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   STATEMENT OF THE PROBLEM

   OBJECTIVES

   HYPOTHESES

   RESEARCH METHODOLOGY

   RESULTS & DISCUSSION

   FINDINGS

   RECOMMENDATIONS/SUGGESTIONS

   CONCLUSIONS

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RELATIONSHIP BETWEEN EXCHANGE RATE AND TRADE BALANCE OF SOUTH ASIA: THE J-CURVE PATTERN

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ABSTRACT

Open market economies has been experiencing a very high and growing deficit in their trade balances since the beginning of the international trade. Developing countries are more victim of this disease and exchange rate depreciation is considered as an injection to overcome this disease. The study has been made an attempt to investigate the long run relationship between trade balance and exchange rate depreciation (J-curve) in south Asia by using panel data technique. The study used panel unit root test and Pedroni cointegration test to investigate the long run relationship between trade balance and exchange rate and some other supporting variables. The study found no evidence of the long run relationship between trade balance and exchange rate depreciation for south Asian region. The study also gives some ideas about further research.

JEL CLASSIFICATION

C33, F10, F14, F31

KEYWORDS

J-curve, Exchange rate, Trade Balance, South Asia, Panel Data, Panel Unit Root, Pedroni Cointegration.

1. INTRODUCTION

In an open market economy, trade balance is considered as one of the major component of GDP. But the problem is that this major component contributes depressingly into the GDP because the payments to the rest of the world are greater than the receiving from the rest of the world. Deficit in the trade balance is a common problem that is being faced by most of the developing countries and exchange rate policy is considered as a powerful tool for the regulation of the external trade sector. These countries devalued their currencies several times with an aim to pick up external trade sector. But the question arises here is that, whether devaluation in the local currency recovers the trade balance or not? To answer this question, most of the economists usually check the Marshall-Lerner condition which postulates that if the sum of imports and exports demand elasticities is greater than unit, devaluation will improve the trade balance otherwise not. Furthermore, goods require moment in time to change the consuming pattern so these goods are inelastic in the short run. Thus, the M-L condition is not fulfilled and real exchange depreciation caused worsening the balance of trade in the beginning. The consumer will fiddle with new prices in the long period and balance of trade will get better. This movement from short run to long run is known as J-curve effect. Thus, each country requires time period to improve her trade balance in response to real exchange depreciation.

In order to explain the J-curve phenomenon in more detail, starting from negative trade balance which usually occurs in the developing countries, experience depreciation in its currency. According to J-curve hypothesis the short run comeback should be negative, but then the trade balance should progress until new level achieved which will be positive (Tarasova and Coupe, 2009). A relevant argument in favor of J-curve hypothesis is that devaluation of a currency required time lags before improving the trade balance in less developed countries, which support the pattern of movement describe by the J-curve (Oskooee, 1985). Rincon and Nelson (2001) also found the strong indication in favor of J-curve hypothesis for small semi-open economies. Depreciation of domestic currency worsens the balance of trade in the short run but get better it in the long run. The existence of M-L condition fulfills in the long run and degree of J-curve hypothesis effects in the short run in East Asia (Onafowora, 2003).

On the other side, some arguments are going against the J-curve hypothesis. Currency devaluation adjusts the balance of trade through import compression and export expansion. A study of 34 developing countries rejects this hypothesis. Imports of these countries are used as inputs into the production of exports. Thus, import compression has as adversely affected on export expansion (Khan and Knight, 1988). An earlier study by Rose and Yellen (1989) examined the relationship between exchange rate depreciation and balance of trade. The study found that trade balance of G-7 countries does not follow the J-curve pattern. Rose (1990) worked on a sample of developing countries to estimate the impact of exchange rate changing on trade balance and concluded that J-curve hypothesis does not exist. Akbostanci (2002) estimated the performance in trade balance in response to real exchange rate depreciation and found no empirical indication which support of J-curve pattern. For instance, a study by Moura and Silva (2005) found no evidence in favor of worsening the trade balance in the short run for Brazil. Alawattage (2002) and Perera (2011) examined the relationship between real exchange rate depreciation and trade balance, and found no empirical confirmation in favor of J-curve phenomenon for the Sri-Lanka. Aftab and Khan (2008) also found no empirical evidence which support the J-curve phenomenon in Pakistan. An important work by Bahmani-Oskooee and Cheema (2009) found no significant impact on balance of trade as a result of exchange rate depreciation of Pakistan's trade with two large trading partners and found no empirical evidence in favor of J-curve hypothesis. Furthermore, a very recent study by Awan et. al. (2012) estimated the impact of currency depreciation on balance of trade in the long run but didn't find any empirical evidence in favor of J-curve phenomenon in Pakistan.

