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Dynamics of Trade Balance and the J-Curve Phenomenon: *Evidence from Pakistan*

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Abstract

We used disaggregated approach to test the validity of J-curve theory for Pakistan in bilateral trade with United Kingdom and United States, as these are the major trading partners of Pakistan having forty percent trade contribution to the total trade of Pakistan. The disaggregated approach is applied in order to avoid the aggregation bias and to captures the response of individual country price and income by calculating the real effective exchange rate for these countries. The separate equations have been estimated for each country.

The vector error correction model has applied to find the impact of exchange rate depreciation on trade balance. The Johansen co-integration test is applied to test the long run relationship among the variables, trade balance, domestic gross domestic product and foreign gross domestic product and real effective exchange rate. To analyze the response of trade balance to exchange rate, impulse response analysis has used.The study support that Pakistan's trade balance follows J-curve pattern in bilateral trade with UK and USA. The co-integration results support the existence of long run relationship of exchange rate and trade balance which is quite clear from the existence of J-curve pattern. In short run the exchange rate depreciation has worsened the trade balance. Combining the short run and long run analysis with the help of impulse response we found support of existence of J-curve in trade of Pakistan with both UK and USA.

Key Words: Trade Balance, VECM, Co-integration, J-Curve
JEL Classification: F14, G18, E31

INTRODUCTION

Pakistan is facing balance of trade and balance of payment deficit problems since its independence. Policy maker has tried various policies to improve the trade deficit problem. But the policies do not produced the promising results. Now a day Pakistan has entered into floating exchange rate system and other free trade agreements with various countries with the hope to improve the trade deficit problem. Proper investigation in required to check whether the floating exchange rate policy will work for Pakistan to improve trade?

Economist links real exchange rate with trade balance by theory called J-Curve theory. The exchange rate depreciation worsens the trade balance in short-run where in long-run the trade balance improves. The effect of exchange rate depreciation in such pattern is not linear rather J-shaped, hence called J-shaped Curve theory.

The trade balance worsens immediately to depreciation because the imports are more costly as their prices are paid in foreign currency. The export becomes cheap due to depreciation. The immediate price effect cause to worsen the trade balance in short run, however, after some time (in long run) the domestic and foreign producer and consumer respond to price change and thus the prices are adjusted and trade balance improves. If there is currency appreciation the whole mechanism will reverted and it will form the inverted J-curve. Following the depreciation of currency, the volume of imports and exports will remain level due in part to pre-existing contracts for imported goods that have to be honored. When depreciation occurs the import prices rises and export falls. The value of import increases in comparison to export value. Thus trade balance is worsened in short run. In short run the consumer pays high prices for imported goods. This is due the fact it take time to search the suitable, acceptable and cheaper products. In this scenario the demand for expensive products becomes inelastic as well. Keeping other things constant, the trade balance and balance of payment turns in deficit in short run if the depreciation occurs. In the long run the depreciation improves the trade balance because of shift in behavior of domestic consumer and producer. They began to purchase their own produced goods instead of purchasing the highly priced imported goods. The demand for export increases and

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imported goods are purchased at lower volume. The behavior of foreign consumer and producer is something different. They purchase the imported goods rather using their own products as the imported goods (for foreign country) are cheap until the equilibrium condition is reached.

Our study will enables us to know the impact of depreciation on trade balance. The Pakistan has adopted the floating exchange rate system where the prices are determined by the supply and demand forces. Further the free trade agreements have been made with various countries in order to import the industrial equipment to enhance the capacity and quality of domestic products and boost export with trading partners. The aim is to explore the new market as well. Our study will enable us to find performance of free trade and floating exchange rate policy. It will also enable us how for this policy is successful in improving the trade balance. Should Pakistan focus on the current trade partners or to explore the new market for their exports? Furthermore, we will able to answer the question about the existence of J-curve pattern in trade balance of Pakistan.

The study is of extreme significance as the study will enable us to know the success of the floating exchange rate system which is applied for the improvement of trade balance. In both cases either we find insignificant or significant result of such evidence then studies have practical policy applications. The policy maker must rethink their policy.

Our contribution includes the application of advance model for the test and the data we used. As various researchers who have conducted test of J-curve theory for Pakistan have some limitations. However, major limitation of their study was the use of aggregated trade data while testing J-curve in bilateral trade. They suffered aggregation bias as data used was aggregated; i.e. the total imports and total exports were taken for specific period of time. While we are using disaggregated trade data with booth the UK and USA which major trading partners of Pakistan and contribute 40 percent trade to total trade of Pakistan. The separated equation for the estimation with individual country has been developed. One of the reasons of using the disaggregated approach is that one must consider the price and income difference in different countries. It is taken into account that what we import and what is exported to these countries.

The study contains four sections. The section two contains the review of literature, methodology in section three and section four contains the results and conclusion.

LITERATURE REVIEW

Before 1973, there was no concept of J-curve. The J-curve phenomenon was first introduced by (Magee, 1973). He characterized the response of trade balance to exchange rate depreciation is letter J-shaped. It is not the linear relationship rather it is J-shaped curve. He further explained the impact of deprecation on trade balance in two phases. In short run the response of trade balance to exchange rate is worsening. While in the long run the trade balance is improved through depreciation. Providing the reasons of the mechanism it was argued that the worsening response of trade balance in the short run is due to price effect. Explaining price effect as the increasing prices of imports and comparatively low prices of export as it happens after depreciation. In long run analysis it was concluded that the price and volume effect force the domestic and foreign consumer and producer to respond and thus the prices adjusts and balance of trade improves. After this investigation the phenomenon became hot issue and focus point of researchers.

