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"Foreign Exchange Determination in Ghana"

JOHN E. BAIDEN, Central University College
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In Ghana, most of the time imports exceed exports, so the demand for foreign exchange (dollar) always exceeds supply and this puts intense upward pressure on the exchange rate. There has been continuous depreciation of the cedi against most of the major currencies especially the US dollar, which is largely use for commercial transactions. Since the demand for dollar most of the time exceeding supply, international dollar values seldom have impacts

EMERGING MARKETS: THEORY & PRACTICE eJOURNAL
Vol. 1, No. 64: Aug 4, 2011
TIMOTHY M. DEVINNEY, EDITOR
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EMERGING MARKETS: THEORY & PRACTICE eJOURNAL

"Analysis of Purchasing Power Parity with Data for Macedonia"

DUSHKO JOSHESKI, University Goce Delcev
Email: dushkojosheski@gmail.com
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This paper examines PPP parity theory with data for Macedonia. We test the empirical consensus in this literature that real exchange rates tend towards PPP in the very long run, also we use co-integration Engle-Granger method and error correction mechanism. The hypothesis we test that PPP theory holds in long run in the case of Macedonia, and this hypothesis is proven to be true.

"Corporate Governance in Developing Economies - A Study of Emerging Issues in India"

2nd International Conference on Corporate Governance, Institute of Public Enterprise, Hyderabad, 2011

SUBRAMANYAM MUTYALA, Sri Venkatewara University - Dept. of Commerce
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The present paper aims at reviewing the various facets of developments in Corporate Governance practices in the emerging economies with special focus on India. Corporate Governance (CG) has gained a lot of importance and momentum the world over. It has

STRATEGY & MACROECONOMIC POLICY eJOURNAL
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STRATEGY & MACROECONOMIC POLICY eJOURNAL

"The Offshoring Relationship"

RACHEL ANG, *affiliation not provided to SSRN*
Email: rachel.ang@msn.com

Offshoring is becoming increasing prominent. Corporations are using offshoring as the key business strategy to ensure growth and competitiveness (Snieska & Draksaite, 2007). Corporate partnership is often compared to the partnership of a marriage. This relationship is evidenced by gained in market share, new market values, a wider range of product offerings, control over the supply chain, and improved operational and cost effectiveness and efficiencies. However, past studies revealed that 50% of the marriage resulted in divorce (Jiang & Qureshi, 2005). The study aligned a comprehensive "insurance" risk assessment to assist corporations with the success of their marriage relationships.

"Analysis of Purchasing Power Parity with Data for Macedonia"

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"Local Immigration Prosecution: A Study of Arizona Before SB 1070"

UCLA Law Review, Vol. 58, 2011
UCLA School of Law Research Paper No. 11-21

INGRID V. EAGLY, University of California, Los Angeles (UCLA) - School of Law
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Analysis of Purchasing power parity with data for Macedonia

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Abstract

This paper examines PPP parity theory with data for Macedonia. We test the empirical consensus in this literature that real exchange rates tend towards PPP in the very long run, also we use co-integration Engle-Granger method and error correction mechanism. The hypothesis we test that PPP theory holds in long run in the case of Macedonia, and this hypothesis is proven to be true.

Key words : **PPP, Exchange rate, Co-integration, unit root, stationarity**

Introduction

The theory of purchasing power parity (PPP) constitutes one of the basic elements of exchange rate determination.In the case of absolute PPP the exchange rate equals the relative price levels between the countries, whereas in the case of relative PPP the exchange rate movement equals the difference between the relative price level shifts (Boršič,Beko, Kavkler,).

The purchasing power parity theory uses long run equilibrium exchange rate of two currencies to equalize their purchasing power. This theory is developed by Gustav Kassel in 1920, and it is based on the law of one price. This theory states that commodity in two different locations should have same price, regardless of the locations (Zheng, 2009). While few economists take PPP seriously as short-term proposition, they believe in purchasing power parity as an anchor for long run exchange rate (Rogof, 1996). Empirical literature in this field has established consensus on a few facts. First, real exchange rates (nominal adjusted for inflation) tend towards purchasing power parity in the long run. This is the hypothesis we set here and we are going to test later with Macedonian data. Second, short run deviations from purchasing power parity are large and volatile. Balasa Samuelson effect also is one of the most well known channels through which real convergence leads to higher inflation rates.

