Estimation of Marshall Lerner Condition in the Economy of Pakistan

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Abstract

The paper evaluates Marshall-Lerner conditions in time when policy experts are facing severe structural unbalance in the economy of Pakistan. Study is based upon secondary data for quantitative analysis which spans over 30 years (1980 to 2010). Johansen Co-Integration approach was applied to examine Marshall-Lerner condition. Stationarity of data set was confirmed by application of ADF test. Analysis shows that though economy of Pakistan is resilient to external shocks and facing exchange rate market pressures even then sustainable improvement in trade balance can be achieved for if policy makers adopt devaluation. But, it is point of caution that there is urgent need to manage other factors that set into motion if monetary experts go by with a policy of exchange rate depreciation in time when difficulties are arising in managing long run value of equilibrium exchange rate.
Keywords: Depreciation, Devaluation, Current account deficit.

Introduction

The policy of exchange rate has always been a controversial issue for the developing countries. Whenever these emerging countries faced the balance of payments deficit problem, they devalued their currencies. The Marshall-Lerner condition states that "if the sum of elasticities of demand of import and export is greater than one, the trade balance improves by devaluation." This is thought necessary as well as satisfactory for the progress in the balance of trade. But, in some cases, the trade balance is continued to fall even when the Marshall-Lerner condition is fulfilled (Bahmani-Oskooee, 1985).

There are two types of exchange rate systems that exist in the current economic situation. The first one is flexible exchange rate system in which exchange rates are determined by demand and supply and there is no intervention of government. The second one is fixed exchange rate system in which exchange rates are determined by government and government makes necessary changes to sustain these rates. Flexible exchange rate is the most existing and adopted exchange rate system in recent past (Edwards, 1989).

Flexible exchange rate system is adopted as a reliable exchange rate since the collapse of gold standard and trade all over the world is carried in this exchange rate system. The value of each currency in this system is determined through market forces. There are two important factors in this system relating to value of currency; depreciation and appreciation. This change in value of any currency can have positive or negative impact on other economies. In the current global trade situation, U.S.A. has emerged as one of the most dominant economic nation and its dollar has attained central position in the international financial system. This is apparent from the fact that 41.5 percent of foreign exchange transactions were in dollars during 1995 (Ferretti, 2008).

Since the breakdown of the Bretton Woods system, the relationship between exchange rates, domestic prices and foreign prices have been important issue for policy discussions. It

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is generally accepted that macroeconomic stability which impacts economic growth favorably is ensured from the stability in exchange rates. Misaligned exchange rates can lead to a decrease in economic efficiency, a misallocation of resources and capital flight. Economic growth is badly affected by the misalignment of the exchange rates in three ways: (i) damage external competitiveness by overpricing exports, (ii) misallocation of resources by distorting domestic prices relative to international prices, and (iii) badly affecting domestic financial markets by creating uncertainty, encouraging speculation and overvaluation. Consequently, in macroeconomic policy discussions the exchange rate has received considerable attention as an important source of macroeconomic disequilibrium (Habermeier and Mesquita, 1999).

Alfred Marshall, Abba Lerner and their followers are of the opinion that the competitive advantage in international market is caused by the devaluations or depreciation of domestic currency. Domestic export becomes cheaper for foreign importers when one nation devalues its currency. On the other hand, import demand decreases because import for the same country becomes expensive by devaluation of domestic currency. So, exports increase and imports are reduced by devaluation (Sulaiman and Hussain, 2010).

Devaluation enhances competitiveness, increases exports and bends demand towards domestically produced goods, thus expanding the production of tradable, is the traditional approach that has dominated the textbooks. On the other hand, regular output declines in the consequence of devaluations hinted that the relative price adjustment caused by devaluations could bring recession. Most of the early models in the literature focused on the demand side effects of devaluations. Studies by Diaz-Alejandro (1963), Krugman and Taylor (1978), Barbone and Rivera-Batiz (1987) are some of the dominant papers of the contractionary devaluation literature. Later studies deal with supply side factors that make devaluations contractionary: Bruno (1979), Gylfason and Schmid (1983), Van Wijnbergen (1986), Agenor (1991), Gylfason and Radetzki (1991), and Taye (1999) are some of the dominant papers.

The BRM and Marshall-Lerner Conditions

The relationship between exchange rate and trade balance for the first time appeared in the paper of Bickerdike (1920), and continued to work with Robinson (1947) and Metzler (1948). These three papers are considered to be the sources of the famous Bickerdike-Robinson-Metzler (BRM) model or the elasticities approach to the balance of payments. The basic idea of this method is the substitution effect caused by the consumption and production of relative price changes caused by exchange rate changes. Change in the exchange rates changes the relative prices of goods across the domestic country and foreign countries.

The BRM model is a partial equilibrium version of a standard two-country (domestic and foreign), two goods (exports and imports) model with perfect competition in the world market, in reality. The model is not only simple, but it also captures the effect of exchange rate and income level of both domestic and foreign economy.

The volume of imported goods required by domestic residents is a function of the real household income and the relative price of imported goods. It is assumed that the demand for import goods depends positively on the real income level and it depends inversely on the relative price of the import goods.

Marshall- Lerner condition can be derived from the BRM condition with the assumption of a zero trade account initially and infinite elasticities of supply in both domestic and foreign countries i. e., $TB = 0$ (initial equilibrium).

The ML condition states that if domestic and foreign elasticities of supply are infinitely elastic, then devaluation causes an improvement of the balance of trade when home plus foreign elasticities of demand for imports, in absolute value, exceeds one (Shao, 2008).

The Marshall-Lerner condition (also called the Marshall-Lerner-Robinson, MLR, condition) is the basis of the elasticities approach to the balance of payments. It is named

after the three economists: Alfred Marshall (1842-1924), Abba Lerner (1903-1982) and Joan Robinson (1903-1983), who discovered this condition independently.

The short run and long run dynamic impact of depreciation of local currency may be different. Economic theory explains that as a result of depreciation of currency the amount of import bill increases as compared to the existing amount of import bill and this will continue till the improvement enters into the positive side. So, the balance of trade deteriorates at the start after the depreciation of local currency. These dynamics of the time path which is followed by the balance of trade is called J-curve phenomena (Sulaiman and Hussain, 2010).

The relationship between the exchange rate for a nation's currency and the country's balance of trade is explained by two concepts i.e., the Marshall-Lerner condition and the J-curve phenomena.