The objective of the study is to examine whether there is evidence of the long run relationship between trade balance and exchange rate, under J-curve hypothesis for the selected South Asian countries named as Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri-Lanka. Thus the study aims to use panel data analysis to examine the long run relationship between trade balance and exchange rate for south Asia for the period 1993 to 2010. The study is different from the previous studies in such a way that this study used regional analysis (pool data) to investigate the relationship between trade balance and exchange rate for South Asia.

After a brief introduction the rest of the study is organized as follows. Section 2 includes the review of literature and section 3 briefly explains theoretical modeling, variable description and data source of the study. Section 4 represents the methodology in detail and in section 5 empirical findings are analyzed. Conclusion of the study and guidance for further study are summarized in the last section.

2. REVIEW OF LITERATURE

The study found various studies on J-curve hypothesis concerning on bilateral basis and/or individual country analysis basis but the study found no study as regional analysis (panel data) regarding J-curve hypothesis. However the relevant review of literature which are presented in the study, clearly divided into two categories. Part 1 includes those studies which give evidence in favor of J-curve hypothesis while part 2 explains those studies which provide evidence of non existence of J-curve hypothesis.

2.1 PART I

Bahmani-Oskooee (1985) estimated that whether exchange rate depreciation will improve the balance of trade in the developing countries named as: Greece, India, Korea and Thailand. The study have used quarterly data for the period of 1973 to 1980 and used Almon lag structure on exchange rate variable. The empirical results supported the pattern of J-curve hypothesis for these countries. However, the study didn't check the stationarity of the data before estimating it, so their empirical findings may be somewhat biased.

Lal and Lowinger (2002) estimated the short run and long run determinants of trade balance of selected South Asian countries. The study used quarterly time series data for the period 1985 to 1998. The study tested the data for stationarity and used Johansen Multivariate Cointegration and Error Correction Model (ECM) approach. The results of the study show that there exist a significant relationship between nominal effective exchange rate and balance of trade of these countries in the short run as well as in the long run. Thus, the study concludes the existence of J-curve phenomenon. However, it was a great effort for developing countries, they can get benefits from trade in the long run but this study has used individual analysis on a region instead of regional analysis.

Wooi and TZE-Haw (2008) examined the exchange rate revelation, J-curve and M-L condition for high frequency trade series between China and Malaysia. The study used the high frequency monthly data for the period of 1990 to 2008. The study used Auto Regressive Distributed Lag (ARDL) bound testing technique and generalized impulse response method to analyze the J-curve hypothesis and M-L condition between the concerned countries. The empirical estimations of the study show that trade balance follow the J-curve pattern in the short run and depreciation get better the trade balance in the long run. Moreover, M-L condition also holds in case of bilateral trade among China and Malaysia.

2.2 PART II

Aftab and Khan (2008) conducted a study to examine, whether the J-curve phenomenon exist in Pakistan or not. The study used time series quarterly data of Pakistan with her 12 major trading partners for the period of 1980:1 to 2005:4. The study used unit root test for checking stationarity and applied Auto Regressive Distributed Lag model. The empirical results of the study provide no evidence in favor of J-curve hypothesis.

Perera (2009) conducted a study to estimate the existence of J-curve phenomenon between Sri-Lanka and her six major trading partners. The study used quarterly bilateral time series data for the period of 1996:1 to 2008:2. The study used Augmented Dickey-Fuller test for stationarity and then employed ARDL model to estimate the short run and long run relationship between exchange rate depreciation and balance of trade. The empirical estimations of the study showed no exact pattern in trade balance of Sri-Lanka as a result of exchange rate depreciation and found no evidence in favor of J-curve hypothesis. However, the study used bilateral data instead of aggregation of data, so the results may be biased.

Bahmani-Oskooee and cheema (2009) investigated the impact of real exchange rate depreciation on balance of trade of Pakistan with her 13 largest trading partners. The study used disaggregated quarterly data of 1980 to 2003 on a bilateral basis to avoid the aggregation bias problem. The study employed two econometric techniques for this rationale, *i.e.* bound testing technique and Johansen's cointegration techniques. The empirical findings of the bound testing approach explain that almost half of the trading partners including two largest trading partners, *i.e.* China and UAE hurt by depreciation of Pakistan's currency. The empirical results of Johansen's cointegration approach did not provide any significant long run impact on bilateral trade balance in response to real exchange rate depreciation which proves no indication in favor of J-curve phenomenon in Pakistan. However, the data used in this study were not tested for stationarity, so the estimated findings may be somewhat biased.