Deepler (1974) investigated the impact of exchange rate on trade balance. He used sophisticated methodology to avoid the seasonal and trend changes in the data. The estimation was made for Netherland, UK, France and Germany by using quarterly data. It was observed the volume changes in response to exchange rate change were larger the estimate of price elasticity estimated by standard procedure. Government normally does not devalue their currency as it cause increase in inflation. The postponing of devaluation in situation like this further intensifies the inflationary pressure, where the devaluation is necessary.

Miles (1979) investigated what happens to trade balance when devaluation occurs. He used mixed methodology using various techniques. The study sample included countries from Europe, Israel, Sri Lanka, and Philippine. Seemingly Unrelated Regression, Pooled cross section time regression and OLS

were employed to find the results. In this study the balance of payment and trade balance was taken into analysis. The separate equations were developed for testing. The study strongly rejected the impact of devaluation on trade balance; however, the results found for balance of payment supported the argument that the devaluation improves balance of payment.

Boylan, Cuddy and 'Muircheartaigh (1980) investigated what factors determine and affects the trade balance. The Box-Cox methodology was employed to reach the conclusion for Ireland, Belgium, and Denmark. The import demand equation was developed for each country. The study concluded that the exchange rate is the primary factor which effects trade balance. The exchange rate was considered the significant factor that determines the import and export demand and supply. Side results shown that if the country employs the proper exchange rate policy can improve trade balance with devaluation or depreciation.

Gylfason and Riasge (1984) using different methodology and found somewhat different results then that of (Miles, 1979). The impact of exchange rate was tested on the trade balance for developed and developing nations of world. He come that exchange rate devaluation was successful policy for developed and developed nations in study period. The exchange rate devaluation was successful in improving the trade balance. However the results were insignificant for Argentina. It was concluded the exchange rate devaluation does not improved trade balance in Argentina. The result supported the existence of J-curve in all countries included in the sample except Argentina.

Bahmani-Oskooee (1985) was the first researcher who developed the proper model for developed for estimation for J-curve. He introduced the short run and long run analysis in estimation. The study investigated that there is no evidence for existence of J-curve in developed and developing nations included in the sample. Further explained the result and presented that the exchange rate has no effect on improvement of trade balance.

After the result of (Bahmani-Oskooee, 1985), the researchers were forced to think about the factor that influence the trade balance if the exchange rate is not the significant variable. Another attempt was made by (Rittenberg, 1986). This study used various techniques including OLS. This study taken three basic variables, namely the own price of country, cross price and income. The study was expecting that export growth across the countries is dependent on these variables, especially for least developing countries. Further it was assumed that income and price elasticity are the key factors in promoting exports. The low own prices, high cross prices and high income was considered the favorable condition for boosting exports. To investigate the impact of own price, cross price and income on exports, the estimation was divided into two parts. In first step the elasticity were estimated by OLS for each country. Secondly the estimated regression for each country by OLS were fitted to cross country equations in which the annual growth of export over the time period was regressed on the estimated own price, cross price and income using OLS. It was expected that the inverse relationship exists in the own price elasticity of export and export growth. Further it was stated that direct relationship exist among the cross price, export and income. The first stage estimated coefficients were positive and significant. In final discussion it was concluded that the expected results were found and it was concluded that the income, cross price and income are the key variable that determine the export growth. The export growth can be achieved if we have low own price, high cross price and income. Thus the exchange rate became the significant variable in determining the export.

Lefort (1988) tested the mechanism of boosting exports for Chile. The Chile has adopted the devaluation policy to improve the export performance. This check of success of the policy was also aim for the study. The study investigated that the devaluation was successful when the relative price were high and downfall started in its progress when the public sector wages were adjusted after devaluation. The policy brought the desired results when the indexation of public sector wages was not complete. The study gave the strong reference to the official that the demand management is of extreme importance. Only the exchange rate control is not sufficient.

Noland (1989) investigated the record export performance in Japan. The study reported the strong support of existence of J-curve theory in Japan at that time. The study further concluded that strong demand management and devaluation policy worked for boosting

export. It given the message to policy maker that if the demand management and suitable exchange rate policy is implemented the export performance can be improved. The evidence was quite clear from the result were the real devaluation worsened the trade balance in short run and in long run the trade balance was improved by devaluation.

In series of paper (Rose & Yellen, 1989; Rose, 1990) investigated the floating exchange rate performance for USA. The result concluded that the depreciation does not improve the trade balance of USA. However the in short run the trade balance was worsened. The final discussion did not support the existence of J-curve in USA. Rose (1991) tested the relationship between the exchange rate and trade balance for UK, USA, Japan, Germany and Canada. Monthly data was used by employing various techniques like co-integration test, direct estimation of trade balance, Gewek's approach and weighted regression. The study reported no relationship of exchange rate to trade balance. The side results shown the Marshall Lerner Condition also does not hold for the countries included in the sample. These results were contrasting to researchers who were arguing the relationship of exchange rate and demand management as discussed in previous discussion.

These contrasting results provided hot news for researcher. Bahmani-Oskooee (1991) made another attempt of checking the relationship between the exchange rate and trade balance. In analysis various techniques were used like the co-integration and unit free measures. The data was taken from eight least developed countries annually. The separate procedure (co-integration was not applicable) was followed for India, Korea and Thailand because the degree of co-integration for both series were not same. For rest of the countries in the sample, the co-integration was found. The study reported that in both the long run and short run there is no relationship between the real effective exchange rate and trade balance. This study resolved the contradictory finding in (Bahmani-Oskooee, 1985; Himarios,1989). Arsalan and Wijnbergen (1993) studied the export growth and performance of floating exchange rate policy in Turkey. The study concluded the policy were successful as the depreciation improved the trade balance in Turkey. In short run the depreciation worsens the trade balance and it was conclude finally that the J-curve theory holds for Turkey.