Pakistan has an open economy, intra country links, small market, less capital intensive economy and huge unemployment. Country is based on imports and exports to generate financial resources. But imports are high and exports are low. Nature of economy is developing and mostly faces huge import bill, constituting mostly on oil. Country is facing deficit continuously and there are intra country payment problems (balance of payments problem). To set these problems, Government set policy to enhance exports (export led policy). But we are not found competitive in exports due to absolute comparative advantage or poor competitive powers in global market. The Pakistan rupee has been characterized by a managed float since 1982 i.e., the rupee was pegged to a basket of currencies with the US dollar being the main anchor currency. To relieve Pakistan from the financial crisis, the authorities adopted a multiple exchange rate system in 1998, which comprised an official rate (pegged to the US dollar), a floating interbank rate (FIBR), and a composite rate i.e., combining the official and FIBR rates. The three exchange rates were unified and pegged to the US dollar within a certain band when the economy recovered from the crises in 1999. This band was removed in 2000. And from July 2000 Pakistan has maintained a floating rate. Even though the intervention of central bank continues, and therefore the issues of real depreciation to correct the trade balance remain controversial (Waliullah *et al.*, 2010).

Pakistan's economic history provides indications concerning its openness with the passage of time. Pakistan's economic openness of trade is a gradual process. By adding imports and exports of any country openness is attained. By increasing exports of any country, its economic growth can be improved. As reflected in foreign currency it also becomes the source of increase in earnings of a country. Demand for exports of products of any country depends upon several factors. These factors include price of its products, quality of its products and economic conditions of importing country.

During the fiscal year 2002-2003 more than 75 percent imports of Pakistan were consisted of only eight items. With the passage of time there is an increasing trend in Pakistani import. This import figure consists of both consumer goods and capital goods, but imports of consumer goods are increasing faster than the imports of capital goods. Total imports of Pakistan in 1975 were 53,185 million rupees and it increased to the level of 212,019 million rupees at the end of 1985 within a short span of ten years. In these ten years, total of imports and exports showed growth of about 300 percent. This figure became 619,882 million rupees in 1995 and 2,130,061 million rupees at the end of 2005, showing that within a period 1985 to 1995 growth rate of openness was high as compared to previous ten years period which further increased during 1995-2005 (Mahmood *et al.*, 2011).

Frequent crises in the current account of the balance of payments are a major problem of economy of Pakistan. When output growth rate of Pakistan increases and this is not due to a rise in the growth of its exports, the result is a crisis of balance of payments. Indeed, suggested by recent developments in Pakistan's economic conditions that the main limitation is likely to come from an under performance in the growth of exports and the resulting

balance of payments problems (Felipe & Lim, 2008). In particular, there are concerns about the changing composition of output and the rise in significant deficits in the current and fiscal accounts. The current account deficit rose to 8.4 percent of GDP in the fiscal year 2007-2008. This had led to a serious balance of payments crises.

The problem had become so serious that Pakistan had to enter into an IMF Programme and borrow US$ 7.6 billion to avoid defaulting on its sovereign debt in November 2008. The rupee had depreciated by 20 percent over the period March-November 2008. The Fund frequently asks countries for fiscal rectitude (i.e., the lower budget deficit with a rapid move to a balanced budget) as a loan condition.

Pakistan's current account deficit was reported equivalent to 815 Million US Dollars in the fourth quarter of 2011. Rice, furniture, cotton fiber, cement, tiles, marble, textiles, clothing, leather goods, carpets and rugs and food products are exported by Pakistan. Pakistan imports include mainly petroleum, petroleum products, machinery, plastics, transportation equipment, edible oils, paper and paperboard, iron and steel and tea. Its major trading partners include: European Union, China, The United Arab Emirates and The United States. Pakistan's current account was last reported at -2.3 percent of GDP. From 1980 until 2010, average current account of Pakistan as percent of GDP was -2.41 percent reaching the historical high of 4.90 percent in December of 2003 and in December 2008 a record low of -8.50 percent (Economic Survey of Pakistan, 2011).

In spite of a recent improvement in the external current account, controlled government borrowings from SBP and stable financial markets, the focus must remain on addressing the structural fiscal weaknesses and reducing inflation in order to provide a sound platform for sustainable economic recovery in fiscal year of 2012. (State Bank of Pakistan, 2011).

As a policy option when the governments those trades want to take initiative to boost its country export or want to make them more competitive, the policy experts take some serious action in the light of responsiveness of the good and services which that are exported and imported by this country. This process involves to find out the respective elasticities of exported and imported goods weather the sum of export and import elasticity is greater than one or not, which is generally studied under Marshall Lerner condition which argues that to have a viable trade balance in favor, a country must have summation of export and import elasticities greater than one or satisfying the Marshal Lerner condition. So there always remains the question whether this balance is in favor to achieve increase in export competitiveness. This question is a need to analyze on the basis of empirically investigation with special reference to Pakistan where severe volatility in the currency markets leading to local currency is depreciating continuously. Will this depreciation is on the other hand making our export balance to change?

In order to answer these questions objectives are framed. The main objective of the study is:

- Examine the validity of the argument that exchange rate devaluation improves the trade balance, in Pakistan.
- Policy recommendations.

Review of Literature

Fluctuations in the exchange rate may have a significant impact on the macroeconomic fundamentals such as interest rates, prices, wages, unemployment, and the level of output. This may ultimately results in a macroeconomic disequilibrium that would lead to real exchange rate devaluation to correct for external imbalances. The topic of exchange rate has gained much more importance in Pakistan since the adoption of floating exchange rate patterns. Theoretically, a direct linkage between exchange rate volatility and

macroeconomic variables of any country is described, but empirical investigation shows that there is no consensus about it because of mixed pattern of results found in those studies.

Adubi *et al.,* (1991) evaluated the impact of price volatility and exchange rate volatility on agricultural trade flow. Bleany *et al.,* (1999) analyzed through a model that if exchange rate of developing countries is pegged to exchange rate of developed countries, the inflationary expectations in developing countries may be reduced. Frey (1999) investigated the impact of short run volatility of exchange rates on the volume of exports. Cooper (1999) compared the scope of different exchange rate choices availed by rich and developing countries. Liwang (2000) studied the impact of exchange rate volatility on flow of international trade. Kawai *et al.,* (2000) discussed conceptual and empirical issues relevant to exchange rate policies. Larrain *et al.,* (2001) put light on the question of which exchange rate arrangement should be adopted by middle income countries. It has been argued by Frydman *et al.,* (2001) argued that the standard Rational Expectation Hypothesis (REH) assumption is the primary reason for the empirical failure of the monetary models of the exchange rates.