Alam (2010) investigated the association among real exchange rate and export earning of Bangladesh. The study used the time series data for the period of 1977 to 2005. The study firstly checked stationarity of the data and then applied cointegration and Granger Causality tests. The empirical estimations of the study represent that there is no cointegration among these variables and the results of Granger causality also show no casual movement of currency depreciation towards export earning of Bangladesh.

A very recent study by Awan et. al. (2012) investigated the existence of J-curve phenomenon in Pakistan by using the quarterly data for the period of 1980 to 2006. The study used ARDL model to estimate the impact of real exchange rate on balance of trade of Pakistan in the long run. The empirical results found that there exists a statistical significance long run relationship among these variables and sign of parameters exhibit that depreciation will only hurt the trade balance. Thus, the study found no evidence which support J-curve phenomenon in Pakistan. The study used only one independent variable, *i.e.* real exchange rate. However, domestic income and foreign income both are also important determinants of trade balance. Thus, the study must consider these variables.

The above review of literature clearly examine that some studies found long run relationship between trade balance and exchange rate in the long run on individual country basis and/or bilateral trade basis, *i.e.* depreciation will improve the trade balance in the long run, while some studies found evidence of no long run relationship. In this study the attempt has been made to analyze the long run relationship between trade balance and exchange rate for South Asian countries by using panel data approach (regional analysis). This attempt creates a dominated difference from the previous studies.

3. MODEL SPECIFICATION AND VARIABLE DESCRIPTION

When the trade is liberalized, the real exchange rate, domestic income of a country and world income influence the balance of trade in the long run. Short run estimation is also showed the role of exchange rate in trade balances (Brada, Kutan and Zhou, 1997). The empirical studies that estimate the J-curve phenomenon and relationship between the balance of trade and exchange rate include other variables that influence the trade balance. Miles (1979), Rose and Yellen (1989), Bahmani-Oskooee (2001) summarized elasticity and absorption models. The model that the study used incorporates the following variables:

$$TB = TB(R, Y, Y^{*})$$

By taking the log on both sides by using log linear model for long run estimation among those variables, the regression equation we get:

$\ln(X/M)_{i,t} = \alpha_o + \alpha_1 \ln(REX)_{i,t} + \alpha_2 \ln(Y)_{i,t} + \alpha_3 \ln(Y^{*})_{i,t} + \varepsilon_{i,t}$ ...... (A)

Where ln represents the natural logarithm, $(X/M)_{i,t}$ is measured as the ratio of country i's exports to the rest of the world and country i's import from the rest of the world. $Y_{i,t}$ and $Y^{*}_{i,t}$ are domestic income[1] of country i and rest of the world income[2], respectively. $REX_{i,t}$ is the real exchange rate[3] of country i with the rest of the world's currency[4].

Many studies used this model to estimate the existence of J-curve phenomenon. Brada, Kutan, Zhou (1997) used this model for Turkish economy, Gupta and Ramaknshan (1999) used this model for Japan, Onafowora (2003) used this type of model for three ASEAN countries by using dummy variable, Tochitskaya (2006) used this model for Belarus, Soleymani and Saboori (2011) used this model for Malaysia and Japan, and Moura and Silva (2005) also used this model for Brazil. Thus different studies have used this type of model, but the difference between them and in this study are that this study is going to estimate this model by using panel study analysis.

For panel data analysis, the study used annual frequency data for selected south Asian countries for the period ranges from 1993 to 2010. The larger part of data has been collected from Asian Development Bank (ADB) and other data sources are International Monetary Fund (IMF) and World Development Indicators (WDI).

4. METHODOLOGY

4.1 PANEL UNIT ROOT TESTS

Unit root tests are now a common practice among the applied researchers for time series estimations and have become an ingredient of econometric courses. However, unit root tests for panel data studies are recent phenomenon. Panel unit root test has been originated from time series unit root tests. But panel unit root tests are similar but not identical to the time series unit root test. However, the panel unit root tests proposed by Levin, Lin and Chu (2002), Im, Pesaran and

[1] Domestic income has been taken as GDP of each country i at constant prices (i.e. real GDP).

[2] World income is defined as the sum of real GDP of seven major trading partners of Asian developing countries, these countries are USA, UK, China, Japan, UAE, France, and Germany. The GDP of these countries account as more than 50 % of the world GDP, so that's why the study has been used this proxy as a world income.