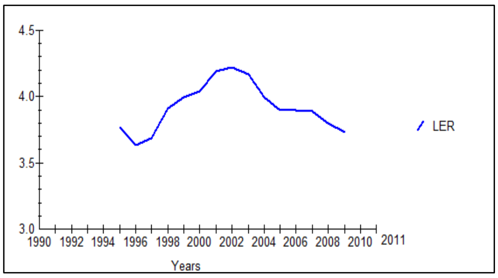
According to this concept, higher productivity growth in the sector of tradable goods, contrary to non-tradable goods sector of one country, will lead to positive inflatory differential and will lead to real appreciation-through the price growth of non-tradable goods on the market(Bogoev,2008) .Following relative PPP, the movements in nominal exchange rates are expected to compensate for price level shifts. So, the real exchange rate should be constant over long-run and their time series should be stationary (Parikh and Wakerly 2000). This is part or a whole second hypothesis that we are testing here. Real exchange rates are calculated from nominal using CPI's:

$$RE_t = E_t (P_t^* / P_t)$$

where RE_t stands for the real exchange rate, E_t is the price of a foreign currency in units of the domestic currency, and P_t^* and P_t represent the foreign price index and the domestic price index(Boršič,Beko, Kavkler,).If we take logarithms of both sides we get

$$\text{Log}(RE_t) = \text{Log}(E_t) + \text{Log}(P_t^*) - \text{Log}(P_t)$$

With the log-log arrangement of the equation we can estimate the elasticities, while with first difference the relative growth of the variables. On the next graph it is plotted natural logarithm of exchange rate variable.



Relative instability of the exchange rate movements in transitional countries (Macedonia is in this group of countries) is in the literature explained by inherited macroeconomic imbalances in transition countries, mixed performance of chosen exchange rate arrangements, and the process of catching up with developed economies(Egert, et al 2006).As in neo-keynesian tradition exchange rate is one of the transmissions channels in the economy through which monetary policy can influence the inflation in the economy and the output gap (Besimi, 2006). Purchasing power parity (PPP) adjusted for the Balassa-Samuelson (BS) effect is expected to hold in the long-run in a small and open economy (Besimi, 2006).

Time series analysis for Purchasing power parity of Macedonia [1]

One of the main tasks in time series analysis is to make conclusions about number of unit roots in a given time series. That way we are making conclusions whether time series is stationary or it has such a non stationary which is removed by differencing.

Most popular tests of unit root are D-F and ADF tests .Next table simulates the idea of the models

Autoregressive model AR(1)	Hypothesis
1. $X_t = \phi_0 + \phi_1 X_{t-1} + \varepsilon_t$	$H_0 : \phi_1 = 1 \Rightarrow$ unit root $H_1 : \phi_1 < 1 \Rightarrow$ Stationary
2. $X_t = \phi_0 + \phi_1 t + \phi_1 X_{t-1} + \varepsilon_t$	$H_0 : \phi_1 = 1 \Rightarrow$ unit root $\Rightarrow$ Unit root with a drift $H_1 : \phi_1 < 1 \Rightarrow$ trend stationary

Next we are estimating DW value from **Model** 1 like

$\tau = \dfrac{\hat{\phi}_1 - 1}{s(\hat{\phi})}$ where $s(\hat{\phi})$ is the standard error of the coefficient (model with constant)

And from the second model (model with constant and a trend) $\tau_t = \dfrac{\hat{\phi}_1 - 1}{s(\hat{\phi})}$

Critical values for comparison we are determining for a given sample T

Type DF test	Level of significance 5 %	Level of significance 10 %
τ	$\tau^t = -2.8621 - 2.738/T$	$\tau^t = -2.5671 - 1.438/T - 4.48T^2$
τ_t	$\tau_t^t = -3.4126 - 4.039/T - 17.83T^2$	$\tau_t^t = -3.1279 - 2.418/T - 7.58T^2$