Esquivel and Felipe (2002) described the exchange rate volatility of G-3 countries. Rollemberg *et al.,* (2002) emphasized the relationship between alternative exchange rate regimes and the different concepts of money and the role of the market as an economic regulator. Zhang (2002) reviewed China's foreign exchange reforms and analyzed their impact on the balance of trade and inflation. Maskay (2003) reviewed the patterns of economic shocks affecting the SAARC member countries. Vuletin (2003) analyzed the influence of exchange rate regimes on fiscal performance focusing on the difference between fixed & floating exchange rate. Shambaugh (2003) investigated how a fixed exchange rate affects monetary policy? Avellan (2003) evaluated the relationship between parallel exchange rates. Hoffman (2003) compared fixed exchange rate with floating exchange rate. Clark (1959) reviewed the impact of exchange rate volatility on the world trade. Hussain *et al*., (2004) investigated the durability and performance of alternative exchange rate regimes of all IMF member countries. Nabi (1996) reviewed the recent trade performance and progress regarding tariff reforms of Pakistan. Aurangzaib *et al*., (2005) investigated the relationship among economic performance, growth and exchange rate uncertainty in Pakistan.

The impacts of currency depreciation on a country's trade balance have been extensively examined in the empirical literature in the context of the Marshall Lerner condition and the J-curve theory. Numerous papers have tested the Marshall Lerner condition and J-curve. Bahmani-Oskooee and Niroomand (1998) have tested the Marshall Lerner condition for 30 developed and developing countries for the period 1960-1992. Gomes and Paz (2005) and Tsen (2006) find the existence of a long-run relationship between the trade balance, RER, foreign and domestic income for Brazil and Malaysia during 1965-2002. Bahamani-Oskooee and Ratha (2004) provide a good survey on the Marshal Lerner condition and J-curve, showing inconclusive results for this issue.

Afzal (2001) concluded that the effects of devaluation or depreciation on the trade balance of a country are usually examined by the Marshall-Lerner condition which states that if the sum of the absolute values of imports and export demand price elasticities is greater than one, devaluation is expected to improve the trade balance of a country. Co-integration being concerned with long run relationship among economic variables was used to estimate the long run Marshall-Lerner condition. Co-integration approach has supported the Marshall-Lerner condition. This suggests that devaluation should improve the trade balance in Pakistan.

Materials and Methods

The MLR condition states that if the sum of elasticity of the demand for imports and exports with respect to the real exchange rate is greater than one, ($\varepsilon + \varepsilon^* > 1$) then a real

devaluation of a currency will improve the balance of trade. The Marshall-Lerner condition assumptions are as follows: firstly, the influence of exchange rate changes is taken on the trade goods with other conditions unchanged; secondly, international balance is equal to the trade balance without the consideration of the capital flow; thirdly, the trade goods supply is of full elasticity; fourthly, the balance of trade is balanced initially. Resting on the above assumptions, it is assumed that e^x denotes the elasticity of export and e^m indicate the elasticity of import and then the following conclusion is achieved:

The depreciation of home currency will improve the trade balance if $e^x+e^m>1$;

if $e^x+e^m=1$, the depreciation of home currency will make no difference to the trade balance;

if $e^x+e^m<1$, the trade balance will be deteriorated with the depreciation of home currency.

The definition of elasticity is based on the mathematical concept of point elasticity. In general, the "x-elasticity of y", also called the "elasticity of y with respect to x", is:

$$E_{y,x} = \left| \frac{\partial \ln y}{\partial \ln x} \right| = \left| \frac{\partial y}{\partial x} \cdot \frac{x}{y} \right| \approx \left| \frac{\%\Delta y}{\%\Delta x} \right|$$

The numerator Δy is the change in variable y and the denominator Δx is the change in variable x. Change in variable, x causes a change in variable, y.

3.1 Functional Form

In order to study the long-run equilibrium relation between volume of imports and its determinants in one relation and the volume of exports and its determinants in another relation, following the literature it is assumed that the import and export demand equations take the following forms:

$Log\ M_t = F[Log\ (PM/PD)_t,\ Log\ NEX_t,\ Log\ Y_t]$ ……………………．   (1)

$Log\ X_t = F[Log\ (PX/PXW)_t,\ Log\ NEX,\ Log\ YW_t]$ ……………………．   (2)

Independent variables: Of equation (1) ratio of index of unit value of imports to the index of domestic price level, $Log\ (PM/PD)_t$, nominal effective exchange rate, $Log\ NEX_t$, country income, $Log\ Y_t$

Dependent Variable: Of equation (1) import volume, $Log\ M_t$

Independent variables: Of equation (2) the ratio of country's export unit value index to the export unit value index of the world, $Log\ (PX/PXW)_t$, nominal effective exchange rate, $Log\ NEX$, world income $Log\ YW_t$.

Dependent Variable: Of equation (2) export volume, $Log\ X_t$

<u>*VARIABLES:*</u>

M = imports volume

PM = import prices

PD = domestic price level

Consumer Price Index (CPI) is the most common price level index.

NEX= nominal effective exchange rate

Y = domestic income

X = volume of exports.

PX = export prices

PXW = world export price level

YW = world income.

It is noted that the price term has a negative coefficient in each equation. Nominal effective exchange rate, which is defined as units of foreign currency per unit of domestic currency, a decrease in it, indicates that imports are likely to be discouraged and exports are

likely to be encouraged by a depreciation of domestic currency. Thus, the coefficient attached to NEX variable in the import demand equation is expected to have a positive sign and in the export demand equation, it is expected to have a negative sign. The income terms in both models are expected to carry positive coefficients (Bahmani-Oskooee, 1991).

Nature and Sources of Data

This study involves secondary data for quantitative analysis. The data is time series and is collected on annual basis for the time period of 1980-2010. Keeping in view the objectives of the study and nature of the data, the secondary data is collected from following sources:

* International Financial Statistics
* Pakistan Economic Survey
* World Development Indicator
* Pakistan Institute of Development Economics (PIDE)
* State Bank Of Pakistan
* World Economic Outlook, World Bank

From the Economic Survey of Pakistan the data on GDP, Consumer Price Index (CPI), value of imports and exports is taken. The data on World Income is obtained from the various issues of World Tables. The data on the subject of export unit value index for Pakistan and the world in US$, unit value of imports is obtained from International Financial Statistics (IFS) yearbooks of various years. From the annual reports of State Bank of Pakistan the data on nominal exchange rate is taken (various reports).

Econometric Technique

Current econometric Johansen co-integration techniques are followed for estimation purposes and before the co-integration technique is applied, it is important to determine the order of integration of each variable. ADF (Augmented Dickey-Fuller) will be used for determining the order of integration. For co-integration purpose the Johansen (1988) and Johansen and Juselius (1990) technique of is applied. A multivariate generalization of the Dickey-Fuller test is the Johansen's technique.