[3] Real exchange rate is measured as $REX_{i,t} = (e.\ P^{*}/P_i)$. Where p^{*} is the world price level, Consumer Price Index (CPI) of USA annual percentage has been used as a proxy for world price level, while P_i is the CPI annual percentage for each country i, and e is the nominal exchange rate of country's currency per unit dollar at average of each annual period.

[4] Rest of the world currency has been taken as US dollar because larger part of world trade takes place by using US dollar currency.

Shin (2003), and The Fisher's type tests: Maddala and Wu (1999) and Choi (2001) tests are known as best non-stationary tests for pool series than the univariate time series tests.

4.1.1 LEVIN, LIN AND CHU TEST

Individual unit root tests like ADF test and Phillip-Perron test have limited power because it tends to evaluate the stationary hypothesis of only time series data. However, Levin, Lin and Chu (2002)[5] argued that the use of Levin-Lin-Chu test of unit root for a pooled time series and cross-sections (panel) data can significantly enhance the power of the test. Levin-Lin-Chu (LLC) test develop the following hypothesis:

H_o: each individual time series contains a unit root

H_1: each individual time series is stationary

The mathematical representation of maintained hypothesis is that

$\Delta Y_{it} = \rho Y_{i,t-1} + \sum_{L=1}^{P_i} \theta_{iL}\, \Delta Y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it}$ ....(4.1.1.1)

Where

Y_{it} is a series for panel country i (i = 1,2,3,……, N) over the period of time t (t=1,2,3,…, T)

P_i is the number of lags in the Augmented Dickey-Fuller regression,

d_{mi} denotes the vector of deterministic variables,

α_{mi} is the corresponding vector of coefficients for model m = 1,2,3.,

And in the last, the error term ε_{it} is assumed to be IID (0, σ^2).

Levin-Lin-Chu proposes a three-step procedure to perform their test.

Step1: Run the separate ADF regression for each individual cross section.

Step2: calculate approximately the fraction of long-run to short run standard deviations.

Step3: finally, get the panel test statistics after estimating the pooled OLS regression. *i.e.*

$\tilde{e}_{it} = \rho \tilde{v}_{i,t-1} + \tilde{\varepsilon}_{i,t}$

The null hypothesis here is that H_o: ρ = 0. The necessary condition for the Levin-Lin-Chu test is $\sqrt{N_T}/\,T \to 0$

Where N_T asserts that cross-sectional dimension N is a monotonic function of time T. while the sufficient condition of Levin-Lin-Chu test is $\sqrt{N_T}/\,T \to 0$ and $N_T/T \to$ (k) constant.

Levin-Lin-Chu test provides statistical basics for panel unit root tests and it seems to be more suitable. However, LLC test has some restriction; one of them is that it enforced a cross-equation constraint of the first order autocorrelation coefficient. This dilemma has been controlled by Im, Pesaran and Shin (2003), which permit the autocorrelation coefficients to differ across individual cross-sections.

4.1.2 Im, Pesaran and Shin Test

Unlike LLC (2002) test, Im, Pesaran and Shin (2003) suppose that autoregressive coefficient vary from country to country. The Im-Pesaran-Shin (IPS) test suggested an alternative testing method based on averaging entity unit root test statistics. Instead of pooling the data, IPS contemplate the mean of Augmented Dickey-Fuller statistics estimated for each cross-section unit in the panel when μ_{it} is serially correlated with different serial correlated properties across cross-section units. *i.e.* The model given as

$\Delta Y_{it} = \rho_i Y_{i,t-1} + \sum_{L=1}^{P_i} \theta_{iL}\, \Delta Y_{i,t-L} + \alpha_{mi} d_{mt} + \varepsilon_{it}$ …….(4.1.2.1)

Where

As usual i = 1,2,3,….., N, and t = 1,2,3,….., T

The null hypothesis here is that each cross-section series in the panel holds a unit root, *i.e.*

H_o: $\rho_i = 0$ for all *i*

Against the alternative hypothesis that some (but not for all) of the individual cross-section series have a unit root. *i.e.*

$$H_1: \begin{cases} \rho_i < 0 \;\; for \;\; i = 1,2,\dots\dots\dots, N_1 \\ \rho_i = 0 \;\; for \;\; i = N_1+1,\dots\dots, N \end{cases}$$

