

*Full Length Research Paper*

# Export-led growth hypothesis: Multivariate rolling window analysis of Pakistan

**Qazi Muhammad Adnan Hye<sup>1\*</sup> and Masood Mashkooor Siddiqui<sup>2</sup>**

<sup>1</sup>Applied Economics Research Centre, University of Karachi, Karachi, Pakistan.

<sup>2</sup>Department of Commerce Federal Urdu University of Arts, Science and Technology of Karachi, Karachi Pakistan.

Accepted 29 September, 2010

**Most of the empirical works have focused on the causal relationship between exports and economic growth in the case of Pakistan, whereas terms of trade have been neglected. This paper investigates the nature of relationship between the exports, terms of trade and economic growth by using the Autoregressive Distributed Lag (ARDL) approach and rolling window regression method. The empirical findings indicate that long run relationship exist when real Gross Domestic Product (GDP) and real exports are dependent variables.**

**Key words:** Pakistan, export-led growth, autoregressive distributed lag, rolling window.

## INTRODUCTION

Trade policies hold a central position in Pakistan for the attainment of higher economic growth. Over the last 15 years, Pakistan has liberalized its international trade. Total exports responded favourably to liberalization, rising from US\$6.7 billion in 1992 to US\$13,909 billion in July, 2007. Real gross domestic product (GDP) growth rose from 4.0% in 1990 to 7.0% in 2007. Trade policy is classified into two broad regimes, import substitution and export promotion. In early days trade policy was based on "import substitution". But gaining the undesired experience of import substitution policy Pakistan later on focused on export promotion policy to promote faster economic growth.

The relationship between exports and economic growth has been a popular subject of debate among economists. It is argued that a nation can accelerate the rate of economic growth by promoting exports it will stimulate the production of goods and services. This argument is termed as export-led growth (ELG) hypothesis in the literature. According to export-led growth hypothesis (ELGH) exports expansion is one of the major determinants of economic growth. Overall growth of the countries can be generated not only by increase in the amounts of labour and capital within the economy, but also by expanding

exports. The economic importance of the linkages between economic growth and exports can not be avoided at any stage of economic development; exports are the engine of any economy because they are the most important source of achieving foreign exchange earnings, ease the pressure of balance of payment and also contribute to provide the employment opportunities to the domestic labour. Expansion of exports can be a vehicle for output growth both directly, as a component of aggregate output, as well as indirectly through efficient resource allocation, greater capacity utilization, economies of scale and stimulation of technological improvement due to foreign market competition (Awokuse, 2003).

Thus, this paper contributes to the literature on exports and economic growth nexus in the following way. First, most of the empirical work on this topic (in Pakistan) shows the causal relationship between the exports and economic growth. This empirical work extends the analysis in multivariate form (real exports, terms of trade and real income). Second, a recent cointegration technique, autoregressive distributed lag (ARDL) of Pesaran et al. (2001) and rolling window regression method are employed to test the existence of long run equilibrium relationship among the variables.

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\*Corresponding author. E-mail: [adnan.economist@yahoo.com](mailto:adnan.economist@yahoo.com).

**JEL classification:** C12, C30, C22.

## LITERATURE REVIEW

The previous debate on international economics shows

that number of developing countries flowed the import substitution policy in past to enhance the process of economic growth (that is newly industrialize countries like South Korea, Hong Kong, Singapore, Taiwan, Mexico and Brazil). But they change policy of import substitution to export-led growth to expedite the process of economic growth and they finally get the impressive level of economic growth (Todaro, 1997).