Bahmani-Oskooee and Alse (1994) tested the relationship between the exchange rate and trade balance using annual data. Co-integration and unit free measure method were employed. The result concluded that there was no significant relationship between the exchange rate and trade balance. The co-integration results provided that the trade balance was not improved in long run. The final results shown that there was no evidence for J-curve in study sample of developing countries. Backus, Kehoe and Khydland (1994) tested the impact of exchange rate on trade balance using the international real business cycle model. The study concluded that the trade balance follows S-shaped pattern. In explanation of result he reported that trade balance was firs worsened, then improved and finally worsened.

Robert (1995) investigated the impact of exchange rate on trade balance. The study reported that the exchange rate first worsens the trade balance which is then improved for some period of time but finally the trade balance again worsened. Hence the S-shaped was formed. Marwah and Klein (1995) studied the impact of exchange rate on trade balance and fond that is follows S-shaped pattern in USA and Canada. The results reported were similar to that of (Backus, Kehoe, and Khydland, 1995; Robert, 1995). Reinhart (1995) investigated the mechanism of devaluation policy in developing countries including Pakistan. The relative prices and import export relationship was found by employing annual data. The co-integration analysis was used to avoid non-stationary data problem. The study reported that the relative has no impact on trade balance thus the devaluation policy would not successful if implemented.

Barlow and Fikert (1995) studied the miraculous export growth during 1977 in Turkey. The study reported that marked increase in export growth at time in the Turkish export was largely due to the export policies instead the external circumstances such as the Iran-Iraq war, changes in consumer income in Turkey market in Europe and Middle East and rainfall fluctuations. He concluded that the real effective exchange rate depreciation was the main factor in boosting agricultural and manufacturing exports.

Buluswar, Thormpson and Upadhyaya (1996) concluded that there is no relation between

exchange rate and trade balance. Centre for Policy Dialogue (1996) tested J-Curve for Bangladesh and concluded that exchange rate does not improve the export for Bangladesh. Brada, Kutan and Zhou (1997) tested the J-curve for Turkey and divided the sample into two halves. The exchange rate has significant effect on trade balance (in short run) from 1980 to 1993 but has no effect on the in long run (1969 to 1979). Koray and McMillan (1999) supported J-curve theory but concluded that the negative monetary shocks improved the trade balance. This result was based on using VAR model. Bahmani-Oskooee and Brooks (1999) used ARDL approach and concluded that the trade balance is worsening by exchange rate in short run but in the long run the trade balance is not affected by the exchange rate. This study did not support J-curve theory. Bahmani-Oskooee and Kantipong (2001) tested j-curve for Thailand with major trading partners and concluded that j-curve exist only for Japan and USA while the other countries in the sample did not follow the J-curve pattern. Leonard and Stockman (2002) used nonparametric methods to estimate J-curve and concluded that result support J-curve theory. Wilson (2001) tested impact of exchange rate on trade balance in bilateral trade with Singapore and failed to find any significant effect of exchange rate depreciation on trade balance both in short run and long run. He used same model as used by (Rose & Yellen,1989). In other attempt (Wilson,2001) tested the J-curve phenomenon for Singapore, Malaysia and Korea. He concluded that exchange rate has no effect on trade balance in short-run as well in long-run. The J-curve hypothesis was rejected. Nabli and Marie-Ange (2002) showed that exchange rate overvaluation caused huge loss in the export of MENA (Middle Eastern and North African) countries by decreasing their export competitiveness. Sing (2002) tested J-curve for India and concluded that the exchange rate depreciation improved trade balance in the long run and in short rum the trade balance worsens. Arora, Bahmani-Oskooee and Goswami (2003) tested J-curve for India and concluded that neither in short run the trade balance is worsening and nor in long run the trade balance is improved by the depreciation. Stučka (2003) tested J-curve for Croatia and concluded that exchange rate depreciation worsen the trade balance in short run and improve in long run given that the result support J-curve theory. Fang & Miller (2004) tested J-curve for Singapore and concluded that depreciation doesn't significantly improve export but exchange rate risk (generated by fluctuation) significantly impedes export. Lai & Miller (2005) tested relation between exchange rate and export, concluded that the exchange rate has weak contribution to the export growth. Razafimahefa and Hamori (2005) was investigating export import function for developing and developed nations of the world and concluded that the Marshall Learner condition holds only for Mauritius. Bahmani-Oskooee and Ardalani (2006) used ARDL approach to study j-curve at industrial level and concluded that the half of the 66 industries have negative coefficient of exchange rate while the 13 industries have positive coefficient. This study further concluded that if aggregated data are used then the positive and negative exchange rate coefficient may cancel each other and the overall result will be no effect of exchange rate on trade flows. Bahmani-Oskooee and Kutan (2009) used ARDL and ECM approach to investigate j-curve for European countries and concluded that j-curve pattern is followed in three countries data that is Bulgaria, Croatia and Russia only while the other countries in the sample did not followed J-curve pattern in their trade balance. Hassan and Khan (1994) tested the impact of devaluation on external trade and concluded that the exchange rate devaluation has no effect on trade.

The formal testing of J-curve for Pakistan was for the first time tested by (Bahmani-Oskooee, 1985). In this study the proper model was used. The short run and long run analysis were made. He concluded that neither in short run nor in long run. (Aurangzeb,2002; Rehman and Afzal, 2003) tested J-Curve for Pakistan. Whatever the result, however, one the major limitation of their studies was that they applied aggregated trade data and suffer aggregation bias. Marquez (1990) criticized all studies based on aggregated trade data when they are testing bilateral trade and suggested to employ disaggregated trade data when someone is testing J-curve in bilateral trade. Akhter and Malik (2000) used disaggregated trade data applying 3SLS technique to test Marshall Lerner condition for Pakistan and concluded that exchange rate devaluation does not improve trade balance. 3SLS is an old technique used by (Akhter & Malik, 2000), this study was criticized by (Aftab & Khan, 2008)

for using old technique (3SLS) and non control of stationary. Aftab and Khan (2008) tested J-curve for Pakistan using ARDL model and concluded that there is no evidence for J-curve in Pakistani trade. Rehman and Afzal (2003) tested J-curve phenomenon for Pakistan using ARDL approach and supported the J-curve hypothesis for the Pakistan, however, not presented the results by arguing the J-curve exists but the long-run relationship of exchange rate is not significant with the trade balance.