The bench mark paper for estimation of Marshall-Lerner condition is "Co-integration Approach to Estimate the Long-run Trade Elasticities in LSD's" by Mohsen Bahmani-Oskooee, it was published in International Economic Journal, volume 12, number 3, autumn 1998.

There are two broad approaches to test the co-integration among variables, that have frequently been used i.e., the method of Engel and Granger (1987) and Johansen co-integration method. The Engel and Granger (1987) method is based on the assessment that whether the estimates of the equilibrium errors of single-equation appear to be stationary or not. The second approach, due to Johansen (1988) and Johansen and Juselius (1990), is based on the Vector Autoregression (VAR) approach, it is a version of analyzing co-integrated system that is multivariate. In order to determine the rank of the co-integrating vector it specifies maximum likelihood estimation. It is claimed that the Johansen-Juselius approach is superior to the Engel and Granger procedure.

3.6 Test of Stationary Data

When the mean, variance and auto covariance (at various lags) of the data remain the same no matter at what point these are measured, the time series data is said to be stationary. In other words, they do not change with time. A stationary time series is one that does not change over time. A non-stationary time series is the one that shows some kind of upward or

downward movement (unit root). Data of time series should be stationary. So, it is important to convert the non-stationary time series into the stationary time series (Dickey and Fuller 1984).

Augmented Dickey-Fuller Test

An **augmented Dickey–Fuller test (ADF)** is a statistical and econometrics test for a unit root in a time series sample. It is an improved version of the DF test and is used for a larger and more complex set of time series models.

In the ADF test, in order to make the error term εt white noise, the lags of the first difference are incorporated in the regression equation. The testing process for the ADF test is the same as for the Dickey-Fuller but it is applied to the model

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1}\Delta y_{t-p+1} + \varepsilon_t, \dots\dots(3)$$

Where, α is a constant, β the time trend coefficient, γ the coefficient of y_{t-1} and p is the lag order of the autoregressive process.

The ADF test can be carried on at least three possible models:

(i) A pure random walk without a drift. This is defined by using $\alpha = 0$, $\beta = 0$ and $\gamma = 0$. This leads to the equation

$$\Delta y_t = \Delta y_{t-1} + \varepsilon_t \dots\dots\dots\dots\dots(4)$$

It is a non-stationary series because its variance grows with the passage of time (Pfaff, 2006).

(ii) A random walk with a drift. This is obtained by imposing $\beta = 0$ and $\gamma = 0$, which results to the equation

$$\Delta y_t = \alpha + \Delta y_{t-1} + \varepsilon_t \dots\dots\dots\dots(5)$$

(iii) A deterministic trend with a drift. For $\beta \neq 0$, equation becomes the deterministic trend with a drift model

$$\Delta y_t = \alpha + \beta_t + \Delta y_{t-1} + \varepsilon_t \dots\dots(6)$$

The sign of the drift parameter α causes the series to drift upward if positive and downward if negative, while the steepness of the series is affected by the size of the absolute value (Pfaff, 2006).

The parameter γ is of interest in the ADF model. For $\gamma = 0$, unit root is contained in the y_t sequence and therefore it is integrated of order $d = 1$.

Under the null hypothesis of $H_o : \gamma = 0$ and the alternative hypothesis of $H_1 : \gamma < 0$, the unit root test is carried out. Once a value for the test statistic is calculated,

$$DF_\tau = \frac{\hat{\gamma}}{SE(\hat{\gamma})} \dots\dots\dots\dots\dots\dots.(7)$$

It can be compared to the appropriate critical value for the Dickey–Fuller Test. If the test statistic is less than the critical value or is a larger negative value, then the null hypothesis of $\gamma = 0$ is rejected and no unit root is present. Absolute values are not considered because this test is non-symmetrical.

Johansen Co-Integration Test

The Johansen's technique is a multivariate generalization of the Dickey-Fuller test. How many of the co-integration vectors are significant i.e., what is the rank of the co-integration matrix is tested by Maximum Likelihood procedure. The Vector Autoregressive (VAR) demonstration of this method is as follows:

$$X_t = \mu + \Pi X_{t-1} + \Pi X_{t-2} + \Pi X_{t-3} + \dots\dots\dots\dots + \Pi X_{t-k} + \varepsilon_t \dots\dots\dots (8)$$

Where, $\varepsilon_t \sim N(0, \Sigma)$. The rank of the matrix Π is estimated by Johansen that is the rank of the coefficient matrix of the lagged variables. The number of co-integrating relationships is

mirrored by this rank. If the data set consists of two or more time series, this method can estimate more than one co-integrating relationship. So, this method has advantage over the Engle-Granger and the Phillips-Ouliaris method. For the number of co-integrating vectors two test statistics are used by Johansen method:

- The Trace test
- Maximum Eigen value (λ-max) test.

The Trace test

      The null hypothesis of r co-integrating vectors against the alternative hypothesis of n co-integrating vectors is tested by the trace test. The test statistic is shown by

$$J_{trace} = -\, T \sum_{i=r+1}^{n} ln(\,1 - \lambda i\,) \quad \text{.......................} \quad \textbf{(9)}$$

The Maximum Eigen value:

      The null hypothesis of r co-integrating vectors against the alternative hypothesis of (r+1) co-integrating vectors is tested by the Maximum Eigen value test. Its test statistic is given by

$$J_{max} = -\, T\,(1 - \lambda_{r+1}\,) \quad \text{...................}\textbf{(10)}$$

Where, the sample size is represented by T, and λ_i represents the ith largest canonical correlation.

      Test of co-integration and calculation of a vector error-correction model to distinguish between short-run and long-run responses is the remedy for integrated variables problematic regression. In modeling a number of studies, the technique of co-integration and error-correction model have both been used before, for example, in modeling gasoline demand of Danish (Bentzen, 1995), the road transport energy demand for Australia (Samimi, 1995), demand for coal in India (Kulshreshtha and Parikh, 1999), coal demand in China (Chen and Lee, 1997) and the United Kingdom's final user energy demand (Fouguest, *et al.,* 1997). In these studies, in order to find out the rank of co-integration the multivariate Johansen co-integrating framework was used.

Results and Discussions

      The main intention of this study is to study the estimation of Marshall-Lerner condition in economy of Pakistan. The secondary data was used for quantitative analysis. The technique of Johansen co-integration was used to examine the Marshall-Lerner condition. Apart from Johansen co-integration technique, to check the stationarity of the data unit root test was applied. The first step of analysis was to check the stationarity of the data. So, before proceeding to the data analysis, stationarity of all the variables included in current study was checked.