There is a huge empirical literature available on the export-led growth hypothesis. It shows that the researcher investigates this hypothesis on cross section and individual country basis. First we review the studies on cross country analysis. Bhagwati (1978) investigated association among exports and growth by using Spearman rank correlation approach. The ordinary least square method has employed by Heitger (1987); Lussier (1993) and concluded exports has the vital determinant of economic growth. Another empirical study in the case of 70 developing countries proved that exports growth and ratio of exports to GDP positively associate to economic growth (Gonclaves and Richtering, 1986). The exports led growth hypothesis rejected by Colombatto (1990). These studies assume similar economic structure across the countries. But in reality this assumption is not viable. Hence, the results of these cross section studies cannot free of criticism. The latest developments of econometrics estimation techniques demands to investigate times series of analysis in order to determine the long run robustness among the exports and GDP. Some studies have empirically investigated the export-led growth hypothesis by utilizing different econometric procedures ranging from simple Ordinary Least Squares (OLS) to cointegration techniques. Eleanor (2001); Choong et al. (2003) examined the link between exports and output and found that ELG hypothesis is valid for Ireland and Malaysia. Abul Foul (2004) finds unidirectional causality from exports to output in Jordan by using the VAR-L, VAR-D and ECM techniques. Mamun and Nath (2005) support the ELG hypothesis for Bangladesh by employing the error correction model (ECM). Herzer et al. (2006) reported bidirectional causality between exports and output in Chili. Maneschiold (2008) tested the export-led growth hypothesis in the case of Argentina, Brazil, and Mexico by using cointegration approach to long run relationship and direction of causality determine through causality test. He suggested export led hypothesis has valid to enhance the economic growth of these countries. Herrerias and Orts (2010) empirically proved that physical capital and research and development, exports and exchange rate have the factors that expediting the process of economic growth.

In Pakistan the export-oriented scenario of growth has been drawn a number of empirical researches in the last two decades. Rana (1985); Khan and Saqib (1993); Khan, et al. (1995); Ali and Manap (2005) empirically found bidirectional causality between exports and economic growth. Kemal et al. (2002) investigates no evidence

of causation in short run in both direction and found long run causality from export to GDP.

## METHODOLOGY

This study uses quarterly data from 1985 - 2008. Exports, unit value of import index, unit value of export index and consumer price index are taken from International Financial Statistics. Quarterly GDP is calculated by using the weight of Kemal and Arby (2004). Both GDP and exports are measured in millions of rupees and both are deflated by the consumer price index in order to real GDP and real exports. Terms of trade (TOT) defined as the unit value index of exports as a percentage of the unit value index of imports.

This study uses autoregressive distributed lag method to test the direction of causality between the variables under consideration. In the first stage, the order of integration of the variables is established by implementing the Ng-Perron (2001) unit root test. The advantage of the Ng-Perron test: it has good size and power. The test is particularly suitable for small sample. Ng and Perron (2001) construct four test statistics. These test statistics are modified forms

of Phillips and Perron  $Z_\alpha$  and  $Z_t$  statistics, the Bhargava (1986)  $R_1$  statistic, and the ERS point optimal statistic. The modified statistics are written as follows:

$$MZ_\alpha^d = (T^1 y_T^d)^2 - f_0 / 2k$$

$$MZ_t^d = MZ_\alpha \times MSB$$

$$MSB^d = (k/f_0)^{1/2}$$

$$MP_T^d = (\bar{c}^2 k - \bar{c} T^1)(y^d T)^2 / f_0 \text{ if } x_t = \{1\}$$

$$MP_T^d = (\bar{c}^2 k + (1 - \bar{c}) T^1)(y^d T)^2 / f_0 \text{ if } x_t = \{1, t\}$$

Where:

$$\bar{c} = -7 \text{ if } x_t = \{1\} \text{ and } \bar{c} = -13.5 \text{ if } x_t = \{1, t\}$$

The Ng-Perron tests require a specification for  $x_t$  and a choice of method for estimating  $f_0$ . As with most other tests, the null hypothesis of unit root cannot be rejected if the test statistic is higher than the critical value. The second stage involves testing for the existence of a long run relationship between real GDP Ln(G), real exports Ln (E) and terms of trade Ln (T) within a multivariate framework. For this purpose ARDL technique of Pesaran et al. (2001), has used. Pesaran et al approach has certain econometric advantages in comparison to other cointegration procedures. They are as follows:

- (i) The Long and short run parameters of the model in question are estimated simultaneously.
- (ii) ARDL is applicable irrespective of whether the underlying regressors are purely  $I(0)$ ,  $I(1)$ , or mutually integrated.
- (iii) ARDL method is free from endogeneity problem.

