Does J-Curve Phenomenon Exist in Pakistan? A Revisit

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Abstract
The present study attempts to explore stable relationship between changes in the real exchange rate and trade balance indicators for Pakistan using quarterly data over the period 1980-2006. ARDL methodology has been employed to find the long run relationships and the long run elasticities. The results show that there exists a long run relationship between real exchange rate and trade balance. Statistical significance and negative elasticities demonstrate that depreciation will lead to deterioration in the trade balance and the J-curve theory does not hold for Pakistan. The results suggest that Pakistan should not rely on the depreciation of exchange rate to improve its trade balance.

Key words: Exchange Rate, Trade Balance, ARDL, Co-integration, Depreciation

1. INTRODUCTION
Pakistan has faced a negative trade balance over a long period of time and recently, it has become more severe. State Bank of Pakistan (SBP), the monetary authority along with other measures has left the exchange rate on market forces for adjusting this deficit. As a result, heavy nominal depreciation of exchange rate has been witnessed since March 2007. Nominal depreciation of exchange rate is assumed to change the real exchange rate and thus has a direct effect on trade balance (Himarios, 1989, Bahmani-Oskooee, 2001). Theoretically, the depreciation of local currency is supposed to be a source of improving trade balance through the conventional channels of cheaper exports and more costly imports2.

Nominal exchange rate and trade balance both are depreciating and deteriorating respectively, over a long period of time. For example, the exchange rate of Pakistan has been depreciating since the delinking with dollar in 1973 and trade balance is on negative side since the creation of Pakistan except for some years in 1990s. The question arises, whether J-type relationship between the two variables exists in this situation or not. If J-type relationship holds, then the depreciation of exchange rate may be beneficial up to some extent.

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The relationship between exchange rate and trade balance is not well researched in Pakistan despite its importance. One of the major objectives of present study is to fill this gap. The present article provides empirical evidence on the linkages between trade balance and exchange rate changes over the period 1980 to 2006, not only in long run but also in the short run. Bounds Testing approach to co-integration also known as ARDL model popularized by Pesaran et al (2001) has been employed for long run as well as short run elasticities. The impacts of shocks to exchange rate on trade balance are checked through impulse response functions.

Rest of the article is divided into five main sections. The literature review is described in section 2. Section 3 is concerned with model and estimation strategy. Impulse response function has been discussed in section 4 and section 5 concludes the article.

2. PREVIOUS LITERATURE


Very few evidences are also available for Pakistan, especially in the context of testing Marshal Lerner (ML) condition. For example, Hassan and Khan (1992) show that devaluation may be successful in improving the trade balance and ML condition is fulfilled. However, the sum of exports-imports elasticities is close to unity and that is the negation of ML condition. Similarly, Akhtar and Malik (2000) examine the ML condition in Pakistan with its four major trading partners. The results suggest that real devaluation is likely to worsen the trade balance with USA and Germany while it has favorable impact on trade balance with UK and Japan. Bahmani-Oskooee (1992) has also investigated the J-curve phenomenon by including lags of the real effective exchange rate for Pakistan. However, Aftab and Aurangzeb (2002) seem to confirm the existence of ML condition in long run and J-curve for short span of time for Pakistan. Recently, Aftab and Khan (2008) and Shahbaz et al (2009) find no evidence for standard J-curve phenomenon for Pakistan.

The inconclusive research on the J-curve, an empirical phenomenon is a motivation for the researchers to investigate this theory in the case of Pakistan. The present article is toil to investigate the link between Pakistan’s trade balance and exchange rate changes.

3. MODEL AND ESTIMATION STRATEGY

The discussion in literature review section allows us to construct model:

\[ Tradebalance = f(exchangerate) \]  \hspace{1cm} (1)

The study uses ratio of real exports to real imports as a measure of trade balance instead of traditional measure for trade balance (net exports) as dependent variable. This measure enables to transform the variables in logarithmic form which gives direct elasticities for interpretations. The econometrically estimatable regression is being specified as:

\[ LTOT = \alpha_1 + \alpha_2 LREER + \mu \]  \hspace{1cm} (2)