IPS test estimated separate unit root tests for all the cross-section units and describe their t-bar statistics as a simple mean of the individual Augmented Dickey-Fuller statistics. *i.e.*

$$\bar{t} = \frac{1}{N}\sum_{i=1}^{N} t_{it}$$

Where t_{it} is the individual t-statistics for testing H_o: ρ_i = 0 for all cross-sections. In this case the lag order is always zero for all cross-sections (*i.e.* P_i=0*)*. IPS also assumes that t_{it} is IID and has finite mean and variance. However, followed by Lindeberg-Levy central limit theorem, the standardized t-bar statistics concentrate towards the standard normal variate as N → ∞ under the null hypothesis. Hence

$$t_{IPS} = \frac{\sqrt{N}\,\left(\bar{t} - \frac{1}{N}\sum_{i=1}^{N} E\,[t_{iT}|\rho_i = 0]\right)}{\sqrt{\frac{1}{N}\sum_{i=1}^{N} var\,[t_{iT}|\rho_i = 0]}} \Rightarrow N\,(0,1)$$

$$t_{IPS} = \frac{\sqrt{N}\,(\bar{t}\,.E[t_{iT}|\rho_i = 0])}{\sqrt{var.[t_{iT}|\rho_i = 0]}} \Rightarrow N\,(0,1)$$

The term $E[t_{iT}/\rho_i = 0]$ and $var.[t_{iT}/\rho_i = 0]$ have been generated by IPS via simulations and tabulations.

IPS simulations illustrate that if there is no serial correlation, the t-bar test has estimated very strong results, even for the small set of T (T=10). The strength of t-bar test is an increasing function of T and N as well. However, it is very essential to note here that this estimation method used by IPS is contemplated only balanced panel data. Unbalanced panel data allow more replication have to be carried out to get critical values. In such cases of serial correlation, IPS suggests the use of Augmented Dickey-Fuller t-test for individual cross-section series. Another drawback of IPS test is that this panel unit root test requires special care at the time of interpretation of these estimated results. The rejection of the null hypothesis does not mean that the unit root null is rejected for all individual cross-sections "*i*", but the null hypothesis is rejected only for $N_1 < N$ cross-sections because N →∞, N_1/ N → δ > 0. The reason behind this is simply that the alternative hypothesis considered heterogeneous nature.

4.1.3 THE FISHER'S TYPE TESTS

Maddala and Wu (1999) and Choi (2001) explore the deficiencies of unit root tests of panel data, as given by LLC (2002) and IPS (2003) which have discussed in previous sections. Maddala and Wu (1999) offer an alternative unit root testing procedure for panel data. They made a amalgamation of the p-values of the test statistics for a unit root in each cross section unit. This method is based on non-parametric Fisher type test. Choi (2001) made an attempt to overcome these limitations and suggests a test which is based on the amalgamation of p-values. Choi (2001) proposed the model as

$y_{it} = d_{it} + x_{it}$ ……….. (4.1.3.1)

Where *i* is cross-section vary with time period t, as usual and

$d_{it} = \alpha_{i0} + \alpha_{i1} t + \cdots \ldots + \alpha_{im_i} t^{m_i}$ ……………… (4.1.3.2)

$x_{it} = \rho_i x_{i(t-1)} + \mu_{it}$ …………… (4.1.3.3)

Where μ_{it} is integrated of order zero. An important note here is that the observed data y_{it} consist of a nonstochastic process d_{it} and a stochastic process x_{it}.

[5] Levin and Lin conduct their study in 1992 in first time and develop a panel unit root test. In 1993 they adjusted the analysis for autocorrelation and heteroskedasticity. In 2002 (Levin, Lin and Chu, 2002) contribute major results of their researches.

The null hypothesis is that all the time series are unit root. *i.e.*

H$_o$: ρ_i= 1 for all cross section (*i*)

The alternative hypothesis is that some time series are unit root while the other are not. *i.e.*

H$_1$: $|\rho_i|$ < 1 for at least one *i* for finite N

Or in a special case, the alternative hypothesis may be that all the time series are stationary. *i.e.*

H$_1$: $|\rho_i|$ < 1 for some *i's* , for infinite N.

The formula of Fisher type test is as follow:

$$P = -2\sum_{i=1}^{N} lnp_i$$

It uses p-values from unit root tests for each cross-sections 'i' in the panel data.

The Fisher's type test has some main advantages. First, like IPS test it does not require the balance panel for estimation. The second one is that it can be carried out for any unit root test derived. Finally, it is feasible to use different lag lengths in the individual ADF test.

The disadvantage of Maddala and Wu (1999) is cross-sectional independence which is logical under the grave assumption. Another important disadvantage of Fisher's type test is that Monte Carlo simulation derived p-values. The situation when N is large, Choi (2001) proposed a modified P test.

$$P_m = \frac{1}{\sqrt[2]{N}}\sum_{i=1}^{N}(-2lnp_i - 2)$$

The test statistics correlates to the standardized cross-sectional average of individual P-values.