[1] See Appendix 1 definitions of the variables

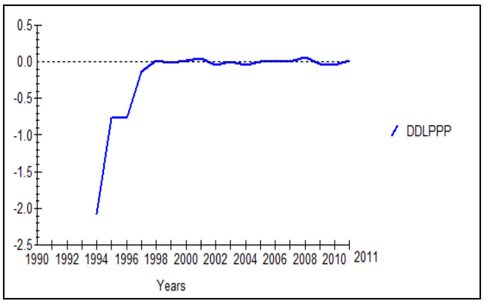
In our analysis we use PPP one country's relative price / US price level and CPI indices, trade as percentage to GDP and Exchange rate (local currency relative to US dollar), and the first difference of the logarithms of these series approximates their growth rates.

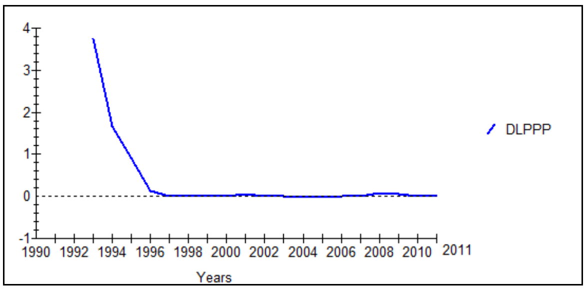
Testing for unit roots

Graphic tests showed that LNPPP and DLNPPP are non-stationary; also ADF test showed that we cannot reject the null hypothesis of unit root, also LER and DLER are non-stationary and we cannot reject the null hypothesis of unit root. We use DF test because it has highest info criteria.[2]

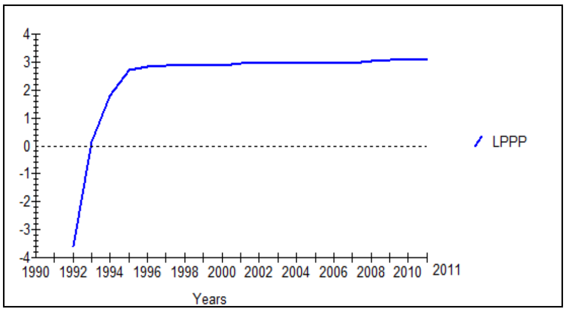
Variables / Critical values	The Dickey-Fuller test regression including intercept but not trend	Critical values	The Dickey-Fuller regressions include an intercept and a linear trend	Critical values
LPPP	0.038015	-3.0819	-1.4935	-3.7612
DLPPP	-2.6955	-3.1004	-2.6193	-3.7921
DDLPPP	-4.1615	-3.1223	-3.9436	-3.8288
decision	Non-stationarity, we cannot reject the existence of unit root , and to achieve stationarity we need second difference (DDLPPP) , variable DDLPPP is stationary		Non-stationarity, we cannot reject the existence of unit root , and to achieve stationarity we need second difference (DDLPPP) , variable DDLPPP is trend stationary	

Next, follows a graphical presentation of these variables





[2] See Appendix 2 Unit root testing



Co-integration Engle Granger method for Macedonia

Engle-Granger method for cointegration, implies a check if the residuals of the cointegrating regression are stationary[3].

The estimated equation is:

$$DL\hat{ER} = 0.0086 - 0.41DLPPP$$

p= [.816] [.602]

Intercept is in the regression because it ensures that error term has zero mean and it is included for statistical purposes only. Dropping the intercept will result in upward biased t-statistics and will lead to incorrect conclusion that certain coefficients are statistically significant. A DLER variable is first difference of natural logarithm of exchange rate. If DLPPP or first difference of the log of relative inflation increases by 1% on average the ER will result in downward change (depreciation) by 0.41%. Unit root test of the residuals from this regression shows that estimated values have less negative value than critical values so that test shows that there exist no long run relationship between this variables .Estimated value -1.4920 is higher than critical value -4.1109 (see Appendix 3 Engle Granger co-integration method).

Error correction mechanism [4]

The short run relationship between variables is captured by the coefficient of the independent variable, whereas the adjustment toward the long run equilibrium is given by the coefficients of the EC mechanism (Harris, Sollis, 2003). ECM use second differences of these variables as they appear to be stationary.