Where LTOT is the logarithm of the real exports to real imports ratio, LREER is the logarithm of the real exchange rate, \( \alpha_1 \) is a constant term and \( \mu \) is an error term. According to J-curve hypothesis, exchange rate depreciation initially deteriorates the trade balance due to the belief that imports in local currency increase more than initial increase in exports after a change in price. However, as export and import volumes adjust to price changes over time, the trade balance improves. Therefore, theoretically, we are expecting that \( \alpha_2 > 0 \).
This study prefers ARDL approach, popularized by Pesaran et al (2001), to other available techniques in the literature for Co-integration analysis due to their some critical disadvantages. ARDL framework of equation 2 is as follows;

\[
\Delta TOT = \phi_0 + \phi_{Tot} LTOT_{t-1} + \phi_{REER} LREER_{t-1} + \sum_{j=1}^{k} \gamma_{TOT} \Delta LTOT_{t-1} + \sum_{j=0}^{k} \gamma_{REER} \Delta LREER_{t-1} + \mu_t
\]  

(3)

Where \( \phi_0 \) is drift component and \( \mu_t \) white noise. Furthermore the terms with summation signs represent the error correction dynamics. While the second part of equation 3 with \( \phi_{TOT} \) and \( \phi_{REER} \) corresponds to long run relationship.

The ARDL bounds test for investigation of equilibrium long-run relationships can be conducted using either F-test or the t-test. F-test examines the pooled (joint) significance of estimates on one period lagged level of the variables in equation 3. Null hypothesis to investigate F-statistics is \( H_0: \phi_{TOT} = \phi_{REER} = 0 \). Critical values for F-test have been given in Pesaran et al (2001). The asymptotic distribution of critical values is obtained for cases if regressors are either I(1) or I(0) or mutually integrated. To carry out the task, quarterly data (1980 to 2006) for exports and imports have been obtained from monthly statistical bulletins of State Bank of Pakistan (SBP). Economic survey of Pakistan (various issues) has been used to collect the data for real effective exchange rate.

### 3.1 UNIT ROOT TEST

Correlation matrix and descriptive statistics are shown in Table 1. The priori expectation is that real effective exchange rate is negatively correlated with trade balance.

Insert table 1 here

A relatively newly developed technique, i.e. Ng-Perron (2001) test, is used to check the integrating order for the variables under consideration in this model. It is evident that both variables are integrated at I(1).

Insert table 2 here

### 3.2 CO-INTEGRATION TEST

The next step is to choose the possible optimal number of lags. The data set has been divided into two sub samples. The first sub-sample represents pre-financial liberalization period i.e. from 1980 to 1990. This was a
regime of fixed exchange rate. The second sub-sample consists of post-financial liberalization period that is the floating exchange rate regime, from 1991 up to 2006. The rational behind using the different sample periods is to test the robustness of results. The ARDL model selects, based on Akaike Information Criteria (AIC), optimal lag 5, 2 and 3 for 1980-2006, 1980-1990 and 1991-2006 samples respectively. The calculated F-statistics, when trade balance is the dependent variable, are much higher than the critical bounds (see Table 3). It posits that we cannot accept the null hypothesis of no co-integration and conclude that there exists a co-integration relationship between both variables in this model.

After establishing the long run relationship between the variables, equation 3 is estimated using the following ARDL \((q, p)\) specification given below;

\[
\Delta LTOT = \phi \sum_{i=1}^{q} \gamma_i \Delta LTOT_{t-i} + \sum_{j=0}^{p} \gamma_j \Delta LREER_{t-j} + \mu_i, \tag{4}
\]

According to the time span, maximum lag for each model is used such that \(i_{\text{max}} = 5, 2, 3\) respectively. The estimates of model are presented here on the basis of AIC (Table 4).

Empirical results show that in the long run, 1 percent devaluation leads to 0.7677 percent deterioration in the trade balance indicator. As data have been subdivided into two different time periods regarding fixed exchange rate and flexible exchange rate regimes. This shows that an increase in real effective exchange rate impacts trade balance negatively at 1 percent and 5 percent in both periods but more in fixed exchange rate rather than in flexible exchange rate regime. This seems to imply that depreciation in real exchange rate is ineffective to improve the trade balance in the country\(^5\). Findings of this study are in line with what Arora et al (2003) find in the case of India. There may be several reasons but the most apparent reason is the less elastic imports. The other may be, inflation has been speedier than the depreciation and always necessitating ‘do more’ for correction. It is important to mention that the depreciation has rarely been done completely, i.e. rarely been done as much as needed to do the needful for correction of imbalances in the current account.