4.2 PANEL COINTEGRATION TEST

Like the panel unit root tests, panel cointegration tests give more appropriate results as compared to cointegration tests for individual time series. The cointegration tests for individual time series have low strengthening power for small T and short duration of the data which is limited because of many reasons like post war, great depression, and earthquakes etc. to overcome this problem of small period data, the study collects similar countries like south Asian region and make pool data with a aim of adding cross-sectional variation to the data. It will enhance the strength of panel unit root tests and panel cointegration tests as well. In this study, these panel cointegration tests will make us sure that whether trade balance has long run relationship with independent variables (expressed in model A) or whether the J-curve phenomenon lies in this region or not. For this purpose the study used panel cointegration techniques as presented by Pedroni (1999, 2004).

4.2.1 PEDRONI COINTEGRATION TEST

Pedroni (1999, 2004) proposed several tests for estimating the null hypothesis of no cointegration. These tests is based on Engle-Granger[6] framework and allowed for considerably heterogeneous intercepts and trend coefficients across cross-sections. The procedure proposed by Pedroni considers the following regression.

$y_{it} = \alpha_i + \delta_i t + \beta_{mi}x_{mit} + e_{it}$ …………… (4.2.1.1)

For t = 1,2,….., T, *i* = 1,2,……, N, and m = 1,…., M

Where T is the number of observations that does vary over time, N is the number of individual cross-sectional units included in the panel, and finally M is the number of independent variables. It is assumed here that y and x are assumed to be integrated of order one I(1). In the above equation (5.2.2.2.1), $\alpha_i and\ \delta_i$are the fixed effects parameters which vary across individual cross-sections.

Pedroni's test can be classified into two categories: first is the within dimensions and second is the between dimensions. The first set involves the averaging test statistics for cointegration in the time series across cross-sections and the second set depends on those estimators that are collect simply by averaging the individual estimated coefficients for each number i. Both sets of procedures are arranged to test the null hypothesis of no cointegration. *i.e.*

H$_o$: $\gamma_i = 1$ for heterogeneous panels

Against the two types of alternative hypothesis, the homogeneous and heterogeneous; these alternative hypothesis depend upon two categories (which are discussed previously). The first category includes averaging test statistics for cointegration in the time series and cross-sections, that is, pooling the residuals within the dimensions of the panel. So that the alternative hypothesis is expressed as:

H$_1$: $\gamma_i = \gamma < 1$ for all i. This considers a common value $\gamma_i = \gamma$.

The second category is the heterogeneous alternative which considers pooling the residual along the between dimensions of the panel, so that the alternative hypothesis:

H$_1$: $\gamma_1 < 1$ for all i. This allows for heterogeneous autocorrelations parameters across cross-sections.

The first set of panel within category includes four statistics that are similar to the 'panel variance ratio', Z_v^w, 'panel rho' Z_ρ^w, and 'panel t' Z_t^wstatistics in Phillips and Ouliaris (1990), such that[7]:

$$Z_\rho^w = \left(\sum_{i=1}^{N}\sum_{t=1}^{T} L_{11i}^{-2}\hat{e}_{it-1}^2\right)^{-1}\sum_{i=1}^{N}\sum_{t=1}^{T} L_{11i}^{-2}(\hat{e}_{it-1}^2\Delta\hat{e}_{it} - \lambda_i) : Rho - stat$$

$$Z_{PP}^w = \left(S_{NT}^{*2}\sum_{i=1}^{N}\sum_{t=1}^{T} L_{11i}^{-2}\hat{e}_{it-1}^2\right)^{-1/2}\sum_{i=1}^{N}\sum_{t=1}^{T} L_{11i}^{-2}(\hat{e}_{it-1}^{*}\Delta e_{it}^{*}) : PP - stat$$

$$Z_t^w = \left(\tilde{\sigma}^2\sum_{i=1}^{N}\sum_{t=1}^{T} L_{11i}^{-2}\hat{e}_{it-1}^2\right)^{-1/2}\sum_{i=1}^{N}\sum_{t=1}^{T} L_{11i}^{-2}(\hat{e}_{it-1}^2\Delta\hat{e}_{it} - \lambda_i) : ADF - stat$$

$$Z_v^w = \left(\sum_{i=1}^{N}\sum_{t=1}^{T} L_{11i}^{-2}\hat{e}_{it-1}^2\right)^{-1} : V - stat$$