The Pesaran et al. procedure involves investigating the existence of a long run relationship in the form of the unrestricted error correction model for each variable as follows:

**Table 1.** Unit root test.

<b>Ng-Perron at level with constant and trend</b>				
	<b>MZa</b>	<b>MZt</b>	<b>MSB</b>	<b>MPT</b>
LG	-3.27	-1.21	0.36	26.31
LX	-3.19	-1.26	0.39	28.55
LT	-11.93	-2.38	0.21	7.93
<b>Ng-Perron at 1<sup>st</sup> difference with constant and trend</b>				
LG	-29.82	-3.85	0.13	3.07
LX	-43.02	-4.63	0.11	2.11
LT	-43.43	-4.65	0.11	2.11

\* 1% significance level.

**Table 2.** Long relationship.

	<b>Computed F-statistic</b>		<b>Computed W-statistic</b>	
<i>LG   LX, LT</i>	4.57		13.69	
<i>LX   LG, LT</i>	6.87		20.59	
<i>LT   LG, LX</i>	3.35		10.07	
<b>Level of significance</b>	<b>Lower bound</b>	<b>Upper bound</b>	<b>Lower bound</b>	<b>Upper bound</b>
5%	3.94	4.97	11.79	14.91
10%	3.26	4.22	9.78	12.64

$$\Delta LG_t = \lambda_{0G} + \sum_{i=1}^n \lambda_{iG} \Delta LG_{t-i} + \sum_{i=0}^n \lambda_{iX} \Delta LX_{t-i} + \sum_{i=0}^n \lambda_{iT} \Delta LT_{t-i} + \alpha_{1G} LG_{t-1} + \alpha_{2G} LX_{t-1} + \alpha_{3G} LT_{t-1} + v_{1t} \text{ ----- (1)}$$

$$\Delta LX_t = \lambda_{0X} + \sum_{i=1}^n \lambda_{iX} \Delta LX_{t-i} + \sum_{i=0}^n \lambda_{iG} \Delta LG_{t-i} + \sum_{i=0}^n \lambda_{iT} \Delta LT_{t-i} + \alpha_{1X} LX_{t-1} + \alpha_{2X} LG_{t-1} + \alpha_{3X} LT_{t-1} + v_{2t} \text{ ----- (2)}$$

$$\Delta LT_t = \lambda_{0T} + \sum_{i=1}^n \lambda_{iT} \Delta LT_{t-i} + \sum_{i=0}^n \lambda_{iG} \Delta LG_{t-i} + \sum_{i=0}^n \lambda_{iX} \Delta LX_{t-i} + \alpha_{1T} LT_{t-1} + \alpha_{2T} LG_{t-1} + \alpha_{3T} LX_{t-1} + v_{3t} \text{ ----- (3)}$$