[3] See Appendix 3 Engle Granger co-integration method

[4] See Appendix 4 Error correction mechanism

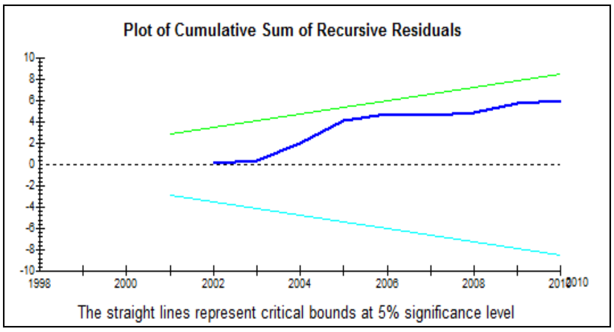
$$DDL\hat{ER} = -0.0052 + 0.297DDLPPP + 0.50958u_{t-1}$$

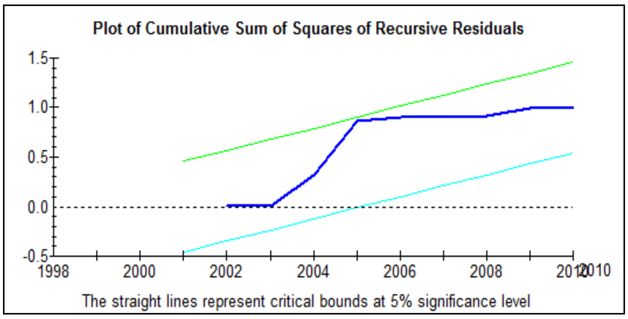
p= [.860] [.653] [.088]

In the short run, 1% relative change will influence change in ER by 0.29%, while in the long run 50,95% of the disequilibrium in the last year between change in ER and inflation will be eliminated in the current year. Short run coefficient is insignificant while long run coefficient is significant. According to the next Table model is well specified.

Hypothesis	p-value of the test	Decision
H_0: No residual correlation	[.080]	Insufficient evidence to reject H_0 at 1, 5 % level of significance
H_0: Linear relationship between variables	[.906]	Insufficient evidence to reject H_0 at 1, 5 and 10% level of significance
H_0: Normality in residuals	[.703]	Insufficient evidence to reject H_0 at 1, 5 and 10% level of significance
H_0: Homoskedasticity	[.287]	Insufficient evidence to reject H_0 at 1, 5 and 10% level of significance

In order to test for parameter stability we perform CUSUM and CUSUMSQ plots are examined





According to CUSUM and CUSUM square there are no structural breaks.

As the variable DDLPPP is not statistically significant, this is consistent with Rogoff (1996), who states that PPP does not hold in long run. So we can rewrite the model and estimate as follows

$$DDL\hat{E}R = -0.0072 + 0.515u_{t-1}$$

p= [.798] [.072]

This model suggests that on average 51,5% of the departure of ER from its equilibrium level will be offset in the next period. In summary model provides some evidence of long run PPP.

and trade % GDP.

Appendices

Appendix 1

PPP	Purchasing power parity conversion factor is the number of units of a country's currency required to buy the same amounts of goods and services in the domestic market as U.S. dollar would buy in the United States. This conversion factor is for GDP.
ER-	Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar
DLER	First difference of the natural logarithm of the exchange rate
DLPPP	First difference of the natural logarithm of Purchasing power parity
DDLER	Second difference of the natural logarithm of the exchange rate
DDLPP	Second of the natural logarithm of Purchasing power parity

Appendix 2 Unit root testing

Unit root testing for LPPP and DLPPP and DDLPPP

```
    Unit root tests for variable LPPP

      The Dickey-Fuller regressions include an intercept but not a trend

*******************************************************************************

 15 observations used in the estimation of all ADF regressions.

 Sample period from 1997 to 2011

*******************************************************************************

        Test Statistic      LL           AIC           SBC           HQC

 DF           .038015       34.6547       32.6547       31.9466       32.6622

 ADF(1)       .067281       34.7091       31.7091       30.6471       31.7205
```