Pakistan has adopted the floating exchange rate sytem and has entered into free trade agreement with major countries. Under the floating exchange rate system the exchange rate is determined by the demand and supply forces in the market. It is not like the devaluation policy where government controls the exchange rate and intervenes time by time. Fresh insight is required how for this policy would be successful in improving the exports and controlling imports for sustainable growth.

Our study will improve the existing literature in couple of aspects. We are using disaggregated trade data to avoid aggregation bias as suggested by (Marquez, 1990). Koray and McMillan (1999) suggest impulse response methodology to check up feedback effects therefore we will use VAR, generalized impulse response methodology. Sing (2002) suggest ECM technique for short run dynamics of trade balance that is why we are using VECM. Collectively using VAR, VECM, and generalized impulse response methodology will enable to study more depth as suggested by existed literature. Furthermore, for differentiating in long term and short term dynamics we will use VECM and co-integration analysis and for further insight of dynamics of trade balance we will use generalized impulse methodology. The general to specific VAR technique will enable us in enough data generating process relating the variable of model. It will provide simple and reduced model. It is suggested by (Elf Akostanci, 2004) to investigate the consurgency of observed data to economic theory.

Impulse response methodology will enable us to check the effect of shock at give point of time. Demirden and Pastine (1995) suggest using generalized impulse response analysis to test J-curve. We will use Eigan value and Trace statistics developed by Koop, Pesaran & Potter, 1996; Shin, 1998). This method is unique and can be used for both linear and non linear model. It is invariant to reorder the VAR.

DATA AND METHODOLOGY

The data set covers the 1975-2012 periods for Pakistan. The variables are the real trade balance TB which is defined as the difference the exports and imports.REX is the real effective exchange rate base on the currencies of the two basic trade partners of the Pakistan, which are the United States and United Kingdom. REX is calculated by using the weighted average of the real U.S dollars and the British Pound exchange rate. Y* is the foreign variable calculated on the basis of weighted average of the United States, United Kingdom GDP indexes. Y is the domestic income i.e. the GDP index of Pakistan. The trade balance data has taken from Federal Bureau of Statistics, Islamabad, Pakistan and International Monetary Fund (IFS) CD-ROM data base.

We employed the imperfect substitute model which was developed by (Gold Stein and Khan, 1985). The equation were reduced and given in simple form by (Rose & Yellen, 1989). The model is supposed to have the following assumptions.

Domestic and imported goods are imperfect substitute of each other. Model assumes the two countries i.e. home country and foreign country or the home country and the rest of the world. Model assumes that single tradable good can be produced in the country and its price is sticky. Consumer of each country maximize their utility consuming booth the goods with in limit of their budget constraints. Similarly the producer maximizes their profit subject to their budget constraints.

The model used has separate equation for import and export demand. Similarly, the separate equations have been developed for the supply side. The import demand for home country is dependent on real domestic income which is measured in form of gross domestic product, the relative price of imports which is given by the ratio of imported goods to domestically produced goods. The import demand equation for home country is given as under.

$$M_d = M_d(P_{mr}, Y) \quad \ldots\ldots\ldots (1)$$

Md is the import demand for home country and it is function of relative import prices

(Pmr) and real gross domestic product (Y). The relative prices is given by (P/P*). It is basically the ratio of domestic and foreign price of imports. Similarly the demand of imports in foreign country would dependent on real income (Y*), the relative price of imported goods to domestically produced goods. The relative price of imports in foreign is represented by Pmr*. The equation for the import demand in foreign country would be given as under.

$$M_d^* = M_d^*(P_{mr}^*, Y^*) \quad \ldots\ldots\ldots (2)$$

Md* is the import demand in foreign country and it is function of relative import prices (Pmr*) and real gross domestic product (Y*). The relative prices is given by (P/P*) with respect to foreign country. It is basically the ratio of domestic and foreign price of imports (from foreign country point of view). Similarly the demand of imports in foreign country would dependent on real income (Y*), the relative price of imported goods to domestically produced goods. The relative price of imports in foreign is represented by Pmr*.

The export supply in home country is dependent on the relative price of export in the home country. The relative price of exports is give by ratio of price of exportable at home to domestic price level. The function is given as under.

$$X_s = X_s(P_{xr}) \quad \ldots\ldots\ldots (3)$$

Where Xs is the export supply in home country and Pxr is the relative price of exports in home country. It is given by the ratio of price of exports at home to domestic price level

Similarly the export supply of exports in foreign country is dependent on the relative prices of export in foreign country and this relationship is given in form of function as under.

$$X_s^* = X_S^*(P_{xr}^*) \quad \ldots\ldots\ldots\ldots (4)$$

The Xs* is the export supply and Pxr* is the relative price of export in foreign country. The relative price in that case is given by Pxr*=Px*/P. The relative price in home country is given by the following equation.

$$P_{mr} = (e.P_x^*)/P = (e.P^*/P)(P_x^*/P^*) = (Q.P_x^*)/P^* = Q.P_{xr}^* \quad \ldots\ldots\ldots (5)$$