In the short run, it is found that real devaluation leads to deteriorate the trade balance in three cases. However, the results are statistically insignificant. The error correction terms \(ecm_{t-1}\)'s measure the speed of adjustment to re-establish equilibrium in the short run dynamic model. The coefficients of \(ecm_{t-1}\)'s have negative signs and are statistically significant at 1 percent level. It ensures that the series are conclusive and that long run equilibrium is within reach for each model. The coefficients of \(ecm_{t-1}\)'s imply that deviations from the long-run trade balance

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1. Insert table 3 here
2. Insert table 4&5 here

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indicator during different periods in the sample are corrected by about 76.54 percent, 97.73 percent, and 51.26 percent in each quarter respectively. It indicates that following a shock, meeting to equilibrium is speedy.

4. IMPULSE RESPONSE FUNCTION

Studies by Lal and Lowinger (2002), Narayan (2004), and Narayan (2006), on the J-curve suggest that J-curve phenomenon can be observed by using the impulse response functions as well. The response of trade balance to one standard deviation shock to real exchange rate and the response of exchange rates to one standard deviation shock to the trade balance are indicated in Figure 1. Graphical representation of impulse response function shows that a one standard deviation shock to the real exchange rate (or devaluation of the Pakistani currency) deteriorates response of trade balance from 4 time horizons and continues to 20 time horizons. It can be concluded that there is no evidence of J-curve in the case of Pakistan. It has been evidenced that major reason of no existence of J-curve is less elastic imports. Secondly, inflation in Pakistan is eating up the beneficial impacts of devaluation of local currency to improve the trade balance (Shahbaz et al., 2009) and more speedy than currency devaluation. The third and important reason is that less depreciation has been done which is insufficient for the correction of imbalances in trade and current account (see for more details, Arora et al, 2003).

5. CONCLUSIONS

The present study attempts to explore the long run relationship between the changes in real exchange rate and trade balance indicators for Pakistan over the period of 1980 to 2006. The ARDL methodology is utilized to establish the long run relationships and to obtain the long run elasticities. The response of trade balance to one standard deviation shock to the real exchange rate has been measured using the impulse-response function. Moreover, three different samples of quarterly data have been used. First the whole sample from 1980 to 2006, second pre-liberalization period of financial sector from 1980 to 1990 when the exchange rate was fixed and third, post-financial liberalization period from 1990 to 2006 when the exchange rate was managed floating.

There are three main findings of the present study. First, there exists a long run relationship between real exchange rate changes and trade balance for all three samples. Second, the statistically significant and negative elasticities show that the depreciation will lead to deterioration in the trade balance for all three samples. Third, one standard deviation shock to the real exchange rate deteriorates response of trade balance from 4 time horizons and continues to 20 time horizons. This also suggests the J-curve theory does not hold in case of Pakistan.
In the light of results, it is suggested that Pakistan should not rely on the depreciation of exchange rate to improve its trade balance. The depreciation will further deteriorate the trade balance due to constant increase in the imports of the country. Therefore, Pakistan should concentrate on the other strategies to improve the trade balance.
Annexure

**TABLE 1:**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Median</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Std. dev.</th>
<th>Correlation Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTOT</td>
<td>-0.373</td>
<td>-0.3218</td>
<td>0.0391</td>
<td>-1.1033</td>
<td>0.2541</td>
<td>LTOT 1.0000</td>
</tr>
<tr>
<td>LREER</td>
<td>4.8292</td>
<td>4.7196</td>
<td>5.4319</td>
<td>4.4951</td>
<td>0.2764</td>
<td>LREER 0.7807</td>
</tr>
</tbody>
</table>

**TABLE 2:**

Unit Root Test

<table>
<thead>
<tr>
<th>Variables</th>
<th>MZa</th>
<th>MZt</th>
<th>MSB</th>
<th>MPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>LREER</td>
<td>-5.1169</td>
<td>-1.5062</td>
<td>0.2943</td>
<td>17.4176</td>
</tr>
<tr>
<td>LTOT</td>
<td>-11.9956</td>
<td>-2.4152</td>
<td>0.2013</td>
<td>7.7819</td>
</tr>
<tr>
<td>DLREER</td>
<td>-49.5118***</td>
<td>-4.9434</td>
<td>0.0998</td>
<td>2.0016</td>
</tr>
<tr>
<td>DLTOT</td>
<td>-41.0434***</td>
<td>-4.5216</td>
<td>0.1101</td>
<td>2.2655</td>
</tr>
</tbody>
</table>