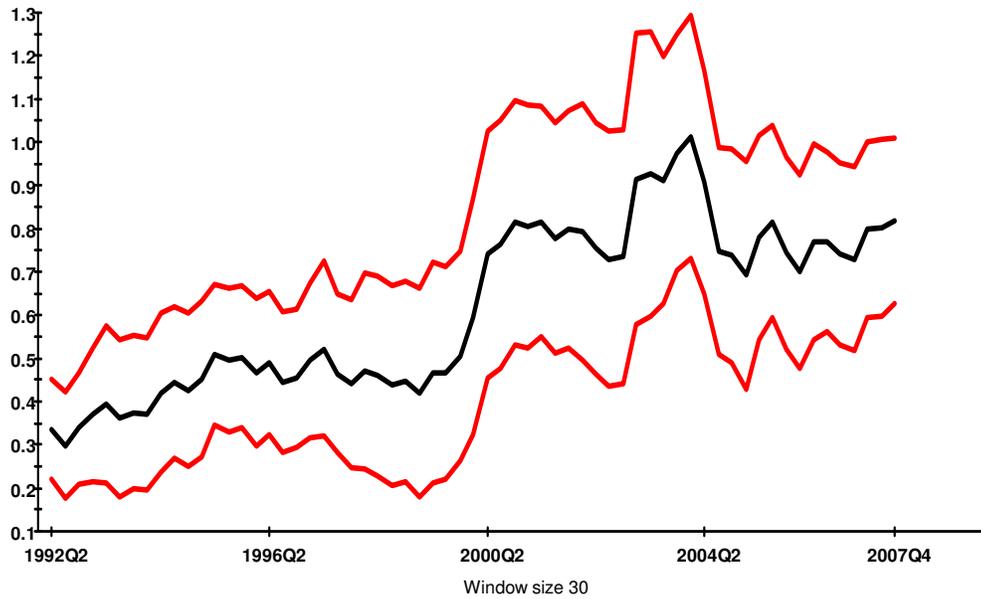
Where, LG, LX and LT respectively, present real economic growth (real GDP), real exports and terms of trade. L shows the sign of natural logarithm and Δ is the difference operator. The long run is evaluated by using the F-statistic and W-statistic of overall significance. The null hypothesis of Equation (1) is  $\langle H_0 = \alpha_{1G} = \alpha_{2G} = \alpha_{3G} = 0 \rangle$ . It is symbolized as  $F_G \langle LG | LX, LT \rangle$ . The null hypothesis of Equation (2) is  $\langle H_0 = \alpha_{1X} = \alpha_{2X} = \alpha_{3X} = 0 \rangle$ , characterized by  $F_X \langle LX | LG, LT \rangle$ . Finally, the null hypothesis of Equation (3) is that  $\langle H_0 = \alpha_{1T} = \alpha_{2T} = \alpha_{3T} = 0 \rangle$  with the following function  $F_T \langle LT | LG, LX \rangle$ . The Pesaran et al. (2001) proposed two of critical

values given significance level. One set assumes that all variables are I(0) and the other set assumes they are all I(1). These values are utilized by this study to the long run decision.