The (e) is the nominal exchange rate and Q is real effective exchange rate which formed after the adjustment of nominal exchange rate against inflation. The import price in foreign country is given as.

$$P_{mr}^* = P_{xr}/Q \quad \ldots\ldots\ldots\ldots (6)$$

The equilibrium condition for trade quantities and their relative price is given by following equation.

$$M_d = X_s^* \quad \ldots\ldots\ldots (7) \text{ And}$$

$$M_d^* = X_s \quad \ldots\ldots\ldots (8).$$

The above conditions ensure the equality between home/foreign country's imports and foreign country's exports. In this model the real income (Y,Y*), price level (P,P*) and the real and nominal exchange rate are assumed to be exogenous. From the above model the following form of reduced equations can be derived.

$$P_{mr} = P_{mr}(Q, Y) \quad \ldots\ldots\ldots\ldots (9)$$

$$M = M(Q, Y) \quad \ldots\ldots\ldots\ldots (10)$$

$$P_{xr} = P_{xr}(Q, Y^*) \quad \ldots\ldots\ldots\ldots (11)$$

$$X = X(Q, Y^*) \quad \ldots\ldots\ldots\ldots (12)$$

The trade balance of country in real term is given as

$$TB = TB(Q, Y, Y^*) \quad \ldots\ldots\ldots\ldots (13)$$

Where $Q = (P^*/P)e$, TB is the trade balance, domestic income(Y), foreign income(Y)*, real exchange rate (Q), the nominal exchange rate (e), P*, P is foreign and domestic price levels, respectively

$$LnTB = \alpha + \alpha_1 Ln(Y_t) + \alpha_2 Ln(Y_{jt}^*) + \alpha_3 Ln(REX_{jt}) + \mu. \quad \ldots\ldots\ldots\ldots (14)$$

As the error correction form depends on the co-integrating relations, we will first search for the long-run co-integrating relations between the variable of the variable the equation (14) will be used. The ECM has used for estimation of short run dynamics. Inspection of the time series shown in the following table 1 suggest that they are non-stationary I (1) processes. Corresponding unit root testing, i.e. Augmented Dickey Fuller test confirms that the entire variable in this study are I (1). For exploring the existence of trade balance relations both in long (Co-integration) and short run (error correction model: ECM). The result of the unit root is given in Table 1.

RESULTS

Relationship between Exchange Rate and Trade Balance in Long- Run

Using the equation (14) we are providing the theoretical relationship between the exchange

rate, domestic income (Y), foreign income (Y*) and trade balance. The exchange rate is independent where as the rest of variables are dependent variables. This equation will determine the long run relationship of variables by employing Johansen co-integration test.

According to the theory the exchange rate depreciation affects positively the trade balance in long run and the effect of domestic and foreign income either is positive or negative on trade balance.

If the exchange rate depreciation affect the trade balance positively then the trade balance will improve in the long run. The exports valued will increase than import value. If it happens then the expected sign on exchange rate coefficient should positive and must greater than zero. The control of foreign and domestic income is necessary in finding the effect of depreciation on trade balance. Therefore, the domestic and foreign income variables are introduced in the equation. As we have discussed earlier that the impact of domestic income on trade balance can be positive or negative. We have to see the coefficients of foreign and domestic income. In case the estimated coefficients on domestic income are negative then domestic income will enhances export. On other way round it is positive when the increase in domestic income is due to the increased production of import substitutes. The net effect domestic can be worsening or improving on trade balance.

According to theory the net effect of foreign income should positive but it can be negative as well depending on the situation of country. If the sign on foreign income coefficient is positive then it means that it has improved the export of Pakistan. However if the increase in foreign income is due to increase in production of imports substitute then the Pakistan export will suffer. The estimated coefficients on foreign income in this case will be negative.

In the next discussion the results of Johansen co-integration test results are given. This discussion will allow us to find the long run relationship between the real effective exchange rate and trade balance. Further it will enable us to know the long run relationship among the domestic, foreign income and trade balance.

Johansen Co-Integration Test

The results reported base on the Johansen's testes do confirm the existence of two co-integrating relation between the trade balance with United Kingdom (TB), real effective exchange rate (REX), domestic income(Y) and foreign income (Y*). The trace statistics reported in Table 2 show that null hypothesis of no co-integration is rejected as trace statistics is larger than 5% critical value (79.80766>54.07904). However, the null hypothesis that there is at most two co-integrating vector can't be rejected (19.00273<20.26184). (See Table 2)

Similarly we found two co-integrating vector in relation with trade balance of United States (TB), domestic income (Y) and foreign (Y*) and real effective exchange rate (REX). The null hypothesis that there is no co-integration is rejected as trace statistics is larger than the critical value at 5% (64.58867>54.07904). However, the null hypothesis there is at most two co-integrating vector can't be rejected (17.48052<20.26184). (See Table 3)

Impact of exchange rate, gross domestic product, and foreign GDP on trade balance in long- run:

As the variables co-integrate we may proceed to estimate the corresponding co-integrating equations are given in Table 4 and Table 5.

We report the estimated coefficients of the co-integrating vector, using the Johansen method. In all cases, the results indicate a positive long-run relationship between the real exchange rate and the real trade balance, as would be expected if a real depreciation leads to more quantities being exported and less being imported. The results for Pakistan-United Kingdom, Pakistan-USA, indicate that real trade balance has a negative long-run relationship with real domestic income and a positive long-run relationship with real foreign income. These signs are what we would expect if demand were the driving force in determining exports and imports. The negative sign on domestic income indicate that increase in the domestic income enhance export. On the other side the positive sign the coefficient of foreign income indicates that the increase in foreign income boosted export.

