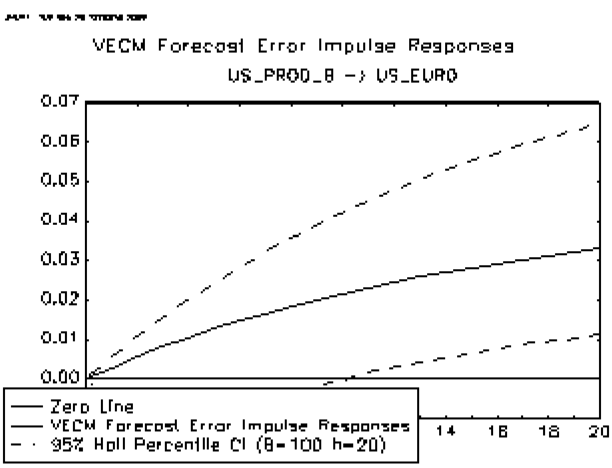
Figure 5: Figure 4 :



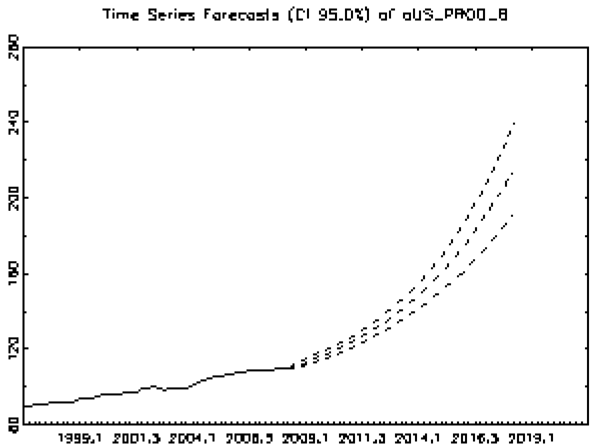

5

Figure 6: Figure 5 :A



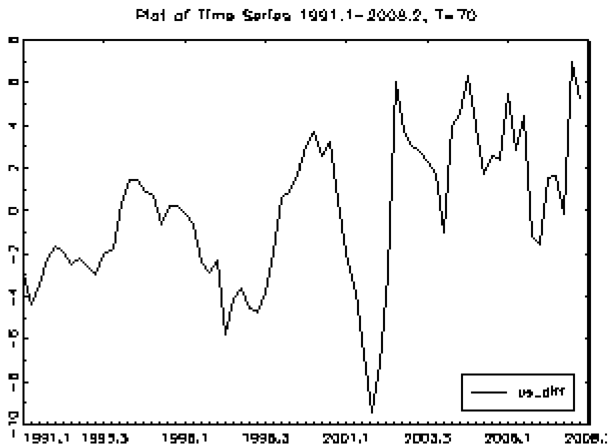

6

Figure 7: Figure 6 :




**6**

Figure 8: Figure 6 :




**7**

Figure 9: AFigure 7 :

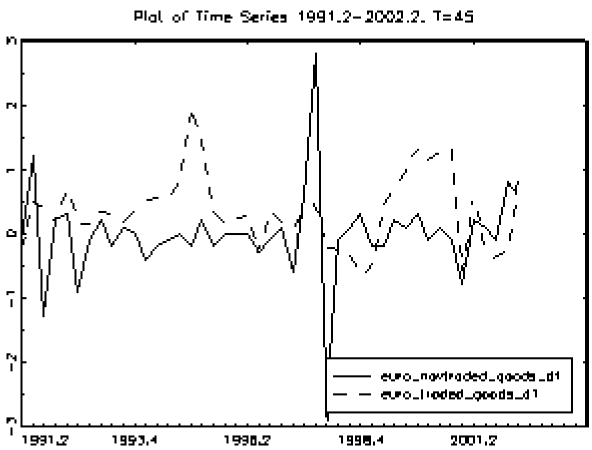



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Figure 10: Figure 10 :Figure 11 :A

