EMERGING MARKETS: THEORY & PRACTICE eJOURNAL

Vol. 1, No. 64: Aug 4, 2011

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EMERGING MARKETS: THEORY & PRACTICE eJOURNAL

"Analysis of Purchasing Power Parity with Data for Macedonia"

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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

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INTERNATIONAL FINANCE eJOURNAL

"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

STRATEGY & MACROECONOMIC POLICY eJOURNAL

Vol. 3, No. 28: Jul 18, 2011

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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"

DUSHKO JOSHESKI, University Goce Delcev
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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.

"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

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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.

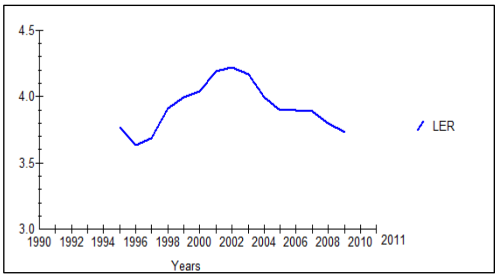
According to this concept, higher productivity growth in the sector of tradable goods, contrary to non-tradable goods sector of one country, will lead to positive inflatory differential and will lead to real appreciation-through the price growth of non-tradable goods on the market(Bogoev,2008) .Following 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

$\tau = \frac{\hat{\phi}_1 - 1}{s(\hat{\phi})}$ 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) $\tau_t = \frac{\hat{\phi}_1 - 1}{s(\hat{\phi})}$

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

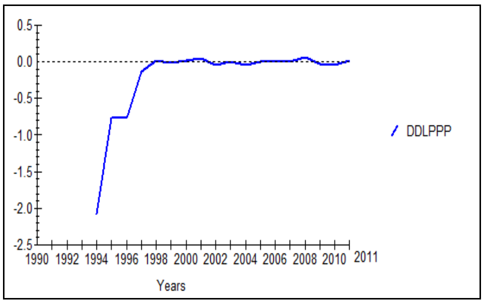
In our analysis we use PPP one country's relative price / US price level and CPI indices, trade as percentage to GDP and Exchange rate (local currency relative to US dollar), and the first difference of the logarithms of these series approximates their growth rates.

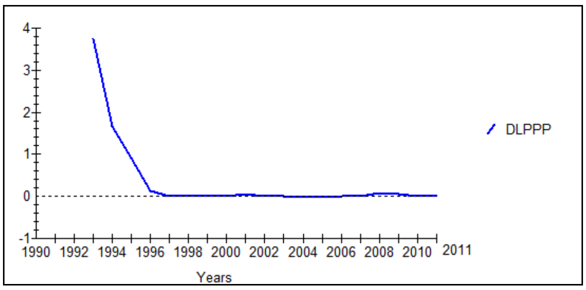
Testing for unit roots

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]

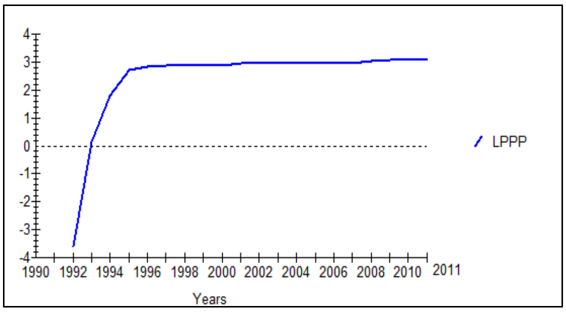
Variables / Critical values	The Dickey-Fuller test regression including intercept but not trend	Critical values	The Dickey-Fuller regressions include an intercept and a linear trend	Critical values
LPPP	0.038015	-3.0819	-1.4935	-3.7612
DLPPP	-2.6955	-3.1004	-2.6193	-3.7921
DDLPPP	-4.1615	-3.1223	-3.9436	-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:

$$DL\hat{E}R = 0.0086 - 0.41DLPPP$$

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

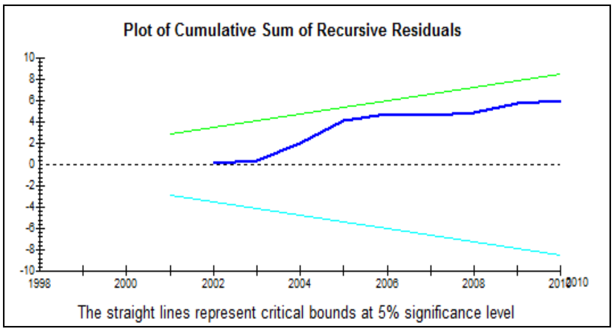
$$\hat{DDLER} = -0.0052 + 0.297DDLPPP + 0.50958u_{t-1}$$

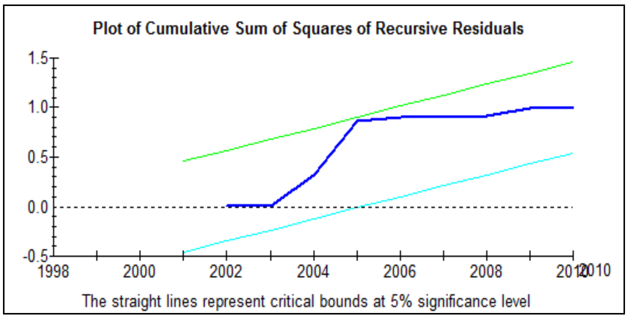
p= [.860] [.653] [.088]

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

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

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

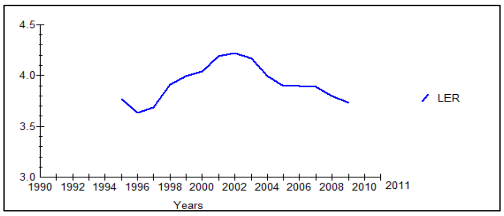
****

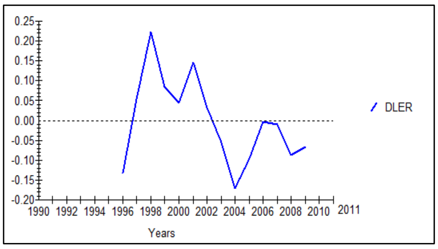
	Test Statistic	LL	AIC	SBC	HQC
DF	-3.9436	26.9228	23.9228	23.0753	24.0970
ADF(1)	-2.8401	26.9463	22.9463	21.8164	23.1786
ADF(2)	-2.8654	27.3955	22.3955	20.9831	22.6858
ADF(3)	-2.7506	27.7827	21.7827	20.0879	22.1311
ADF(4)	-2.3889	28.1503	21.1503	19.1730	21.5567

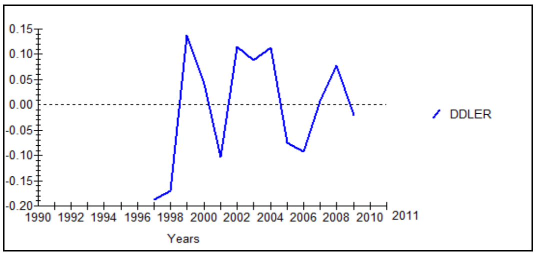
****

```
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

Appendix 3

ENGLE GRANGER CO-INTEGRATION METHOD

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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