      To determine the degree of integration of each variable i.e., how many times each variable needs to be differenced in order to achieve stationarity, is the first step in applying co-integration technique. Augmented Dicky-Fuller (ADF) test of unit root is applied to check the stationarity, unit root test technique was also used. If mean, variance and covariance of the series remain constant over time it is said to be stationary. It is non-stationary if they vary over time. The results are as follows:

Table 1: Stationarity of All Variables

Variable	ADF Value	Critical Value	Degree of Integration	Probability	Lag
Imports volume	-4.135739	-2.9665**	I(1)	0.0003	0
Ratio of import prices to domestic price level	-4.601023	-2.9665**	I(1)	0.0001	0
Nominal effective exchange rate	-5.918792	-2.9665**	I(1)	0.0000	0
Domestic income	-4.606053	-2.9907**	I(1)	0.0003	5
Exports volume	-5.609951	-2.9665**	I(1)	0.0000	0
Ratio of export prices to world export price level	-4.511925	-2.9665**	I(1)	0.0001	0
World income	-4.110727	-2.9665**	I(1)	0.0003	0

*1% Critical Value
**5% Critical Value
***10% Critical Value

The table (1) show that by taking first difference all variables are stationary. The ADF value of all variables is more negative than critical value at 5% so all the seven variables are stationary at 5% critical level.

Results mentioned in the Table 1 show that all the variables are significant at first difference. Order of integration is determined by unit root test. The level of significance is 5 percent. Results indicate that at order of integration I (1) all variables are stationary. The series is supposed to be of order 0, I(0) or stationary at level, when its integration order is 0. On the other hand, series is said to be stationary at 1st difference when its order is I(1), and when it is I(2), it is said to be stationary at 2nd difference. In general, series is said to be stationary at d difference when its order is I(d). In current case, the series is of order 1 or 1(1) because at first difference all the variables achieve stationarity. Order of integration is determined by ADF (Augmented Dickey-Fuller) test.

The variables i.e., imports volume, ratio of prices of imports to home price level, nominal effective exchange rate, exports volume, ratio of prices of exports to export price level of world and income of world have zero lag values. But the variable of domestic income have five lag values, i.e., it depends on its five previous values.

Auto-Correlation

Auto-correlation is described as "relationship between members of series of observations ordered in time (in time-series data) or space (in cross-sectional data)." It is assumed in Classical Linear Regression Model that there is no auto-correlation in the disturbances u_i. In other words, the disturbance term concerning to one observation is not influenced by the disturbance term concerning to any another observation (Gujarati, 2005).

There are different methods to detect auto-correlation. These include graphical methods as well as statistical tests. For the detection of auto-correlation the most well-known test is developed by Durbin and Watson, the two statisticians. It is normally known as **Durbin Watson *d* Statistic.** It is basically the proportion of the sum of squared differences in

consecutive residuals to the RSS (Gujarati, 2005).

Co-Integration Test Results

Co-integration shows long-run relationship between variables. If the residuals are stationary after the co-integration test than there is true relation. Series is co-integrated, which shows that between the variables there is long-run relationship.

However, if after the application of co-integration, the residuals are non-stationary than there is spurious relation, i.e., actually the variables are not correlated but due to any third factor, correlation is achieved.

Results of model (1)

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	0.034090	0.046246	0.737157	0.4676
D(LPM/PD)	0.458163	0.203314	2.253480	0.0329
D(LNEX)	-0.215739	0.461256	-0.467721	0.6439
D(LY)	0.283185	0.410908	0.689169	0.4968

Durbin-Watson stat $2.626380 \approx 2$ no auto correlation

Interpretation: Applying co-integration test on model (1), results that it is statistically significant. Long-run relationship is there between the variables.

For the purpose of checking the auto-correlation the value of d is of concern. There is a thumb rule that if d is found to be near 2 in any regression result, one may assume that there is no auto-correlation, either positive or negative. By looking at the Durbin-Watson stats it has been observed that there is no auto-correlation present in the result because in present case the value of d is approaching to 2. Hence, it is concluded that residuals or error terms of the model are not co-related.

Applying ADF on error term

Augmented Dickey Fuller test statistic		**-4.028345**
Test critical value	**5% level**	**-2.991878**

ADF value is more negative than the critical value at 5 percent; it shows that error term is stationary at 5 percent critical value. Its mean, variance and covariance are constant over time.

4.3.2 Results of original model: *Log M$_t$ = F[Log (PM/PD)$_t$, Log NEX$_t$, Log Y$_t$]* …(11)

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	-5.850329	4.567103	-1.280972	0.2111
L(PM/PD)	0.710838	0.105241	6.754373	0.0000
LNEX	-0.530092	0.183559	-2.887851	0.0075
LY	0.698117	0.150323	4.644098	0.0001

Durbin-Watson stat   2.475478 ≈ 2 no auto correlation

Interpretation:

Applying co-integration on original model, results that it is statistically significant. There is long-run relationship between variables.

R-Squared	0.984579
Adjusted R^2	0.982866
Akaike info criterion	-2.026361
Schwarz criterion	-1.841330

Interpretation:

The table of results for the original model (1) depicts that the value of R^2 is 0.98 which is very high and it shows that variation in dependent variable due to independent variable is much high. The value of Durbin-Watson is about 2 so there is no auto-correlation. Akaike info criterion value is -2.026361 and Schwarz criterion value is -1.841330, the lower the values of AIC and SICS, the better the model.

The overall results of model (1) show that between variables there is long-run association. Results are statistically significant and there is co-integration.

Results of model (2)

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	-0.010020	0.028435	-0.352372	0.7274
D(LPX/PXW)	0.097626	0.157990	0.617924	0.5420
D(LNEX)	-0.922098	0.374664	-2.461135	0.0208
D(LYW)	0.486315	0.364366	1.334689	0.1935

Durbin-Watson stat   2.626380 ≈ 2 no auto correlation

Interpretation

Applying co-integration test on model (2), results that it is statistically significant. There is long-run association between the variables.

In order to check auto-correlation the value of d is of concern. There is a thumb rule that if d is found to be near 2 in any regression result, one may assume that there is no auto-correlation, either positive or negative. By looking at the Durbin-Watson stats it has been observed that there is no auto-correlation present in the model hence, it is concluded that residuals of the model are not co-related.

Applying ADF on error term

Augmented Dickey Fuller test statistic	**-7.134914**
Test critical value **5% level**	**-2.967767**

From the critical value at 5 percent, ADF value is more negative, it shows that error term is stationary at 5 percent critical value. Its mean, variance and covariance are constant over time. Stationarity of error term is achieved. Now there is no variation in the means, variances and covariance.