The second set of the panel between statistics includes three statistics represented as:

$$Z_\rho^B = \left(\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{e}_{it-1}^2\right)^{-1}\sum_{i=1}^{N}\sum_{t=1}^{T}(\hat{e}_{it-1}^2\Delta\hat{e}_{it} - \lambda_i) : Rho - stat$$

$$Z_t^B = \sum_{i=1}^{N}\left(\hat{\sigma}^2\sum_{t=1}^{T}\hat{e}_{it-1}^2\right)^{-1}\sum_{t}^{T}(\hat{e}_{it-1}^2\Delta\hat{e}_{it} - \lambda_i) : ADF - stat$$

$$Z_{PP}^B = \sum_{i=1}^{N}\left(\sum_{t=1}^{T} S^{*2}\hat{e}_{it-1}^{*2}\right)^{-1}\sum_{t}^{T}(\hat{e}_{it-1}^{*}\Delta\hat{e}_{it}^{*}) : PP - stat$$

[6] Conventional Engle-Granger based on time series analysis. Pedroni (2004) explained that testing for cointegration in panel data is not as simple as the conventional Engle-Granger way because the problems of homogeneous and heterogeneous are involved in the cross-sectional panel data. Thus, Pedroni (1999, 2004) extending the Engle-Granger framework to tests the panel data.

[7] For more detail, see Badarudin (2009), and Baltagi (2008), and Abdullah, Bakar and Hassan (2010)

5. EMPIRICAL ESTIMATIONS

The results of panel unit root test for all variables included in model A are expressed in table 1, 2, 3, and 4. These tables represent the results of LLC t-stat, IPS W-stat, ADF Fisher Chi-Square, and PP Fisher Chi-Square at level and at first order difference with intercept and with intercept plus time trend.

TABLE 1: PANEL UNIT ROOT TEST RESULTS

Variable	LXM			
Test type	At Level		At First Order Difference	
	Intercept	Intercept + Trend	Intercept	Intercept + Trend
LLC t*stat	1.0093 (0.8436)	1.5594 (0.9405)	1.5215 (0.9359)	3.1507 (0.9992)
IPS W-stat	1.05680 (0.8547)	1.0186 (0.8458)	-3.3387* (0.0004)	-1.7812** (0.0374)
ADF-Fisher Chi-square	6.8517 (0.9403)	7.6898 (0.9049)	36.8297* (0.0008)	25.1121** (0.0335)
PP-Fisher Chi-square	11.4063 (0.6539)	15.0873 (0.3722)	90.3959* (0.0000)	66.7274* (0.0000)

Note: Probabilities are in parenthesis. * and ** indicate the rejection of null hypothesis at 1% and 5% level of significance, respectively. The values are rounded off to four decimal points.

TABLE 2: PANEL UNIT ROOT TEST RESULTS

Variable	LY			
Test type	At Level		First Order Difference	
	Intercept	Intercept + Trend	Intercept	Intercept + Trend
LLC t*stat	3.01647 (0.9987)	-0.3554 (0.3612)	-3.2669* (0.0005)	-3.6281* (0.0001)
IPS W-stat	5.4926 (1.0000)	1.4324 (0.9240)	-2.3960* (0.0083)	-1.7594** (0.0393)
ADF-Fisher Chi-square	1.8489 (0.9999)	6.9722 (0.9358)	27.2533** (0.0178)	22.3583*** (0.0715)
PP-Fisher Chi-square	4.9593 (0.9864)	12.1144 (0.5971)	73.0805* (0.0000)	66.6583* (0.0000)

Note: Probabilities are in parenthesis. *, ** and *** indicate the rejection of null hypothesis at 1%, 5% and 10% level of significance, respectively. The values are rounded off to four decimal points.

TABLE 3: PANEL UNIT ROOT TEST RESULTS

Variable	LY*			
Test type	At Level		At First Order Difference	
	Intercept	Intercept + Trend	Intercept	Intercept + Trend
LLC t*stat	-3.6923* (0.0001)	-0.7923 (0.2141)	-6.5993* (0.0000)	-6.9994* (0.0000)
IPS W-stat	0.18390 (0.5730)	-0.7748 (0.2192)	-5.2769* (0.0000)	-5.0023* (0.0000)
ADF-Fisher Chi-square	8.6668 (0.8518)	15.0217 (0.3767)	52.7776* (0.0000)	48.2883* (0.0000)
PP-Fisher Chi-square	31.2757* (0.0051)	1.8693 (0.9999)	43.6414* (0.0001)	37.1278* (0.0007)

Note: Probabilities are in parenthesis. * and ** indicate the rejection of null hypothesis at 1% and 5% level of significance, respectively. The values are rounded off to four decimal points.