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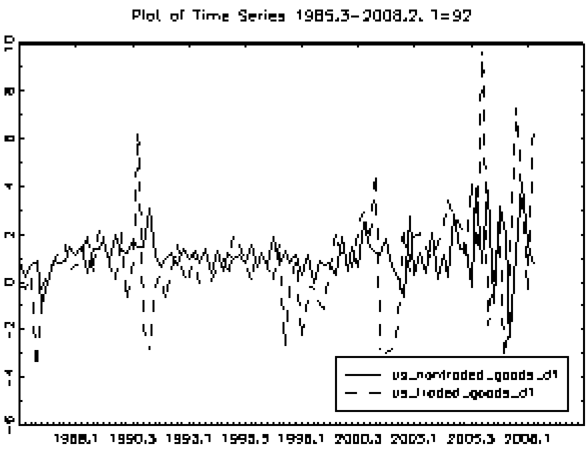


Figure 11: Figure 13 :AFigure 14 :Figure 12 :Figure 15 :Figure 16 :

17

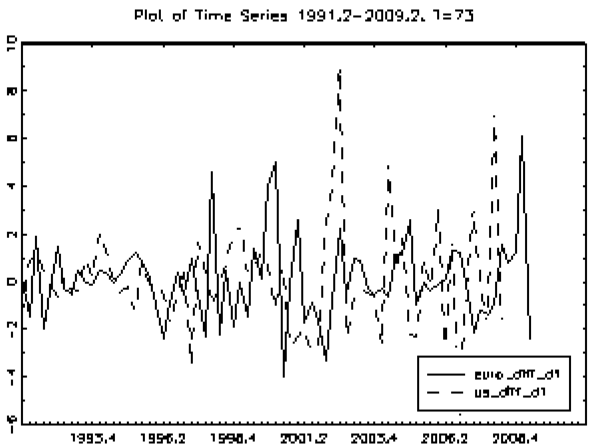


Figure 12: Figure 17 :

| ADF Unit Root Tests | Sample Range | Lagged Difference | Values Critical | Test Values | Schmidt & Phillips C | |
|---|---|---|---|---|---|---|
| US Prod | 1985-2008 | 2 | -3.2535 | 3.13* | -9.9532 | 1 |
| Euro Prod | 1985-2008 | 2 | -4.1978 | 3.96 | -17.3112 | 1 |
| US GDP | 1985-2008 | 2 | -5.4389 | 3.41 | -11.5869 | 1 |
| Euro GDP | 1985-2008 | 2 | -3.2786 | 3.96*** | -11.4467 | 2 |
| US CPI | 1985-2008 | 2 | -5.4851 | 3.13 | -18.5775 | 2 |
| Euro CPI | 1985-2008 | 2 | -3.7792 | 3.41** | -12.1413 | 1 |
| US PPI | 1985-2008 | 2 | -2.013 | 2.56*** | -5.4734 | 1 |
| Euro Govt % of GDP | 1985-2008 | 2 | -1.0952 | 1.94** | -15.0563 | 1 |
| Oil Prices | 1985- | 2 | -2.7965 | 3.96*** | -2.5623 | 2 |

*[Note: 2008Significance at the 99%, 95% and 90% levels are noted by ***, ** and * respectively. The Sand L critical values are taken from tables computed by Saikkonen and Lutkepohl]*

Figure 13:

**1**

Figure 14: Table 1

**2**

| Cointegration With Oil | Period | Specification | LR Ratios | Critical Ratios & Test Results |
|---|---|---|---|---|
| US Prod | 1985-2008 | 2 lags | 15.34 | 25.73** |
| Euro Prod | 1985-2008 | 2 lags | 31.68 | 42.77** |
| US GDP | 1985-2008 | 2 lags | 13.61 | 16.22*** |
| Euro GDP | 1985-2008 | 2 lags | 26.07 | 30.67*** |
| US CPI | 1985-2008 | 2 lags | 17.82 | 25.73** |
| Euro CPI | 1985 2008 | 2 lags | 16.62 | 30.67** |