ADF(2)	-.43206	35.3861	31.3861	29.9700	31.4012
ADF(3)	-.30587	35.4000	30.4000	28.6298	30.4188
ADF(4)	-.77801	36.0766	30.0766	27.9525	30.0992

****

95% critical value for the augmented Dickey-Fuller statistic = -3.0819

LL = Maximized log-likelihood   AIC = Akaike Information Criterion

SBC = Schwarz Bayesian Criterion   HQC = Hannan-Quinn Criterion

Unit root tests for variable LPPP

The Dickey-Fuller regressions include an intercept and a linear trend

****

15 observations used in the estimation of all ADF regressions.

Sample period from 1997 to 2011

****

	Test Statistic	LL	AIC	SBC	HQC
DF	-1.4935	36.1490	33.1490	32.0869	33.1603
ADF(1)	-1.7773	36.8930	32.8930	31.4769	32.9081
ADF(2)	-2.0534	37.9612	32.9612	31.1911	32.9801
ADF(3)	-1.9430	38.1421	32.1421	30.0180	32.1648
ADF(4)	-2.1416	39.0251	32.0251	29.5469	32.0515

****

95% critical value for the augmented Dickey-Fuller statistic = -3.7612

LL = Maximized log-likelihood   AIC = Akaike Information Criterion

SBC = Schwarz Bayesian Criterion   HQC = Hannan-Quinn Criterion

unit root tests for variable DLPPP

The Dickey-Fuller regressions include an intercept but not a trend

****

14 observations used in the estimation of all ADF regressions.

Sample period from 1998 to 2011

****

	Test Statistic	LL	AIC	SBC	HQC
DF	-2.6955	32.3708	30.3708	29.7317	30.4300
ADF(1)	-2.4205	32.4282	29.4282	28.4696	29.5169
ADF(2)	-2.3438	32.5517	28.5517	27.2736	28.6700
ADF(3)	-2.3351	32.9825	27.9825	26.3848	28.1304
ADF(4)	-2.3262	33.4397	27.4397	25.5226	27.6172

****

95% critical value for the augmented Dickey-Fuller statistic = -3.1004

LL = Maximized log-likelihood AIC = Akaike Information Criterion

SBC = Schwarz Bayesian Criterion HQC = Hannan-Quinn Criterion

Unit root tests for variable DLPPP

The Dickey-Fuller regressions include an intercept and a linear trend

****

14 observations used in the estimation of all ADF regressions.

Sample period from 1998 to 2011

****

	Test Statistic	LL	AIC	SBC	HQC
DF	-2.6193	32.4519	29.4519	28.4933	29.5406
ADF(1)	-2.3274	32.4853	28.4853	27.2072	28.6036
ADF(2)	-2.3348	32.8026	27.8026	26.2049	27.9505
ADF(3)	-2.2049	33.0317	27.0317	25.1145	27.2092
ADF(4)	-2.3271	33.8357	26.8357	24.5990	27.0428

****

95% critical value for the augmented Dickey-Fuller statistic = -3.7921

LL = Maximized log-likelihood AIC = Akaike Information Criterion

SBC = Schwarz Bayesian Criterion HQC = Hannan-Quinn Criterion

unit root tests for variable DDLPPP

The Dickey-Fuller regressions include an intercept but not a trend

****

13 observations used in the estimation of all ADF regressions.

Sample period from 1999 to 2011

****

	Test Statistic	LL	AIC	SBC	HQC
DF	-4.1615	26.9222	24.9222	24.3572	25.0383
ADF(1)	-3.0434	26.9389	23.9389	23.0915	24.1131
ADF(2)	-3.0498	27.3611	23.3611	22.2312	23.5933
ADF(3)	-2.9331	27.7655	22.7655	21.3531	23.0558
ADF(4)	-2.5782	28.0261	22.0261	20.3313	22.3745

****

95% critical value for the augmented Dickey-Fuller statistic = -3.1223

LL = Maximized log-likelihood   AIC = Akaike Information Criterion

SBC = Schwarz Bayesian Criterion   HQC = Hannan-Quinn Criterion

Unit root tests for variable DDLPPP

The Dickey-Fuller regressions include an intercept and a linear trend

****

13 observations used in the estimation of all ADF regressions.