Results of original model: *Log X_t = F[Log (PX/PXW)$_t$, Log NEX, Log YW$_t$]*

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	-19.15527	5.400251	-3.547107	0.0014
L(PX/PXW)	0.095957	0.076234	1.258725	0.2189
LNEX	-0.304671	0.173648	-1.754531	0.0907
LYW	0.960798	0.146589	6.554386	0.0000

Durbin-Watson stat   2.468010≈ 2 no auto correlation

Interpretation:

Applying co-integration on original model, results that it is statistically significant. There is long-run association between variables. There is co-integrated in variables.

R-Squared	0.986558
Adjusted R^2	0.985064
Akaike info criterion	-2.090780
Schwarz criterion	-1.905750

Interpretation:

The table of results for the original model (2) depicts that the value of R^2 is 0.98 which is very high and it shows that variation in dependent variable due to independent variable is much high. The value of R^2 in current table is 0.98 showing that 98 percent variation in dependent variable is due to independent variables. The value of Durbin-Watson is about 2 so there is no auto-correlation. Akaike info criterion value is -2.090780 and Schwarz criterion value is -1.905750, the lower the values of AIC and SICS, the better the model.

The overall results of model (2) depicts that there is long-run association between variables. Results are statistically significant and there is co-integration between variables of model (2).

4.4 Marshall-Lerner Condition:

The MLR situation states that the trade balance will be enhanced by the devaluation of a currency if the sum of elasticity of the demand for its imports and exports with respect to its real exchange rate is greater than one. It is assumed that e^x indicates the export elasticity and e^m denote the elasticity of imports and then the following conclusion is achieved:

if $e^x+e^m>1$, the balance of trade will be enhanced by the depreciation of home currency;

if $e^x+e^m=1$, the trade balance will not be affected by the depreciation of home currency;

if $e^x+e^m<1$, the depreciation of home currency will worsen the trade balance.

Elasticity can be measured by taking the log of the values. By applying test on volume of exports and imports, the following result is obtained:

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	-2.290165	0.452111	-5.065491	0.0000
LM	3.146317	0.143385	21.94313	0.0000
LX	-2.127810	0.138253	-15.39068	0.0000

LM = log of imports = 3.146317
LX = log of exports = -2.127810
Taking the sum,
LX + LM = -2.127810 + 3.146317
LX + LM = 1.018507

Co-integrating Vectors Normalized on Log M

Log M	- Log (PM/PD)	+ Log Y	+ Log NEX
1.00 (12.02)	1.09 (18.56)	3.26 (10.26)	-1.27 (7.14)

The critical value of χ^2 = 5.99 at the 5% level of significance.

Co-integrating Vectors Normalized on Log X

Log X	- Log (PX/PXW)	+ Log YW	- Log NEX
1.0(11.08)	1.92(12.5)	-2.78 (5.13)	2.043 (8.36)

The critical value of χ^2 = 3.84, at the 5% level of significance.

Interpretation:

On the basis of both λ-max and λ- trace tests, the no co-integration null hypothesis are discarded. The co-integration outcome shows that there are co-integrating vectors in the exports function and function of imports. Since the aim is estimation of long run elasticities of export and import, the co-integrating vectors are normalized following the common

practice on the Log M in the function of imports and on the Log X in the function of exports. While, much normalization are possible, it is usually found out by the economists that it is suggested by the interpretation of the co-integrating vectors that one of the coefficients in each vector must be put equal to 1 (Patterson, 2000).

At this moment it is compulsory to find out in which of the variables co-integration is present. Likelihood ratio test is used for this reason. This test can be executed by making the coefficient of each variable equal to zero. Exclusion of a variable by the test of Likelihood ratio is given as:

$$-2Ln(Q) = -T \sum_{i=1}^{r} Ln[(1 - \lambda^*_I)/(1 - \lambda_i)] \ldots\ldots..(12)$$

Where, the amount of co-integrating vector is represented by r, the Eigen value of the ith vector of the original co-integrating space is λ_i and λ^*_I is the Eigen value of the of the ith vector of co-integrating space that is new, obtained when variable is excluded. It has been shown by Johansen and Juselius that the expression mentioned above is distributed as χ^2 with r (p-s) degrees of freedom and where the number of co-integrating vectors is r, p is the dimension of the original co-integrating space the dimension of the newly co-integrating space is represented by s. By the restriction of the coefficient of a variable equal to zero, the latter space is achieved, s = p-1 and the degrees of freedom is equal to r (p-p+1) = r of each χ^2 (Bahmani-Oskooee ,1996).

In Table 4.4.1 and Table 4.4.2 in the bracket next to each coefficient, the likelihood ratio test for the exclusion of each variable has been reported. As the χ^2 value exceeds χ^2 = 5.99 for import function and χ^2 = 3.84 for export function, the coefficients are significant. These expressions explain that the elasticities of import and export are adequately high and in absolute terms as the Marshall-Lerner condition says, they add up to more than one.

The elasticity of exports and imports is larger than 1, which means that the trade balance of Pakistan will be improved by the devaluation of Pakistan's currency. It is favorable for Pakistan to depreciate its currency relative to US Dollar. The trade balance of Pakistan will improve. So, the Marshall-Lerner condition is satisfied for Pakistan's Economy.

Summary

Most developing countries, including Pakistan, have devalued their currencies, time and again, whenever they have faced the balance of payments deficit problem. The Marshall-Lerner condition states that "if sum of import and export demand elasticities is greater than one, devaluation will improve the trade balance". The main objective of the study is to estimate Marshall-Lerner condition in the economy of Pakistan. The study is based upon the time-series 1980-2010. Johansen co-integration technique has been followed for estimation purposes and before the co-integration technique is applied, the order of integration of each variable is determined. ADF (Augmented Dickey-Fuller) unit root test has been used in order to check the stationarity of time series and the order of integration. Two types of equations have been established for imports and exports to investigate the long-run relationship between volume of imports, the ratio of import prices to domestic price level, domestic income and nominal exchange, similarly, volume of exports, the ratio of export prices to world export price level, nominal exchange rate and world income. Problem of non-stationarity was there and after the application of Augmented Dickey-Fuller test, stationarity was achieved. According to results there exists long-run relationship between the variables, they are co-integrated. The results also show that Marshall-Lerner condition is satisfied for the economy of Pakistan. The elasticity of exports and imports is larger than 1, which means that the trade balance of Pakistan will improve