Figure 15: Table 2

A Paradigm for Economic Growth in The 21 st Century
*** Sun, 26 Jul 2009 07:38:32 ***
PORTMANTEAU TEST (H0:Rh=(r1,...,rh)=0)

| | |
|---|---|
| tested order: | 16 |
| test statistic: | 419.1197 |
| p-value: | 1.0000 |
| adjusted test statistic: 505.9513 | |
| p-value: | 0.9746 |
| degrees of freedom: | 570.0000 |

*** Sun, 26 Jul 2009 07:38:33 ***
LM-TYPE TEST FOR AUTOCORRELATION with
5 lags LM statistic: p-value: df: 301.5520 0.0000 180.0000

*** Sun, 26 Jul 2009 07:38:33 ***
TESTS FOR NONNORMALITY
Lutkepohl, Reference: Doornik & Hansen (1994) joint test statistic: 89.2009 Econometrics.2004, Cambridge
degrees of freedom: a) Test for Nonnormality 12.0000 skewness only: 42.7256 The following test for residual
p-value: hypothesis of no residual autoc
large values of Q h (test statistic). The p-value is relatively Reference: Lütkepohl (1993), large: consequentl

shown in Table 6 indicate the p-value is relatively large: *** Sun, 26 Jul 2009 07:38:33 *** consequently, the
VARCHLM test statistic: 908.0688
p-value(chi^2): 0.2642
The data for this study was collected from the degrees of freedom: 882.0000
following sources:

Figure 16:

**6**

| | |
|---|---|
| ** Sun, 26 Jul 2009 07:10:23 *** | |
| CHOW TEST FOR STRUCTURAL BREAK | |
| On the reliability of Chow-type tests. | |
| .., B. Candelon, H. Lütkepohl, Economic | |
| Letters 73 (2001), 155-160 | |
| sample range: | [1996 Q3, |
| 2008 Q2], T = 48 | |
| tested break date: | 1999 Q4 |
| (13 observations before break) | |
| break point Chow test: | 83.7823 |
| bootstrapped p-value: | 0.0000 |
| asymptotic chi^2 p-value: 0.0000 | |
| degrees of freedom: | 27 |
| sample split Chow test: | 9.3234 |
| bootstrapped p-value: | 0.2500 |
| asymptotic chi^2 p-value: 0.1562 | |
| degrees of freedom: | 6 |
| Chow forecast test: | 1.3188 |
| bootstrapped p-value: | 0.0000 |
| asymptotic F p-value: | 0.2388 |
| degrees of freedom: | 210, 20 |

Figure 17: Table 6 *

**8**

| | |
|---|---|
| point estimate | -0.0174 |
| CI a) | [ -0.0310, -0.0021] |

Figure 18: Table 8

## .1 Year 2017

A Paradigm for Economic Growth in The 21 st Century Clarida, R. & Gali,J. **??**1992). "The Science of Monetary Policy and the New Keynesian Perspective," CEPR Discussion Paper No. 2139, London Closter mann, J. and B. **??**chnatz (2006) However, the results imply that the productivity measure can explain only about 27% of the actual amount of depreciation of the euro against the US dollar for the period 1995-2001. This outcome is confirmed by a specification in this study. This study shows that the productivity can explain only about 28% of the appreciation of the euro during the period 1995-2007. Evidently, productivity is not the only variable affecting the real exchange rate in the model specified. The other variables identified also affected the dollar/euro exchange rate. In particular, the surge in oil prices since early 1999 seems to have contributed to the weakening of the euro. The magnitude of the long-run impact of changes in the real price of oil on the dollar/euro exchange rate is certainly significant. Between 1997 and 2001, the model indicates on the average that the equilibrium euro depreciation related to oil prices developments could have been around 20%. These results are based on long-term relationships. Overall, the model is surrounded by significant uncertainty, reflecting the inherent difficulty of modeling exchange rate behavior. While we find that in 1995-2001 the euro traded well below the central estimates derived from these specifications, this uncertainty precludes any quantification of the precise amount of over or under valuation at any point in time. **??**gain

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