Sample period from 1999 to 2011

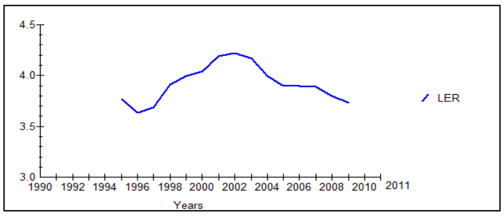
****

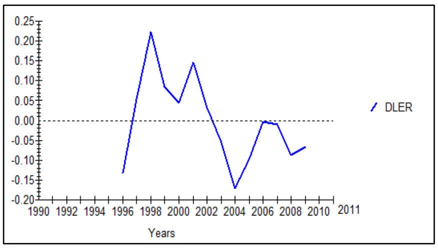
	Test Statistic	LL	AIC	SBC	HQC
DF	-3.9436	26.9228	23.9228	23.0753	24.0970
ADF(1)	-2.8401	26.9463	22.9463	21.8164	23.1786
ADF(2)	-2.8654	27.3955	22.3955	20.9831	22.6858
ADF(3)	-2.7506	27.7827	21.7827	20.0879	22.1311
ADF(4)	-2.3889	28.1503	21.1503	19.1730	21.5567

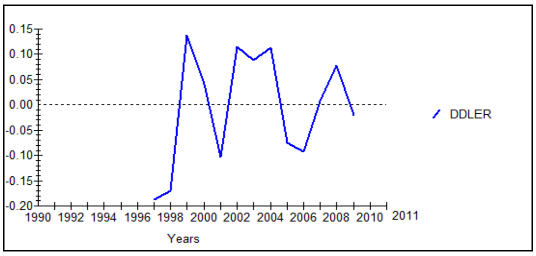
****

```
95% critical value for the augmented Dickey-Fuller statistic =  -3.8288

LL  = Maximized log-likelihood      AIC = Akaike Information Criterion

SBC = Schwarz Bayesian Criterion    HQC = Hannan-Quinn Criterion
```