If we look the historic background of Pakistan commercial policy, we will see that the objective is to import the capital goods (heavy machinery and industrial goods) to strengthen

the local industry and to meet the supply requirements. Which is quite clear in the results where the negative sign on the domestic GDP and positive sign on foreign GDP, means the more imports of industrial goods have increased. The second reason to reason of decreasing GDP is mass import of petroleum products for industrial use and transport requirements. Let have a brief insight in the commercial policy of Pakistan since 1991. After Gulf War 1991, due to which oil prices increased sharply, Pakistan trade balance was worsen badly. Despite this, Pakistan reduced budget deficit and increase foreign exchange reserves. Various import quotas had been converted into import tariff and various import items were allowed to be imported without acquiring import licensing. The liberalization of the exchange control was another major decision of that period. The policy of trade liberalization during this decade primarily aimed at liberalizing import in order to enhance the capacity utilization of endogenous industry and to boost export. The objective has been gradually convert the economy from relatively closed, inward locking system with high tariff walls, inefficient import substituting industry, distorted prices, into open outward looking economy.

On first July, 1994, convertibility on current account transactions was made effective. Maximum import tariff were reduced from 94 percent to 70 percent that year, 65 percent in 1995-96 and further to 45 percent in 1996-97. Beside the Pakistan signed the charter of World Trade Organization in 1994. During 1997, the comprehensive package for boosting the export was announced, under which the number of tariff slabs were reduced. The duty on the import of machinery was reduced to 10 percent. The objective was to double the total dollar value of export in next three years. Moreover, the functioning of Export Promotion Bureau has been improved to enhance to enhance its market intelligence role and strengthening its ability to support supply response of exporting firms. This de-regulation led the Pakistan to become Free Trade era.

In 1998, to alleviate the financial crises in Pakistan, the authorities adopted a multiple exchange rate system, which comprised of an official rate (pegged to U.S dollars), a Floating Inter bank Rate (FIBR), and a composite rate that combines the official and FIBR rates. With the recovering from the crisis in 1999, the three exchange rates were unified and pegged to the U.S dollars with in certain band. This band was removed in 2000. Currently the Pakistan has adopted the floating exchange regime along with free trade policy. The aim is to import the industrial machinery freely and to boost the production so that the export requirements can be met. The import of heavy machinery and other equipments is allowed to develop the country exporting firm to boost export. Keeping in view the exchange rate and commercial policy of Pakistan we conclude that the negative sign on domestic GDP and positive impact on foreign income is due to the policy of importing the raw material and other necessary equipments to enhance the performance of local firms to boost exports.

Short-run impact of exchange rate on trade balance: j-curve effect:

As explained above, in short run currency depreciation might first worsen the trade balance and then after some period of time it is improved, hence creating the J-curve effect. Empirical evidence from a number of countries supports the presence of this effect. We shall examine the J-curve effect by inspecting the estimate of ECM that corresponds to the long-run trade balance equation above, and by calculating the impulse response of the trade balance following a shock from the real exchange rate.

Error Correction Model:

The estimates of the co-integrating trade balance equation based on Johansen procedure are used to get corresponding ECM are given in Table 6 and Table 7.The short term effect of exchange rate on trade balance can be captured by the lagged difference real effective exchange rate coefficients. The significantly negative coefficients for both the USA and UK show that the real depreciation has worsen the trade balance in short run (-0.05, -0.0457) and (-0.096, -0.0318) respectively. The significant negative coefficient on the trade balance clearly shows that the real effective exchange rate has worsened the trade balance in short run. Furthermore, if we look the coefficients of normalized equation estimates which and negative and significant that clearly shows that the real exchange rate depreciation has worsen trade balance in short run.(-0.56 and -0.44).

Impulse Response Analysis

In this section we are combining results of ECM and co-integration by employing impulse analysis. We are using the impulse analysis developed by Pesaran and shin (1998). This approach is beneficial because and superior to the other techniques because the outcome of this analysis is not affected by ordering of variables. Further it consider historical pattern of correlation observed in different shocks.

According to Elf (2004) the impulse response is average of current and fast shocks. It is conditional on expectation of historic observations. The impulse response analysis measures the time profile of effects of shocks at a given point in time on the future values of the variables.

One of common impulse analysis is the orthogonalized impulse analysis and the most popular way is Choleskey decomposition. However the draw back of this method is that the ordering variable in VAR affects the outcome and magnitude of shocks. If it happens the shocks would not be unique and will not present the correct response. In such situation the imposition of restriction are required in VAR. This restriction should in accordance to theory or should statistically acceptable.

The alternative method has developed by Pesaran and shin in 1998, which is applied in this paper. "The vector auto-regression has moving average representation and it is similar to that of auto-regression. The VAR system combines the current and fast values of shocks of the respective variables forming response analysis. The parameters of error term are called impact multiplier and measure the immediate response of given variable to one unit change in shocks. When we consider this response of given variable with respective variable shock over time, is called the impulse response analysis".

If we consider the effect of specific variable on the evolution of Xt+1, Xt+2……..Xt+N the generalized impulse response analysis is given as under.

$$GI_{ij,N} = \left(N, \sigma_{it}, \Omega_{t-i}\right) = E\left(X_{it} \middle| \varepsilon_{it} = \sigma_i, \Omega_{t-i}\right) - E\left(X_{it} \middle| \Omega_{t-i}\right)$$

…….. (15)

As disused earlier the impulse response is obtained by the repose one variable shock to other. More specifically in VAR model it is given by the differences of two realization of future values of a variable Xt+N. If we consider infinite moving average representation the above equation can be written as.

$$GIi_{j,N} = e_j A_N \sum e_i / \sqrt{\sigma i_t}$$

…… (16)

Where the AN is the coefficients of moving average representation and ei is the selection vector. The Jth item of the equation (16) gives the impulse response. Moving toward the results the impulse response has been achieved through ECM estimate by implication of VAR.In this analysis we will found the result whether the exchange rate depreciation worsens the trade balance in short run and improve in long run or not. If does we will obtained the final curve which will combine the short run and long run exchange rate depreciation effects.