References

- Adubi, A., A. Okunmadew and Denial. 1991. Price, exchange rate volatility and Nigeria's agricultural trade flows: A dynamic analysis, AERC Research Paper 87 African Economic Research Consortium, Nairobi.
- Afzal, M. 2001. Exports in a Simultaneous Model The Case of Pakistan Government College, Economic Journal, Vol. XXXIV, No. 1&2 pp. 53-66.
- Afzal, M. 2001b. "Import Functions for Pakistan – A Simultaneous Equation Approach" The Lahore Journal of Economics, Vol. 6, No. 2. pp. 109-116.
- Aftab, Z. and S. Khan. 2008. Bilateral J Curves between her Trading Partners. PIDE Working Paper No.45.
- Aftab, Z. and Aurangzeb. 2002. The Long run and Short run Impact of Exchange Rate Devaluation on Pakistan' s Trade Performance.
- Agenor, P. R., 1991. Output, devaluation, and the real exchange rate in developing countries. Weltwirtschaftliches Archive, Vol. 127, pp. 18–41.
- Akhtar, S. and F. Malik. 2000. Pakistan Performance vis a vis its Major Trading Partners. Pakistan Development Review, 39(1): 37.
- Alexander, S. 1959. Effects of a Devaluation: A simplified Synthesis of Elasticities and Absorption Approach. American Economic Review, pp.22-42.
- Arize, A. C. 1994. Cointegration test of a long-run relation between the real effective exchange rate and the trade balance. International Economic Journal, 8(3):1–9.
- Arndt, H. W. and G. Dorrance. 1987. The J-Curve. Australian Economic Review, 20(11): 9-19.
- Aurangzeb, A., T. Stengos and Muhammad. 2005. Short-Run and Long-Run Effects of Exchange Rate Volatility on the Volume of Exports: A Case Study for Pakistan. International Journal of Business and Economics. 4(3): 209-222.
- Avellan, L. M. 2003. Parallel exchange rates and economic performance in developing countries: is the medicine worse than the disease?, University of Maryland, Central Bank of Ecuador and ESPOL.
- Baharumshah, A. Z. 2001. The Effects of Exchange Rate on Bilateral Trade Balance: New Evidence from Malaysia and Thailand Asian Economic Journal, 15(3): 291-312.
- Bahmani Oskooee, M. 1985. Devaluation and the J Curve: Some Evidence from LDCs. The Review of Economics and Statistics, 67(3): 500-504.
- Bahmani Oskooee, M. 1991. Is There a Long run Relation between the Trade Balance and the Real Effective Exchange Rate of LDCs? Economics Letters, 36(4): 403-407.
- Bahmani Oskooee, M. and A. Ratha. 2004. The J Curve: A Literature Review. Applied Economics, 36(13): 1377-1398.
- Bahmani Oskooee, M., G. Goswami and B.K. Talukdar. 2005. The Bilateral J Curve: Australia versus Her 23 Trading Partners. Australian Economic Papers, 44(2): 110-120.
- Bahmani Oskooee, M. and F. Niroomand. 1998. Long run Price Elasticities and The Marshall Lerner Condition Revisited. Economic Letters, 61: 101-109.
- Barbone, L. and F. Rivera-Batiz. 1987. Foreign capital and the contractionary impact of currency devaluation, with an application to Jamaica. Journal of Development Economics, Vol. 26: 1-15.
- Belloumi, M. 2009. Energy consumption and GDP in Tunisia: Cointegration and causality analysis. Energy policy, 37:2745-2753.
- Bentzen, J., 1995. An empirical of gasoline in Denmark using cointegration approach. Energy Economics, 17:329-339.
- Bickerdike, C. F. 1920. The instability of foreign exchanges. The Economics Journal, March.

- Bird, G. 1983. Should Developing Countries Use Currency Depreciation as a Tool of Balance of Payments Adjustment? A Review of the Theory and Evidence: A Guide for the Policy Makers. The Journal of Development Studies, Vol.9, No.6, pp. 461-483.
- Blecker, R. A. and A. Razmi. 2007. The fallacy of composition and contractionary devaluations: output effects of real exchange rate shocks in semi-industrialised countries. Cambridge Journal of Economics, 32(1), pp. 83-109.
- Branson, W. H. 1986. Stabilization, stagflation, and investment incentives: The case of Kenya, 1979-1980. In Sebastian Edwards, Liaqat Ahamed (Eds.), Economic Adjustment and exchange rates in developing countries. Chicago, pp. 267- 293.
- Crowder, W. J. 1996. Purchasing Power Parity over the Modern Float: An Application in Higher Order Cointegration. Economics Letters, 40: 313-318.
- Diaz-Alejandro, C. F. 1963. A note on the impact of devaluation and the redistributive effects. Journal of Political Economy, 71: 577–580.
- Diaz-Alejandro, C. F. 1965. Exchange rate devaluation in a semi industrialized country: The experience of Argentina, 1955—1961. MIT Press, Cambridge, MA.
- Dickey, D. A. and W. A. Fuller. 1984. Likelihood ratio statistics for autoregressive time series with a unit root. Econometrika, 49 (4): 1057 – 1072.
- Edwards, S. 1986a. Are Devaluations Contractionary? The Review of Economics and Statistics, Vol. 68, pp. 501-508.
- Edwards, S. 1989a. Exchange controls, devaluations, and real exchange rates: The Latin American Experience. Economic Development and Cultural Change. Vol. 37, pp. 457-494.
- Edwards, S. 1989b. Real Exchange Rates, Devaluation, and Adjustment. MIT Press, Cambridge, MA.
- Engle, R. F. and C. W. J. Granger. 1987. Co-integration and Error Correction: Representation, Estimation and Testing. Econometrica, Vol.55, No.2, pp. 251-276.
- Esquivel, G. and L. B. Felipe. 2002. The impact of G-3 Exchange Rate Volatility in Developing Countries. G-24 Discussion Paper Series No. 16: 453-486.
- Fan, E. X. 2002. Implications of U.S. dollar depreciation for Asian Developing Countries. Asian Development Bank.
- Fatima, N. 2010. Analysing the Terms of Trade Effect for Pakistan. Pakistan Institute of Development Economics, Islamabad.
- Felipe, J. and J. Lim. 2008. An Analysis of Pakistan's Macroeconomic Situation and Prospects. ADB Economic Working Paper Series No. 136, Manila, Philippines.
- Ferretti, G. M. M. 2008. Fundamentals at Odds? The U.S. current account deficit and the dollar. IMF Working Paper, No. 260.
- Genye, T. 2011. Currency Devaluation and Economic Growth: The case of Ethopia. Department of Economics. Stockholm University.
- Gomes, F. A. R. and L. S. Paz. 2005. Can real exchange rate devaluation improve trade balance? The Brazilian Case.
- Government of Pakistan, Economic Survey [various issues], Islamabad, Ministry of Finance, Economic Advisor Wing.
- Granville, B. and S. Mallick. 2004. Fisher Hypothesis: UK Evidence over a Century. Applied Economics Letters 11: 87-90.
- Gujrati, D. N. 2004. Basic econometrics, 4th ed., McGraw-Hill.
- Harve, B. G., Y. Shen and A. Amed. 2010. The Effects of Real Exchange Rate on Trade Balance in Cote d'Ivoire: Evidence from the Co-integration Analysis and Error Correction Models. Shanghai University 99 Shangda Road, Shanghai 200444, China.