Examining the level of integration of ER







Unit root testing for LER and DLER

```
                    Unit root tests for variable LER
     The Dickey-Fuller regressions include an intercept but not a trend
*******************************************************************************
 10 observations used in the estimation of all ADF regressions.
 Sample period from 2000 to 2009
*******************************************************************************
        Test Statistic       LL              AIC             SBC            HQC
 DF        -.025494       10.5888         8.5888          8.2862         8.9207
 ADF(1)     -1.1051       13.3583        10.3583          9.9044        10.8562
 ADF(2)     -.92926       13.3738         9.3738          8.7686        10.0377
 ADF(3)     -1.7243       15.4770        10.4770          9.7205        11.3068
 ADF(4)     -1.9796       16.8237        10.8237          9.9160        11.8195
*******************************************************************************
 95% critical value for the augmented Dickey-Fuller statistic =  -3.2197
 LL  = Maximized log-likelihood       AIC = Akaike Information Criterion
 SBC = Schwarz Bayesian Criterion     HQC = Hannan-Quinn Criterion


                    Unit root tests for variable LER
    The Dickey-Fuller regressions include an intercept and a linear trend
*******************************************************************************
 10 observations used in the estimation of all ADF regressions.
 Sample period from 2000 to 2009
*******************************************************************************
        Test Statistic       LL              AIC             SBC            HQC
 DF         -2.1771       14.8938        11.8938         11.4399        12.3917
 ADF(1)     -2.4716       16.4990        12.4990         11.8938        13.1629
 ADF(2)     -2.6698       18.2639        13.2639         12.5074        14.0937
 ADF(3)     -2.6948       19.0103        13.0103         12.1025        14.0061
 ADF(4)     -2.3582       20.0806        13.0806         12.0215        14.2424
*******************************************************************************
 95% critical value for the augmented Dickey-Fuller statistic =  -3.9949
 LL  = Maximized log-likelihood       AIC = Akaike Information Criterion
 SBC = Schwarz Bayesian Criterion     HQC = Hannan-Quinn Criterion
```

```
                    Unit root tests for variable DLER
     The Dickey-Fuller regressions include an intercept but not a trend
*******************************************************************************
 9 observations used in the estimation of all ADF regressions.
 Sample period from 2001 to 2009
*******************************************************************************
        Test Statistic       LL              AIC             SBC            HQC
 DF         -1.5655       10.8647         8.8647          8.6675         9.2903
 ADF(1)     -1.6465       11.1942         8.1942          7.8983         8.8326
 ADF(2)     -1.3428       12.1052         8.1052          7.7108         8.9564
 ADF(3)     -1.2356       12.1842         7.1842          6.6911         8.2482
 ADF(4)     -1.3352       12.8284         6.8284          6.2367         8.1052
*******************************************************************************
 95% critical value for the augmented Dickey-Fuller statistic =  -3.2698
 LL  = Maximized log-likelihood       AIC = Akaike Information Criterion
 SBC = Schwarz Bayesian Criterion     HQC = Hannan-Quinn Criterion


                    Unit root tests for variable DLER
    The Dickey-Fuller regressions include an intercept and a linear trend
*******************************************************************************
 9 observations used in the estimation of all ADF regressions.
 Sample period from 2001 to 2009
*******************************************************************************
        Test Statistic       LL              AIC             SBC            HQC
 DF         -1.6463       11.2184         8.2184          7.9225         8.8568
 ADF(1)     -1.9597       12.1092         8.1092          7.7147         8.9604
 ADF(2)     -.96081       12.2432         7.2432          6.7501         8.3072
 ADF(3)     -1.1140       12.9075         6.9075          6.3158         8.1843
 ADF(4)     -1.8433       15.8901         8.8901          8.1999        10.3798
*******************************************************************************
 95% critical value for the augmented Dickey-Fuller statistic =  -4.0816
 LL  = Maximized log-likelihood       AIC = Akaike Information Criterion
 SBC = Schwarz Bayesian Criterion     HQC = Hannan-Quinn Criterion
```

```
                     Unit root tests for variable DDLER
     The Dickey-Fuller regressions include an intercept but not a trend
*******************************************************************************
 8 observations used in the estimation of all ADF regressions.
 Sample period from 2002 to 2009
*******************************************************************************
        Test Statistic       LL            AIC           SBC           HQC
 DF          -2.7119       9.0586        7.0586        6.9791        7.5944
 ADF(1)      -2.4390       9.5693        6.5693        6.4502        7.3730
 ADF(2)      -2.0572      10.0098        6.0098        5.8509        7.0814
 ADF(3)      -1.6897      10.2591        5.2591        5.0605        6.5986
 ADF(4)      -1.6563      11.0753        5.0753        4.8370        6.6827
*******************************************************************************
 95% critical value for the augmented Dickey-Fuller statistic =  -3.3353
 LL  = Maximized log-likelihood       AIC = Akaike Information Criterion
 SBC = Schwarz Bayesian Criterion     HQC = Hannan-Quinn Criterion


                     Unit root tests for variable DDLER
    The Dickey-Fuller regressions include an intercept and a linear trend
*******************************************************************************
 8 observations used in the estimation of all ADF regressions.
 Sample period from 2002 to 2009
*******************************************************************************
        Test Statistic       LL            AIC           SBC           HQC
 DF          -2.8042      10.0513        7.0513        6.9321        7.8550
 ADF(1)      -2.9448      11.3654        7.3654        7.2065        8.4370
 ADF(2)      -7.2936      19.0285       14.0285       13.8299       15.3680
 ADF(3)      -7.6439      21.7816       15.7816       15.5433       17.3890
 ADF(4)     -16.1979      31.6970       24.6970       24.4190       26.5723
*******************************************************************************
 95% critical value for the augmented Dickey-Fuller statistic =  -4.1961
 LL  = Maximized log-likelihood       AIC = Akaike Information Criterion
```