The results given in table 8, 9 and graph shows that trade balance has worsened in short run and in long run the trade balance has improved by exchange rate depreciation. As it is demonstrated by the J-shaped curve formed. The trade balance with UK (Form Table 8) clearly shows the trade balance has worsened in second year while for rest of years the trade balance shown positive figure which is an indication that the trade balance has improved. If we look the figure 2 (impulse response based on trade balance with UK) parallel then it also shows the clear J-curve pattern.

Similarly the impulse analysis Table 9 and figure 2 based on trade with USA shows that the trade balance has negative figure in second year while in rest of year the trade balance is with positive figure. That is the clear indication that in short run the trade balance is worsened by the exchange rate depreciation while in the long run the trade balance has improved with USA also. For support the table and graphs has given in appendix and table.

As argued by the economists in the economic literature, our results are same with other studies that employed the same model as we applied for Pakistan. A lot of studies are available that support the J-curve theory in bilateral theory but we present few as support of our work. For example, Wilson (2001) studied the impact of depreciation on trade balance for Singapore, in bilateral trade with Malaysia, Korea USA and Japan. VECM model was employed and quarterly data was used. The study provided strong support for

existence of Singapore in bilateral trade with Malaysia, Korea, USA and Japan.

Marwah and Klein (1996) tested J-curve for USA and Canada using VECM model employing quarterly data and found that the real depreciation worsens the trade balance in short run however the trade balance was improved in long run.

CONCLUSION

We have applied the vector error correction model by employing annual trade data with UK and USA. Separate equation and estimation are developed for trade balance with UK and USA to avoid aggregation bias as suggested by (Marquez ,1990). The co-integration analysis confirmed the existence of two co-integrating vector with Both UK and USA. This confirmed that the long run relationship exists among domestic income, foreign income and real effective exchange rate. The normalized co-integrating equations showed that the real effective exchange rate is passively related with the trade balance for both the UK and USA. This is what we obtain when in the long run the exchange rate depreciation improve the trade balance as suggested by the theory. By this we mean that exchange rate depreciation has improved the trade balance in the long run. Finally we can say the exchange rate depreciation has improved the export for Pakistan. Furthermore, the normalized co-integrating equations shown that the trade balance is negatively related to relate to domestic income and positively related to foreign income. These results we obtain when the demand is the driven force for booth import and export. Our results in that case are also matching the theory argument. The estimated coefficients sign on domestic and foreign income confirmed that demand is the driven force in determination of export and imports in Pakistan. The supply side effects are not the main determinants of import and export in Pakistan. The analysis of ECM estimates confirmed that the exchange rate worsens the trade balance in short run. The negative coefficients of trade and lag values of the real effective exchange rate is strong indication that the real effective exchange rate depreciation has worsened the trade balance of Pakistan in short run. (See Table 6 and 8). Finally the impulse response analysis confirmed the existence of J-curve in bilateral trade with booth UK and USA (See figure 2). The study strongly supports the existence of J-curve in trade with UK and USA and confirmed that real exchange rate deprecation worsened the trade balance in the short run and improved in the long run. Summarizing the main findings of the study we concluded real exchange rate depreciation has a significant positive long run impact on the trade balance in Pakistan, and that in the short run trade balance first deteriorates before it later improves. Thus, as in a number of other economies, a long run co-integrating trade balance relation is found for Pakistan showing that a one percent real depreciation leads to a 0.02 (with UK) and 0.05 (with USA) percent improvement in trade balance. The corresponding error correction models (ECM) of trade balance capture its short run movements and indicate the existence of the J-curve effect. Namely, the estimated ECMs show that exchange rate depreciation has negative impact on the trade balance in the first few years. Combining this result with the one in the long run (i.e. an improvement of trade balance), one obtains the J-curve effect of depreciation on the trade balance. Moreover, one can directly estimate the J-curve by calculating the impulse response of the trade balance upon the exchange rate shock. The estimates of the J-curve obtained for Pakistan, both based on ECM and co-integration analysis of VECM Model, show that the trade balance hit by exchange rate depreciation deteriorates in the first two years and subsequently improves, reaching a new equilibrium value in somewhat more than a year's time. Although these estimates should not be taken literally, they do however strongly support the existence of the J-curve pattern in trade balance movement. Thus the results obtained for Pakistan add to evidence found in other countries that currency depreciation improves trade balance in long run, and does so with the J-curve effect. Furthermore, these results bear essential immediate policy implication for Pakistan as it faces large current account adjustments in the post 2008 - 09 crisis periods.

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Figure 1 Time series Characteristics of Data