- Herberger, A. 1950. Currency depreciation, income and the balance of trade. Journal of Political Economy. pp. 47-68.
- Hjalmarsson, E. and P. Osterholm. 2007. Testing for Cointegration Using the Johansen Methodology when Variables are Near-Integrated.
- Hoffmann, M. 2003. Fixed versus Flexible Rates: A Panel-VAR Analysis. Research Paper. Department of International Economics, University of Cologne, Germany.
- Hussain, A. M., A. Mody and K. S. Rogoff. 2004. Exchange Rate Regime Durability Monetary Eand Performance in Developing Versus Advanced Economies. Journal of conomics, 52 (1) : 35-64.
- Islam, S.1984.Devaluation,stabilization policies and the developing countries: A macroeconomic analysis. Journal of Development Economics, Vol. 14, pp. 37-60.
- Johansen, S. 1988. Statistical Analysis of Cointegrating Vectors. Journal of Economic Dynamics and Control. Vol.12, pp.231-254.
- Johansen, S. 1991. Estimation and Hypothesis Testing of Cointegrating Vectors in Gaussian Vector Autoregressive Models. Econometrica. Vol. 59, pp.1551-1580.
- Kulshreshtha, M. and J. K. Parikh. 1999. Modeling demand coal India: vector autoregressive models with cointegration variables. Energy Economics 26:149-168.
- Larrain, F.B., A. Velasco. 2001. Exchange Rate Policy in Emerging Markets: The Case for Floating. National Bureau of Economic Research, Harvard University.
- Lerner, A. 1994. The economics of control. New York: Macmillan.
- Magee, S. P. 1973. Currency Contracts, Pass Through and Devaluation. Brooking Papers on Economic Activity, 1973(1), 303-325.
- Mahmood, I., M. Ehsanullah and H. Ahmed. 2011. Exchange rate volatility & macroeconomic variables in Pakistan. Business Management Dynamics. pp.11-22.
- Mussa, M. 2002. Exchange Rate Regimes in an Increasingly Integrated world Economy. Washington DC.
- Nabi, I. 1996. Outward Orientation of The Economy: A Review of Pakistan's Evolving Trade and Exchange Rate Policy. Journal of Asian Economics, Vol. 8, No. 1, pp. 143-163.
- Naqvi, K., J. S.L. McCombie and F. Jesus. 2010. Is Pakistan's growth rate balance of payments constrained? Policies and implications for development and growth. Oxford development studies, vol. 38, no. 4.
- Nieh and Wang. 2005. ARDL approach to the exchange rate overshooting in Taiwan. Review of Quantitative Finance and Accounting, Volume 25: 55-71.
- Nishat, M. and K. Mustafa. 2004. Volatility of Exchange Rate and Export Growth in Pakistan: The Structure and Interdependence in Regional Markets.
- Nunnenkamp, P. and R. Schweickert. 1990. Adjustment policies and economic growth in developing countries – Is devaluation contractionary? Weltwirtschaftliches Archive, Vol.126, pp. 474-493.
- Patterson, K. 2000. An Introduction to Applied Econometrics, New York, Palgrave.
- Pfaff, B. 2006. Analysis of integrated and cointegrated time series with R. London:Springer +Business Media.
- Rehman, H. 2007. An Econometric Estimation of Traditional Import Demand Function for Pakistan. Pakistan Economic and Social Review. 45: 245-256.
- Samimi, R. 1995. Road transport energy demand in Austaralia: a cointegration approach. Energy Economics 17:349-339.
- Shahbaz, M., R. Awan and K. Ahmad. 2010. The Exchange Value of Pak-Rupee & Pak-Trade Balance: An ARDL Bounds Testing Approach. Journal of Developing Areas.

- Shahbaz, M., P. Azim and K. Ahmad. 2011. Exports- led growth hypothesis in Pakistan: Further evidence. Asian Economic and financial Review, 1 (3): 182-197.
- Shambaugh, J. C. 2003. The Effect of Fixed Exchange Rate on Monetary Policy. Journal of Economics, June 2003.
- Solimano, A. 1986. Contractionary Devaluation in the Southern Cone: The Case of Chile. Journal of Development Economics, Vol. 23, September, pp. 135-151.
- Ssekuma, R. 2011. A study of cointegration models with applications.
- State Bank of Pakistan, Annual reports [various issues], Karachi.
- Sulaiman, D. M. and A. Hussain. 2010. The Role of Exchange Rate on Balance of Trade: Empirical from Pakistan. European Journal of Social Sciences. 14(1).
- Taye, H. K. 1999. The impact of devaluation on macroeconomic performance: The case of Ethiopia. Journal of Policy Modeling, Vol. 21(4), pp. 481-496.
- Tsen, W. H. 2006. Granger Causality Test among Openness to International Trade, Human Capital Accumulation and Economic Growth in China. International Economic Journal, 20(3): 285-302.
- Upadhyaya, K. P. 1997. Currency devaluation, aggregate output, and the long run: an empirical study. Economics Letters, Vol. 64, pp.197–202.
- Vuletin, G. J. 2003. Exchange Rate Regimes and Fiscal Performance. Do Fixed Exchange Rate regimes generate more Discipline than Flexible Ones? National University of Laplatta (UNLP).
- Walliullah, M. K. Kakar, R. Kakar and W. Khan. 2010. The Determinants of Pakistan's Trade Balance: An ARDL Co-integration Approach. The Lahore Journal of Economics, 15(1): 1-26.
- Wei, W. S. 2006. Time series analysis: univariate and multivariate. Boston: Pearson.
- Wijnbergen, S. V. 1986. Exchange Rate Management and Stabilization Policies in Developing Countries. Journal of Development Economics, Vol. 23, pp. 227-247.
- Zhang, M. 2002. Influence of RMB depreciations on China's trade income and payment. Financial Education and Research. No. 1: 2-6.
- Ziwei, S. 2008. Exchange Rate Changes and Trade Balance: an Empirical Study of the Case of Japan. Singapore Management University.