<u>Appendix 3</u>

<u>ENGLE GRANGER CO-INTEGRATION METHOD</u>

```
                       Ordinary Least Squares Estimation
*******************************************************************************
 Dependent variable is DLER
 14 observations used for estimation from 1996 to 2009
*******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 C                         .0086514           .036380              .23781[.816]
 DLPPP                     -.41005            .76646              -.53499[.602]
*******************************************************************************
 R-Squared                    .023295   R-Bar-Squared                 -.058097
 S.E. of Regression           .11237    F-stat.     F(  1,  12)    .28621[.602]
 Mean of Dependent Variable -.0023328   S.D. of Dependent Variable      .10924
 Residual Sum of Squares      .15153    Equation Log-likelihood        11.8171
 Akaike Info. Criterion       9.8171    Schwarz Bayesian Criterion      9.1781
 DW-statistic                 .96300
*******************************************************************************
```

Unit root tests for residuals

****

Based on OLS regression of DLER on:

C   DLPPP

14 observations used for estimation from 1997 to 2010

****

	Test Statistic	LL	AIC	SBC	HQC
DF	-1.4920	9.8993	8.8993	8.8007	9.1121
ADF(1)	-1.6077	10.2100	8.2100	8.0127	8.6356
ADF(2)	-1.2578	10.4964	7.4964	7.2006	8.1348
ADF(3)	-1.2502	10.6675	6.6675	6.2731	7.5187
ADF(4)	-1.3010	11.0347	6.0347	5.5416	7.0987

****

95% critical value for the Dickey-Fuller statistic = -4.1109

LL = Maximized log-likelihood   AIC = Akaike Information Criterion

SBC = Schwarz Bayesian Criterion   HQC = Hannan-Quinn Criterion

Unit root tests for residuals

****

Based on OLS regression of DLER on:

C   DLPPP

14 observations used for estimation from 1996 to 2009

****

	Test Statistic	LL	AIC	SBC	HQC
DF	-1.4920	9.8993	8.8993	8.8007	9.1121
ADF(1)	-1.6077	10.2100	8.2100	8.0127	8.6356
ADF(2)	-1.2578	10.4964	7.4964	7.2006	8.1348
ADF(3)	-1.2502	10.6675	6.6675	6.2731	7.5187
ADF(4)	-1.3010	11.0347	6.0347	5.5416	7.0987

****

95% critical value for the Dickey-Fuller statistic = -4.1109

LL = Maximized log-likelihood   AIC = Akaike Information Criterion

SBC = Schwarz Bayesian Criterion   HQC = Hannan-Quinn Criterion

Appendix 4

THE ERROR CORRECTION MODEL

```
                         Ordinary Least Squares Estimation
*******************************************************************************
 Dependent variable is DDLER
 13 observations used for estimation from 1997 to 2009
*******************************************************************************
 Regressor               Coefficient        Standard Error         T-Ratio[Prob]
 C                        -.0052652            .029085            -.18103[.860]
 DDLPPP                      .29779             .64232             .46362[.653]
 U1                          .50958             .26932             1.8921[.088]
*******************************************************************************
 R-Squared                    .28015   R-Bar-Squared                     .13618
 S.E. of Regression           .10361   F-stat.    F(  2,  10)     1.9459[.193]
 Mean of Dependent Variable -.0051331  S.D. of Dependent Variable       .11148
 Residual Sum of Squares      .10735   Equation Log-likelihood         12.7320
 Akaike Info. Criterion       9.7320   Schwarz Bayesian Criterion       8.8845
 DW-statistic                 1.4022
*******************************************************************************
```

```
                                 Diagnostic Tests
*******************************************************************************
*    Test Statistics  *         LM Version          *         F Version        *
*******************************************************************************
*                     *                             *                          *
* A:Serial Correlation*CHSQ(   1)=   3.0750[.080]*F(   1,    9)=   2.7885[.129]*
*                     *                             *                          *
* B:Functional Form   *CHSQ(   1)=  .013922[.906]*F(   1,    9)= .0096486[.924]*
*                     *                             *                          *
* C:Normality         *CHSQ(   2)=   .70360[.703]*       Not applicable        *
*                     *                             *                          *
* D:Heteroscedasticity*CHSQ(   1)=   1.1319[.287]*F(   1,   11)=   1.0491[.328]*
*******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

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