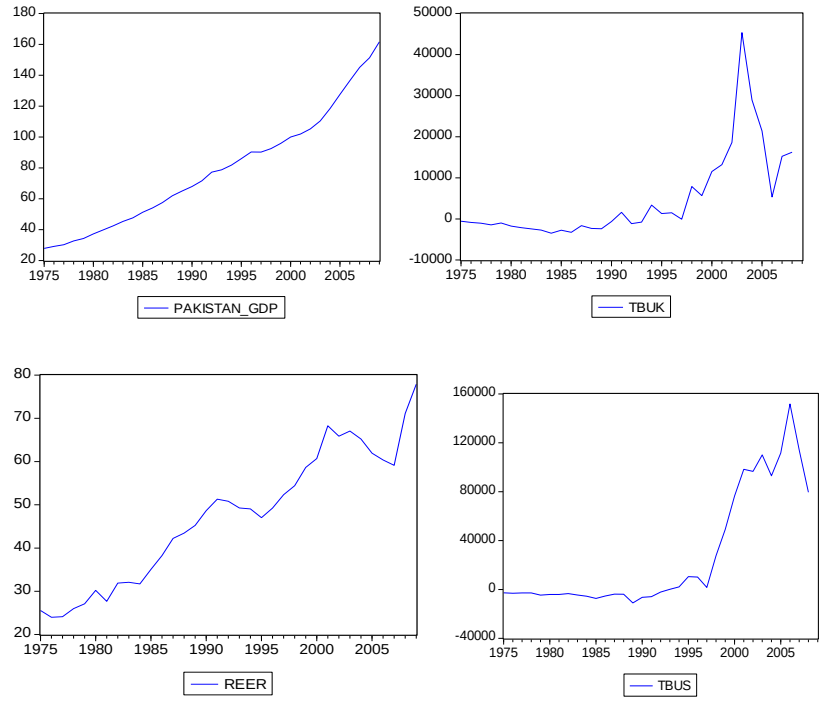

Figure 2 J-curve Graph with USA and UK

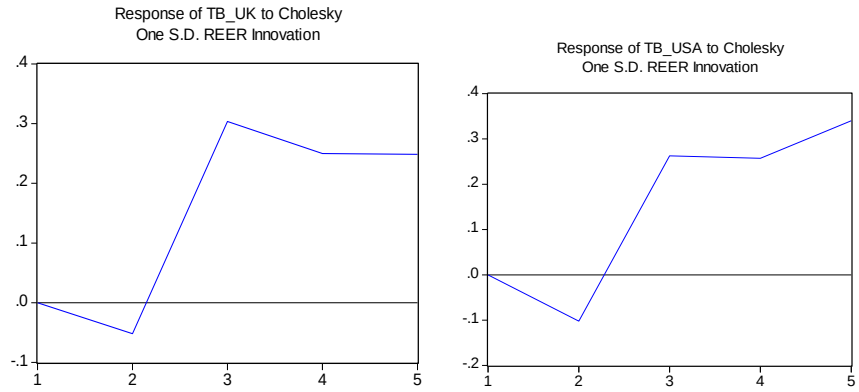

Table 1 ADF Test Results, Variables at Level and First Difference

Null hypothesis: The variables are non-stationary
At 5% level of significance

Variable	ADF Statistics at level	Probabilities	ADF at First Difference	Probabilities*
Foreign GDP (Y*)	-1.017	0.325*	-4.746	0.0001**
REER (REX)	-2.206	0.238*	-4.603	0.0002**
GDP PAK (Y)	-2.260	0.132*	-3.929	0.0004**
TB UK	-1.756	0.394*	-6.233	0.0002**
TB USA	-2.456	0.134*	-3.703	0.0010**

Note: * Variable has unit root and ** variable are stationary and significant.

Table 2 Co-integration Rank Tests: Trace and Maximum Eigen Value Statistics for the Trade Balance with UK, Domestic Income, Foreign Income and Real Effective Exchange Rate

Hypothesized No. of CE (s)	Eigen value	Trace Statistics	0.05 Critical Value	Probabilities**
None*	0.679375	79.80766	54.07904	0.0001
At most 1*	0.561312	44.54570	35.19275	0.0037
At most 2	0.354356	19.00273	20.26184	0.0738
At most 3	0.160949	5.439995	9.164546	0.2386

Table 3 Co-integration Rank Test: Trace and Maximum Eigen Value Statistics for the Trade balance with USA, Domestic Income, Foreign Income and Real Effective Exchange Rate

Hypothesized No. of CE (s)	Eigen value	Trace Statistics	0.05 Critical Value	Probabilities**
None*	0.584601	64.58867	54.07904	0.0044
At most 1*	0.473288	37.35467	35.19275	0.0288
At most 2	0.328662	17.48052	20.26184	0.0738
At most 3	0.160949	5.439995	9.164546	0.2697

Table 4 Normalized Co-integrating Equation for UK

Trade Balance UK	Real Effective Exchange Rate	GDP Pakistan	Foreign GDP	Constant
1.000	0.023466	-0.040052	0.075804	-2.687684
	(0.00629)	(0.00586)	(0.00932)	

Note Standard errors are given in parenthesis

Table 5 Normalized Co-integrating Equation for USA

Trade Balance USA	Real Effective Exchange Rate	GDP Pakistan	Foreign GDP	Constant
1.000	0.05654	-0.093001	0.186774	-6.608440
	(0.01667)	(0.01665)	(0.02645)	

Note Standard errors are given in parenthesis

Table 6 ECM Estimate for the Trade Balance with UK using Johansen Test based on (Normalized Eq.)

Variables	Coefficients	t-statistics
(TB UK+2.68-0.023REX+0.04Y-0.07Y*) t-1	-0.56	-3.33
D (TB UK (-1))	-0.609	-3.33
D (REX (-1))	-0.096	-3.66
D (REX (-2))	-0.0318	-1.96

Table 7 ECM Estimate for the Trade Balance with USA using Johansen Test based on (Normalized Eq.)

Variables	Coefficients	t-statistics
(TB USA+6.6-0.05REX+0.09Y-0.18Y*) t-1	-0.44	-2.98
D (TB USA (-1))	-0.473	-2.17
D (REX (-1))	-0.05	-3.66
D (REX (-2))	-0.0457	-1.4957

Table 8 Impulse Response of Trade Balance with USA following the Exchange Rate

Period	Value
1	0.000000
2	-0.102197
3	0.262559
4	0.257210
5	0.340030

Table 9 Impulse Response of Trade Balance with UK following the Exchange Rate

Period	Value
1	0.000000
2	-0.051822
3	0.303608
4	0.249879
5	0.248484