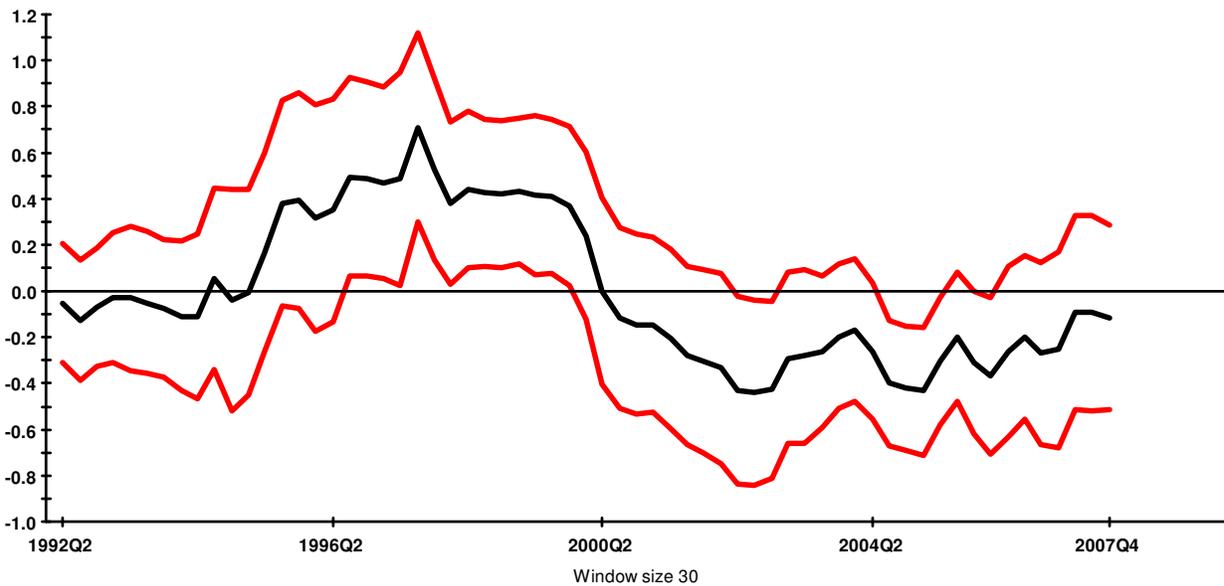
**EMPIRICAL RESULTS**

To determine the order of integration this study employs Ng-Perron unit root test (2001). The result of unit root test (Table 1) indicates that LG, LX and LT are integrated order or I (1). Now we apply the ARDL approach to cointegration to investigate the long run relationship among the variables. In this test it is important to determine the lag order of the first difference variables in the Equation 1 to 3. Thus this study determines the lag order by using the Schwarz Bayesian Criterion (SBC). Table 2 reveals the result of ARDL approach to long run robustness.

The both computed F-statistic and W-statistic are confirmed long run relationship when real economic growth and real exports are the dependent variable. Next we estimate the coefficients of long run cointegrated equations by using the rolling window method. The main advantage of this is that it can estimate the coefficient of each observation. The results of rolling widow regression represent the Figures 1 to 4. The rolling window size is fixed by 30 observations. Figure 1 indicates that exports positively determine the long run real GDP in the case of



**Figure 1.** Coefficient of LX and its two\*S.E. bands based on rolling OLS (Dependent variable: LG; Total no. of regressors: 3).



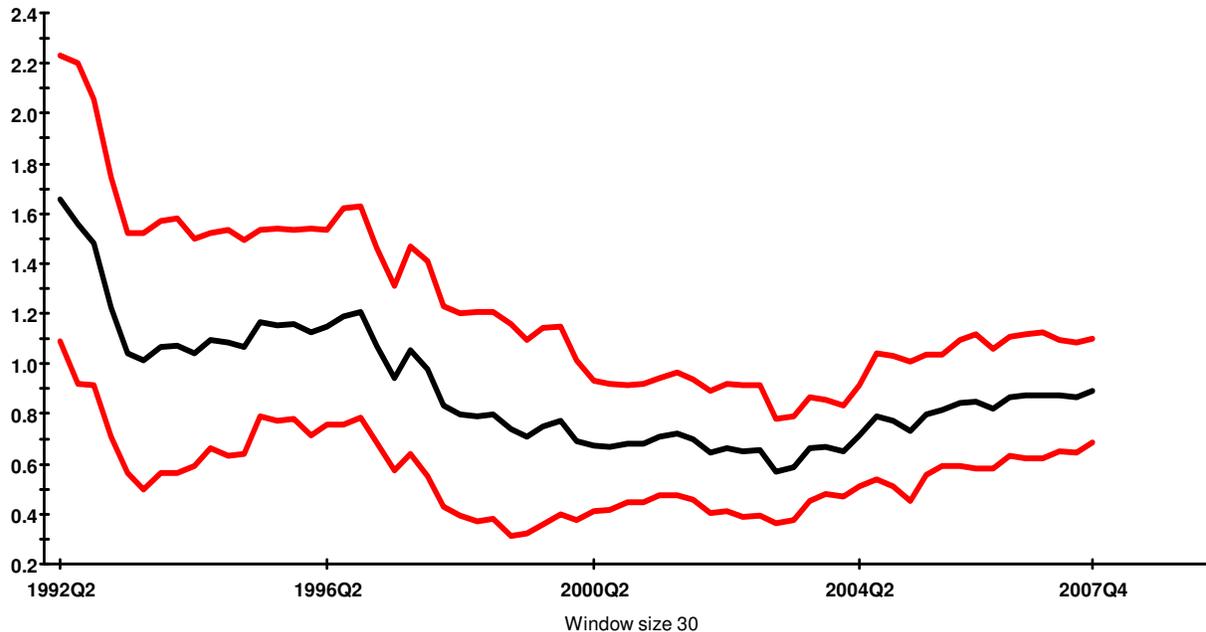
**Figure 2.** Represents the graph of terms of trade coefficients [Coefficient of LT and its two\*S.E. bands based on rolling OLS (Dependent variable: LG ; Total no. of regressors: 3)]. This indicates that from 1995 to 1999 the terms of trade (LT) positively determine the real GDP and in remaining sample it impede real GDP.