TABLE 4: PANEL UNIT ROOT TEST RESULTS

Variable	LREX			
Test type	At Level		At First Order Difference	
	Intercept	Intercept + Trend	Intercept	Intercept + Trend
LLC t*stat	-1.7750** (0.0379)	-0.8379 (0.2010)	-4.4230* (0.0000)	-4.2058* (0.0000)
IPS W-stat	-1.3059*** (0.0958)	0.7734 (0.7804)	-4.4741* (0.0000)	-2.7344* (0.0031)
ADF-Fisher Chi-square	19.0238 (0.1640)	12.5218 (0.5645)	46.6710* (0.0000)	34.4117* (0,0018)
PP-Fisher Chi-square	24.3106 (0.0420)	13.1070 (0.5181)	99.3213* (0.0000)	79.1691* (0.0000)

Note: Probabilities are in parenthesis. *, ** and *** indicate the rejection of null hypothesis at 1%, 5% and 10% level of significance, respectively. The values are rounded off to four decimal points.

The empirical findings of panel unit root tests (LLC, IPS, ADF and PP tests) reported in the above four tables indicate that the study failed to reject the null hypothesis of unit root at level. So it supports the existence of unit root in all variables across countries. Hence, based on these four tests, the study found the strong evidence that all the series are in fact stationary at first order difference, *i.e.* I(1).

After conformation of the order of integration, the next step is to find out the long run relationship among variables. Since all the variables are found to be integrated of the same order, *i.e.* I(1)., thus the study continue with the panel cointegration test as presented by Pedroni (1999, 2004). The results of Pedroni Panel Cointegration are expressed in the following table.

TABLE 5: THE PEDRONI PANEL COINTEGRATION RESULTS

Tests	Individual Intercept		Individual Intercept and Individual Trend	
	Statistics	Prob.	Statistics	Prob.
Panel v-Statistics	0.7346	0.3046	0.1258	0.3958
Panel ρ-Statistics	1.0179	0.2376	1.3426	0.1620
Panel PP-Statistics	-1.0918	0.2198	-2.1812	0.0370**
Panel ADF-Statistics	-0.9143	0.2627	0.1743	0.3929
Group ρ-Statistics	1.9649	0.0579***	2.0720	0.0466**
Group PP-Statistics	-1.9349	0.0614***	-3.8795	0.0002***
Group ADF-Statistics	-0.6979	0.3127	-0.3941	0.3691

Note: All the test-statistics and probabilities are computed from Pedroni's procedure (1999, 2004). The values are rounded off to four decimal points. ** and *** indicate the rejection of null hypothesis at 5% and 10% significance level, respectively.

The results of Pedroni panel cointegration with and without individual trend are presented in table 11. With individual intercept, we found 2 out of 7 statistics and goes in favor of alternative hypothesis. Group ρ and Group PP-Statistics indicate that the null hypothesis is rejected at 10 percent significance level. While other 5 statistics explain that we fail to reject null hypothesis and there exist no long run relationship among variables. On the other hand, at individual Intercept and Individual time Trend, 3 out of 7 statistics indicate the rejection of null hypothesis of no cointegration while other 4 statistics failed to reject null hypothesis. Thus the results indicate that there exists no cointegration among variables and depreciation of a currency would not lead to improvement in the trade balance for south Asian countries even in the long run.

6. CONCLUSIONS

In this study, the attempt has been made to estimate the long run relationship between real exchange rate and balance of trade of South Asia as a regional analysis. The Pedroni cointegration approach provided no confirmation of long run relationship among real exchange rate, domestic income, world income, and trade balance of South Asia. Thus, the study found no evidence in favor of J-curve phenomenon for South Asia. This region has devalued their currency many times with an aim to improve the trade balance but the results are always opposed to it. Because major imports of this region are petroleum and petroleum products, capital goods and machinery which have lack of substitute availability and the demand for these imported products are price inelastic, that's why; this would create an exchange rate trap for this region. *i.e.* when exchange rate depreciation occurs, the imports commodities of this region becomes more expensive and this region has to pay more foreign currency ($) for the purchase of these imported items which cause the increase in the demand for foreign currency and as a result domestic currency devalued again. Thus, the empirical estimation of the study found no evidence of the long run relationship between trade balance and real exchange rate depreciation of south Asia. In other words real exchange rate depreciation will not cause improvement in the trade balance of South Asian countries even in the long run. Here the study gives some ideas for further research, i.e. why this region doesn't improve the trade balance by using exchange rate as a tool, or how this region can improve their trade balance or how this region can break up this exchange rate trap.

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