Note: *** shows significance at 1 percent level of significance

**TABLE 3:**

F-Statistics for Co-integration

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Calculated</th>
<th>Wald Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F-Statistics(^t)</td>
<td>Statistics</td>
</tr>
<tr>
<td>1980Q1-2006Q4</td>
<td>7.6402</td>
<td>7.1908</td>
</tr>
<tr>
<td>1980Q1-1990Q4</td>
<td>5.3329</td>
<td>5.1204</td>
</tr>
<tr>
<td>1991Q1-2006Q4</td>
<td>4.1781</td>
<td>3.9547</td>
</tr>
</tbody>
</table>
**TABLE 4:**

**Long Run Elasticities of Trade Balance**

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficient</th>
<th>T-Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>LREER Panel-A Sample Period 1980Q1-2006Q4</td>
<td>-0.7677</td>
<td>-15.1867a</td>
</tr>
<tr>
<td>Constant</td>
<td>3.3337</td>
<td>13.6331a</td>
</tr>
<tr>
<td>LREER Panel-B Sample Period 1980Q1-1990Q4</td>
<td>-0.8429</td>
<td>-7.3968a</td>
</tr>
<tr>
<td>Constant</td>
<td>3.7178</td>
<td>6.4037a</td>
</tr>
<tr>
<td>LREER Panel-C Sample Period 1991Q1-2006Q4</td>
<td>-0.4107</td>
<td>-2.1222b</td>
</tr>
<tr>
<td>Constant</td>
<td>1.6792</td>
<td>1.8730c</td>
</tr>
</tbody>
</table>

Note: a, b & c show significance at 1%, 5% & 10%
TABLE 5:
Short Run Relationship

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficient</th>
<th>T-Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel-A</td>
<td>Sample Period 1980Q1-2006Q4</td>
<td></td>
</tr>
<tr>
<td>ΔLRER</td>
<td>-0.2842</td>
<td>-0.7267</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.0005</td>
<td>-0.0396</td>
</tr>
<tr>
<td>ecm_{t-1}</td>
<td>-0.7654</td>
<td>-8.0062^a</td>
</tr>
</tbody>
</table>

| Panel-B    | Sample Period 1980Q1-1990Q4 |             |
| ΔLRER      | -0.0026     | -0.0033      |
| Constant   | 0.0021      | 0.0823       |
| ecm_{t-1}  | -0.9773     | -6.3222^a    |

| Panel-C    | Sample Period 1991Q1-2006Q4 |             |
| ΔLRER      | -0.0058     | -0.0139      |
| Constant   | -0.0009     | -0.0712      |
| ecm_{t-1}  | -0.5126     | -4.1606^a    |

Note: a indicates significance at 1%

Figure 1 Impulse Response Function
REFERENCES


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2 See (Shahbaz et al., 2009)


4 The theory of S-curve states that trade balance initially declines after depreciation and follows by a trade balance improvement, i.e. the typical J-curve effect. However, after several quarters when trade balance improvement reaches its limits it then starts to deteriorate.

5 The results of this study reveal that devaluation of local currency has no immediate effect on trade balance of Ghana and does not show deterioration in trade balance. In the following year, the negative effect of the devaluation on trade balance may be due to an increase in the quantity of imports which causes the trade balance to deteriorate. This situation is having positive impact on trade balance through decrease in domestic income that discourages demand for imports. In resulting, it improves the trade balance.

6 This condition says that, for a currency devaluation to have a positive impact in trade balance, the sum of price elasticity of exports and imports (in absolute value) must be greater than 1.

7 The parity is defined as PKR/ USD.

8 Various issues

9 For more details see [Shahbaz, Awan and Ahmd, (2009)]

10 In case-III (unrestricted trend and no trend), critical values for lower and upper bounds (3.725 & 5.163, 4.133 & 5.260 and 2.843 & 3.920) are obtained from Paresh N. Kumar (2005, pp: 1988) at 1%, 5% & 10% level of significance with lag 5, 2 & 3.