Pakistan over the sample. The coefficients sharply increase from 2000 and little bit decline in 2002 and then increases. It could show sharply decline in 2004 than fluctuate and from 2007 showing movement upwards. The real GDP positively cause the real exports in the sample (Figure 3). The Figure 3 demonstrates from 1997-2008 the coefficients of real GDP vary in the range of '0.9

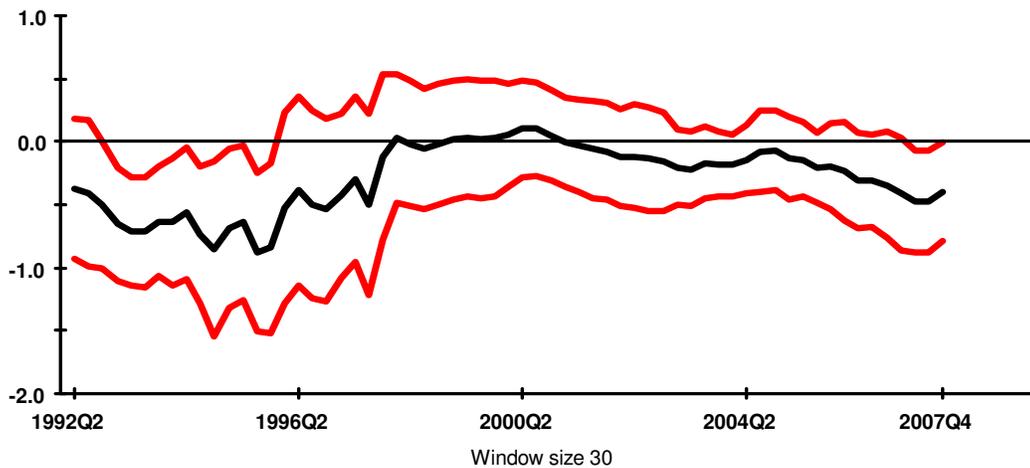
to 0.6'. The Figure 4 shows that terms of trade (LT) impede real exports over the sample except few years.

**Conclusion**

The objective of this study is to investigate the link



**Figure 3.** Coefficient of LG and its two\*S.E. bands based on rolling OLS (Dependent variable: LX ; Total no. of regressors: 3).



**Figure 4.** Coefficient of LT and its two\*S.E. bands based on rolling OLS (Dependent Variable: LX; Total no. of regressors: 3).

between real exports, terms of trade and real GDP in the case of Pakistan. The results indicate that cointegration exists when real GDP and real exports are the dependent variables. The rolling regression confirms that real exports positively associated with the real GDP and terms of trade impede the real GDP from 2000 to 2008. The terms of trade negatively determine the real exports during the sample except few years. On the basis of empirical results this study suggested exports-led growth valid for Pakistan because exports throughout sample positively determine the real GDP. This study also

recommends Pakistan government to keep on promoting export sector for rapid economic growth. Thus, growth in exports improves terms of trade and then eventually terms of trade will enhance the real GDP.

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